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NEW DATA ON FOSSILS IN THE MESOLITHIC OF THE POLISH PLAIN

ABSTRACT

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Two fossil shark teeth (B1 and B6/2014) were discovered in a cluster of flints excavated in 2014 on the Mesolithic site Wierzchowo 6, in Pomerania, NW Poland. Found a small distance apart, the surface of both teeth displays natural modifications. The apex of tooth B1/2014 was broken off after deposition, and on its surface were some marks of trampling and transport. On tooth B6/2014 marks clustered on three surfaces labelled G1-G3. The most apparent striations and irregular points seen on surface G1 are interpreted as trampling marks caused by low intensity action of the sand deposit. The occasional occurrence of fossil shark teeth in Quaternary sediments in Poland suggests the specimens from Wierzchowo were brought deliberately to the camp site by Mesolithic settlers. Fossilized shark teeth are recorded in Palaeolithic and Mesolithic sites in Europe and have been used for various practical and symbolic purposes by modern age foragers.

Keywords: fossil, shark teeth, Mesolithic, Maglemosian, trampling, sedimentary abrasion
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INTRODUCTION

Fossil use by humans is rarely documented on Mesolithic sites in the European Lowland Plain. Some have been encountered as a natural element of the sediments containing artefacts. Any fossil attributable to some form of human activity must attract attention and raise questions about its significance for the users and the community at large.

During the excavation in 2014, two fossil shark teeth were found in a flint concentration on the Mesolithic site Wierzchowo 6, in Pomerania, NW Poland. They were mentioned in an interim article on this site but they have never been studied meticulously up to now (Chłoń and Płonka 2016). The present article reports on the study of marks identified on the surface of these fossil teeth, and discusses their significance in light of other fossils found on Mesolithic sites in Europe.

MATERIALS AND METHODS

Site no. 6 at Wierzchowo lies in the western area of the Wałcz Plain (Fig. 1), a physico-geographical unit of the Western Pomerania Lakeland (Kozarski 1998; Solon *et al.* 2018). Two seasons of excavation have produced an assemblage of 8221 flints from 1989 (Trench

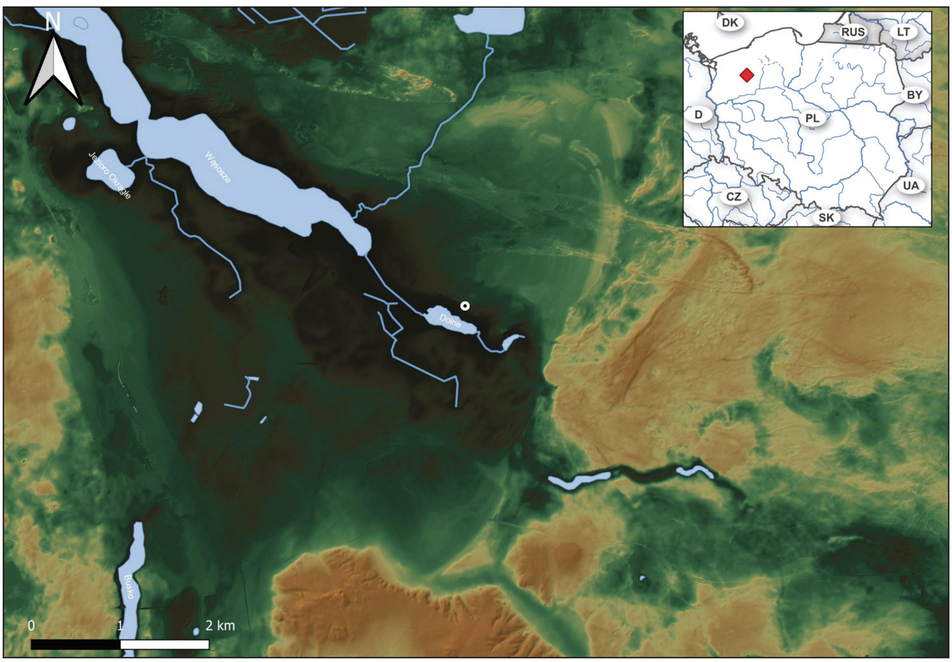

Fig. 1. Wierzchowo 6. The location of the site. Prepared by M. Chłoń

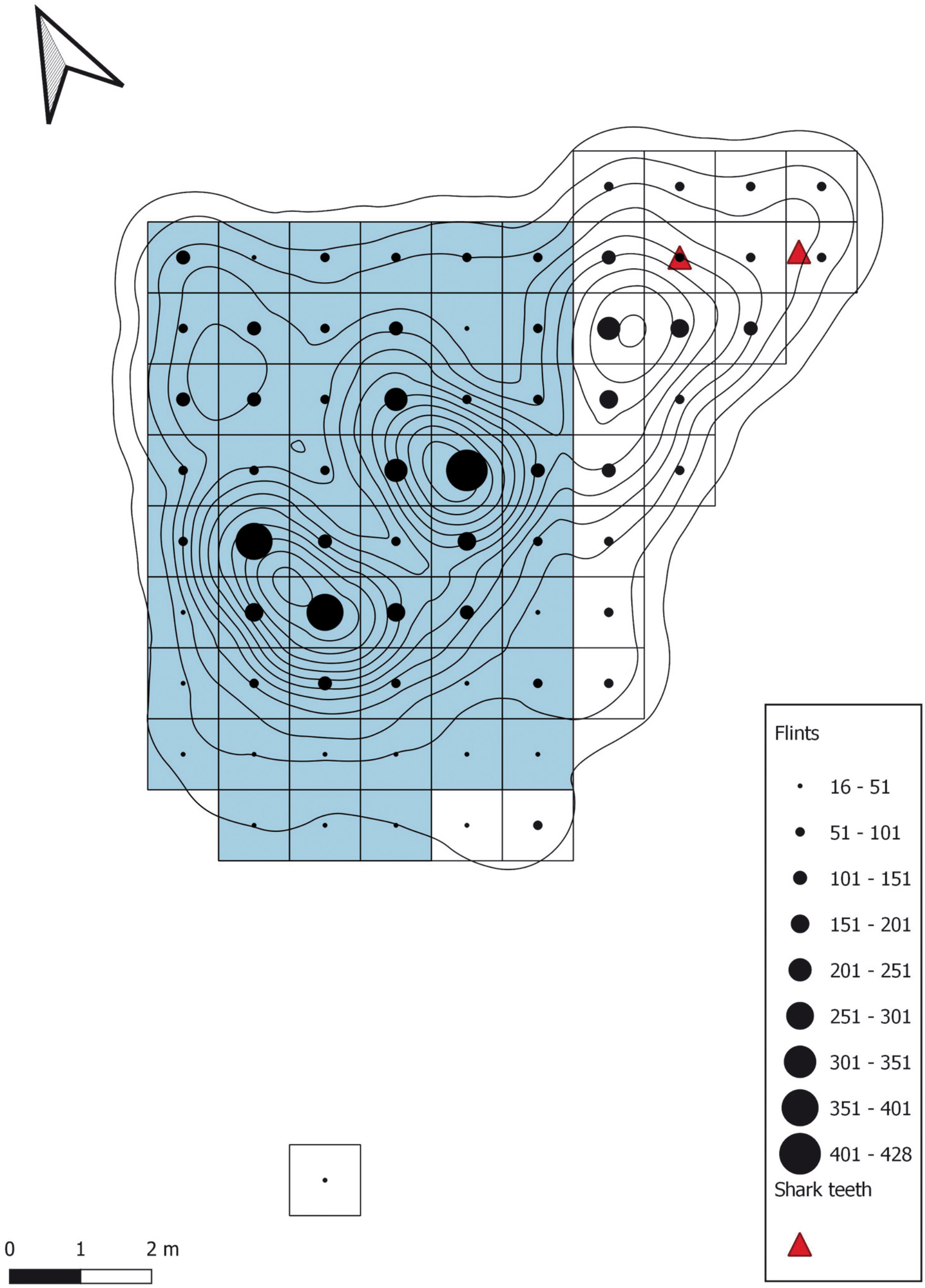

Fig. 2. Wierzchowo 6. The frequency of flint artefacts and the location of the two fossil shark teeth. Prepared by M. Chłoń

Fig. 3. Wierzchowo 6, tooth B1/14. *Lamniformes indet*. distal, lingual, labial and mesial view. Photo B. Miazga; computer processing by N. Lenkow

Fig. 4. Wierzchowo 6, tooth B6/14. *Lamniformes indet*. distal, lingual, labial and mesial view. Photo B. Miazga; computer processing by N. Lenkow

I/89; n = 6126) and 2014 (Trenches II/14, III/14; n = 2095) (Bagniewski 1991; Chłoń 2013; Chłoń and Płonka 2016). The Mesolithic finds were made of the local erratic flint. Both blade and flake cores were present (n = 73; 0.89%), but unidirectional blade cores were the predominant form. Retouched tools make up a minor percentage (n = 322; 3.92%). Most of them were macrolithic forms represented by tranchet adzes and picks, the second largest group of tools were geometric microliths. The artefacts and technology of knapping are characteristic of the Maglemose culture of the Boreal period (Brinch Petersen 1973; Bille Henriksen 1976; 1980; Bagniewski 1991)

After the excavation in 1989, the excavated compact scatter of flints (6 × 8 m) was originally identified as the remains of a Mesolithic dwelling (Bagniewski 1991). A more recent interpretation is that the site was revisited several times by a group, or groups of hunter-gatherers of the Maglemosian culture (Chłoń 2013; Chłoń and Płonka 2016). We distinguished three clusters – two with a larger number of artefacts (western and central clusters) and a less apparent eastern cluster, investigated in 2014. The forms of the dwelling structures are unclear.

The teeth, recorded as B1/14 and B6/14, were discovered in grid units 8H and 8J (Fig. 2), within layer 2 composed of sand and gravel sediments underlying the modern topsoil. Tooth B1/14 from grid unit 8H (Fig. 3) was found during sieving, thus its location shown on the site drawing must be approximate. The second tooth (Fig. 4) came to light during excavation and has been precisely recorded in 3D. In effect, the two fossils could have been separated by 1.25-2.25 m.

Both teeth survived incomplete and are weathered and slightly eroded. Specimen B6/14 is a crown fragment and specimen B1/14 has a crown and part of the root. Both crowns are straight, narrow, slender and smooth with a slightly sigmoid profile in lateral view. The cutting edges are prominent without serration. Because of the poor state of preservation their species or genus could not be determined. We managed to classify them broadly as teeth of representatives of order *Lamniformes* (specimen B1/14 probably to family *Odontaspididae*) which were present from the Cretaceous to recent times (Cappetta 1987). However, the state of fossilization precludes them are of the Quaternary age. They were eroded from the sea rocks dated to the Upper Cretaceous – Paleogene, which are present under the Quaternary deposits of Pomerania (Stankowski 1996) or were brought from the north by Scandinavian glaciers in the Quaternary.

In our analysis of the shark teeth, we used the widely accepted procedures of observation of bone surface modifications where the key role is played by microscopy techniques (Behrensmeyer 1978; Binford 1981; Behrensmeyer *et al.* 1986; Olsen and Shipman 1988; Villa and Mahieu 1991; Fisher 1995; Domínguez Rodrigo *et al.* 2009; Fernández-Jalvo and Andrews 2016). The marks were documented in general using the portable digital microscope Nikon ShuttlePix P-400R, and in more detail, using the Hirox 3D digital microscope RH-2000 available in the Laboratory of Archaeometry and Archaeological Conservation University of Wrocław.

ANALYSIS

Tooth B1/14

Damaged during excavation, the tooth additionally has earlier damage on its apex and root, and on the labial surface between the break and the root (Fig. 3; 5: 1). Its length at present is 15.6 mm, its width and thickness at its crown are respectively, 6.6 mm and almost 3.6 mm. The surface of the tooth is light grey, shiny, covered by longitudinal cracking, and is stained rusty brown and dark brown by iron and manganese oxides. The cracking resembles bone weathering stage 1 of Behrensmeyer (1978). Generally speaking, the preservation of the tooth shows that after the animal's death, it rapidly passed into a layer where the environment favoured its survival and subsequent fossilization.

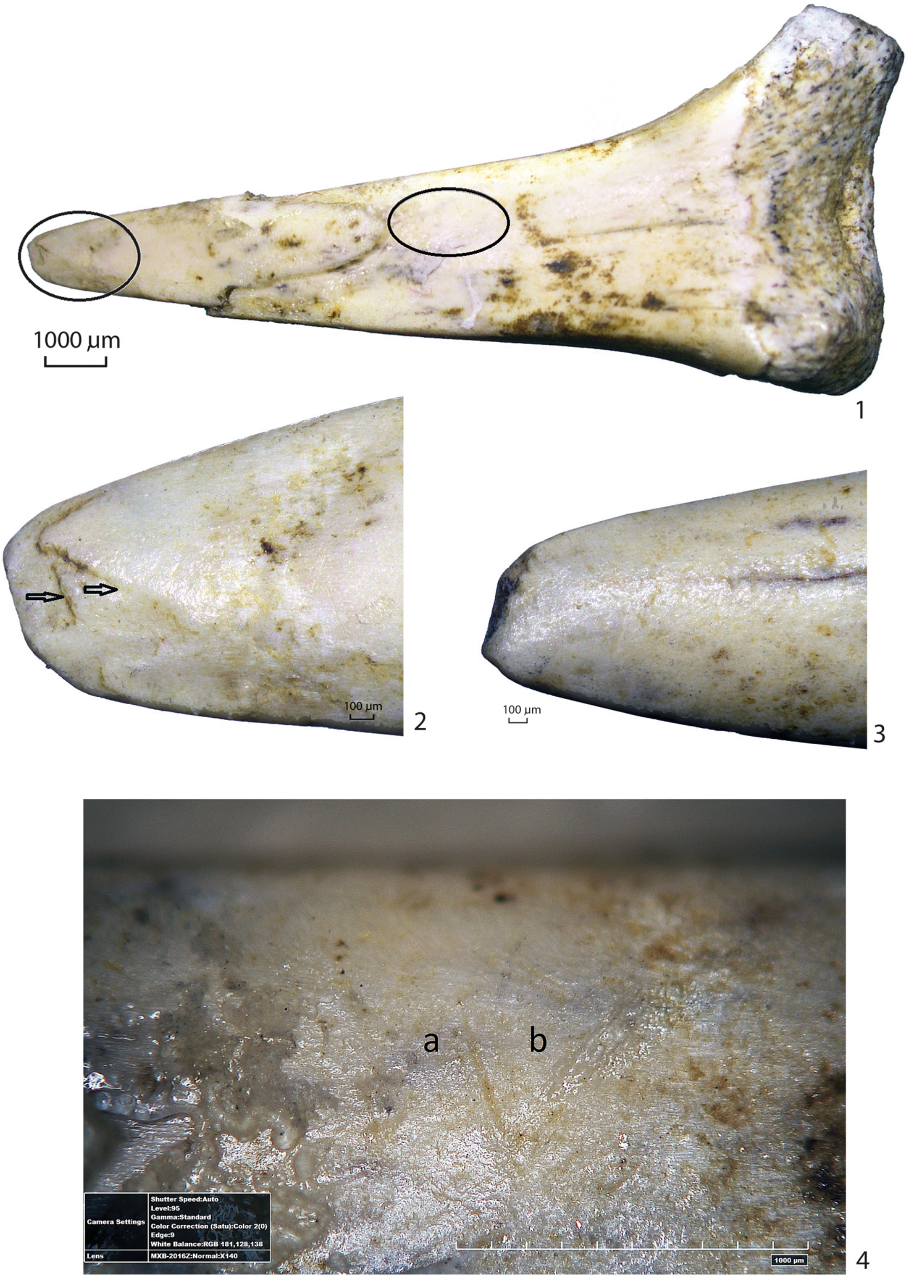

Fig. 5. Wierzchowo 6, tooth B1/14. 1 – general view showing magnified areas (Fig. 5: 2, 4) and exfoliation at the root; 2 – fracture of the apex, labial surface (arrows indicate the ridges); 3 – fracture of the apex, lingual surface; 4 – linear traces on labial surface (a – single linear mark; b – set of striations). Photo M. Diakowski; computer processing by N. Lenkow

The apex of the tooth is broken (Fig. 5: 2; 3). On the labial side, the fracture has a step-like form and consists of two ridges (Fig. 5: 2), and on the lingual side it has the form of a crack at right angles to the tooth axis (Fig. 5: 3). This form of damage suggests substantial force exerted parallel to the longer axis of the tooth, probably during a single episode, or possibly, two episodes. It is rather unlikely that this happened when the shark was still alive, and *e.g.*, was feeding, since shark teeth tend to fall out upon contact with hard elements in the shark's food (for example, a bone) and rarely break according to the line root – crown. The shark teeth are stuck in the soft tissue of the protective membrane, and are not lodged permanently within the jaw (Cappetta 1987). The fracture is more likely to have occurred when the tooth was being redeposited by glacial processes. It is probable because the state of preservation of the surface of the scar and the remaining surface of the tooth do not differ.

An exfoliation visible at the root of the tooth on its outer surface occurred when the tooth was entering the deposit (Fig. 5: 1), presumably at the same time as the longitudinal cracking before it was buried in the deposit and underwent fossilization.

The second area of damage is visible on the labial surface of the tooth in its central part – an individual linear mark and a group of several parallel striations (Fig. 5: 4a, b). Interestingly enough, the direction of the single linear mark and the striations is ifferent. All of them are shallow, with irregular edges, and do not resemble cutmarks (Olsen and Shipman 1988). The width of the single linear mark is nearly 30 µm, and the width of the striations is in the range of 6-20 µm.

Tooth B6/14

Its proximal and distal end broke at the time it was buried. The surviving length of this specimen is 10.8 mm, its width and thickness are respectively 5.3 mm and 3.5 mm. The surface of the tooth is light grey and shiny, stained dark brown and black by precipitated iron and manganese compounds. Also visible is longitudinal cracking, a larger number on the lingual surface tooth resembling bone weathering stage 1 of Behrensmeyer (1978). The

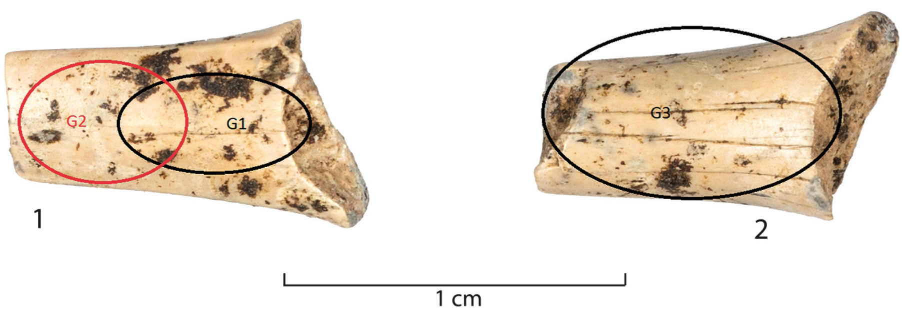

Fig. 6. Wierzchowo 6, tooth B6/14. 1 – areas with groups of marks – G1 and G2 – on labial surface; 2 – area with group of marks – G3 on lingual surface. Photo B. Miazga; computer processing by N. Lenkow

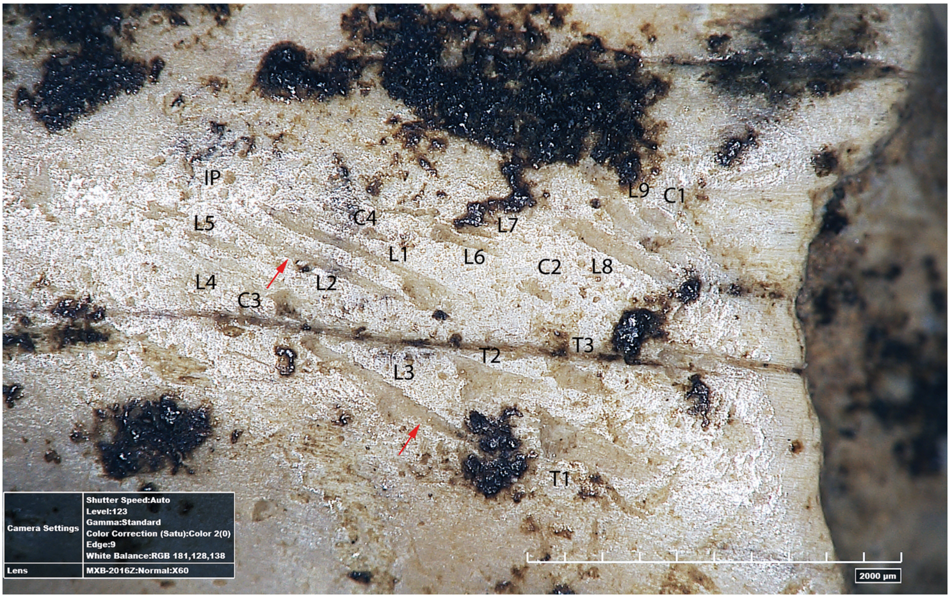

Fig. 7. Wierzchowo 6, tooth B6/14, area G1. Linear marks L1-L9, C1-C4, triangular marks T1-T3, and selected pit mark – IP. Arrows indicate cross-sections through marks L2 and L3. Photo M. Diakowski; computer processing by N. Lenkow

preservation of the tooth, except for its two fractured ends, is good and indicates deposition in a favourable environment. It could have broken when it was eroded from the Paleogene or Neogene layer by the ice sheet and transported south.

Striations and irregular points (IP) were identified in three areas (Fig. 6: 1, 2): i./ on the lingual surface, on the proximal end of the tooth (area G1); ii./ on the lingual surface, between G1 and the broken off apex (area G2); iii./ on the labial surface, near to the broken off end (area G3). The most wide-ranging set of marks was observed in area G1 (Fig. 7). It includes some approximately parallel striations with a length of 240-1200 µm, oblique to the longer axis of the tooth (L1-L9). The width of these striations is in the range of 20-100 µm, and is not uniform the entire length of a striation. Viewed at a higher magnification, the edges of these linear marks are not straight – they are wavy and resemble a winding path (Fig. 8: 1). Cross-sections have the form of a shallow bowl (Fig. 8: 2); the angle between the sides of the linear mark is strongly obtuse, the depth is small, in the range of 1.7–15 µm. Also found in area G1 are shorter striations with a length of 20–210 µm (C1-C4), which run in the same direction as marks L1-L9. By contrast, these short striations are relatively wide - 20–100 µm. The depth and wavy edges of these shorter linear marks are similar to those in marks L1-L9. The third type of mark is quite different from the longer and shorter striations L1-L9 and C1-C4 (Fig. 7). These are triangular marks (T1-T3), their starting point is narrow, and the maximum width is at their ending point. Their length

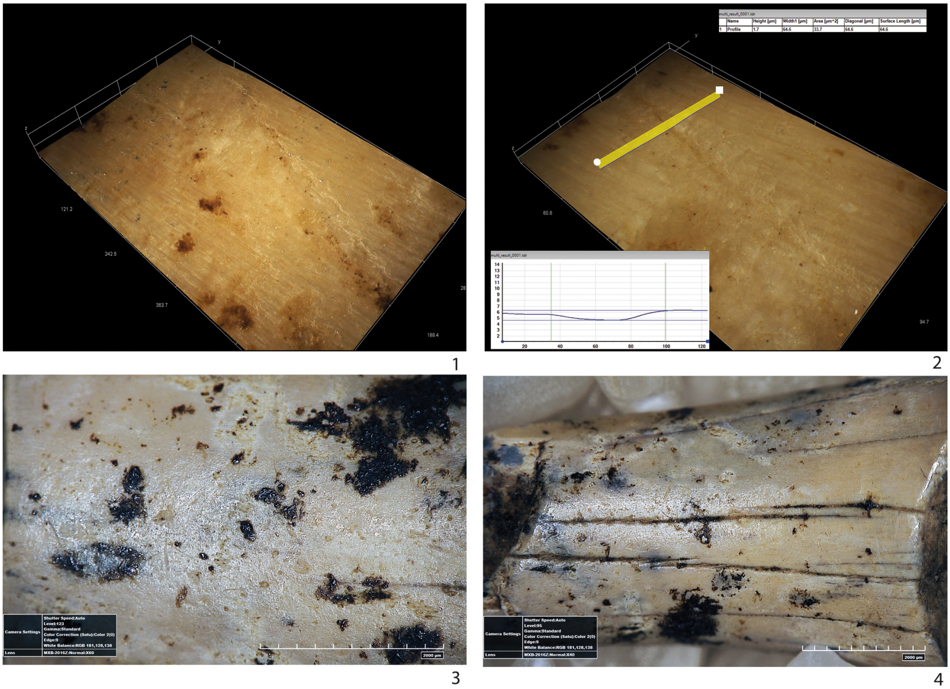

Fig. 8. Wierzchowo 6, tooth B6/14. 1 – edges of mark L2 in area G1; 2 – cross-section through mark L2; 3 – view of the group of marks in area G2; 4 – view of the group of marks in area G3. Photo M. Diakowski; computer processing by N. Lenkow. 1, 2 – original magnification 280×

ranged between 400 and 800 µm, and their maximum width between 160 and 260 µm. The triangular marks had approximately the same alignment as L1-L9 and C1-C4, and wavy edges. While for the longer and shorter striations the starting and ending points were not easily identifiable, marks T1-T3 were formed during a movement of an engraving factor from the proximal part towards the apex of the tooth, slightly obliquely to its axis. The inventory of marks in area G1 is completed by pitting – roughly oval points with irregular edges (IP). Their diameter is between 20 and 80 µm.

Next to marks in area G1, modifications occurred in areas G2 and G3 (Fig. 6: 1, 2). They have the form of short, irregular linear marks lacking alignment, up to 30 µm in thickness (Fig. 8: 3, 4). They are accompanied by some minor pitting – roughly oval points with irregular edges (IP).

DISCUSSION

Our analysis has confirmed the presence, other than fractures on tooth B1/14, and in areas G2 and G3 of tooth B6/14, of mainly three types of marks: i./ individual short striations of a small width, length and depth; ii./ linear marks of different width, length and depth – always small – and lacking any discernible alignment; iii./ a group of parallel linear marks. Finally, in areas G2 and G3 of tooth B6/14, we identified small irregular oval pits (IP). Variant i./ and ii./marks are mostly regarded as an effect of sedimentary abrasion caused by the shifting of sediments against the surface of the objects they contain (Behrensmeyer *et al.* 1986; Olsen and Shipman 1988; Domínguez Rodrigo *et al.* 2009; Fernández-Jalvo and Andrews 2016). One of the key causes of this phenomenon observed in archaeological sites is trampling by humans and animals but some of these traces could result from the redeposition by glacial processes. Another effect of trampling are characteristic groups of parallel striations, such as were observed on tooth B6/14 (variant iii./).

However, the most complex marks were discovered on the labial surface of tooth B6. Setting aside the irregular points (IP), all the other modifications regardless of their morphological differences, form a set of aligned marks (L1-L9, C1-C4 and T1-T3). It is legitimate to assume they are all the result of the same action (episode). The irregular shape of their edges and small depth indicate that they cannot be cutmarks, or lines of ornament (Behrensmeyer 1978; Behrensmeyer *et al.* 1986; Olsen and Shipman 1988; Bello and Soligo 2008; Domínguez Rodrigo *et al.* 2009; Fernández-Jalvo and Andrews 2016; Płonka *et al.* 2023). The marks do not resemble traces which were found on shark teeth used as tools and ornaments by traditional societies – ancient and modern (Gilson *et al.* 2021, 2023). Striations L1-L10 resemble trampling marks made when the particles building the sediment eroded the surface layer of the tooth. The origin of the short marks C1-C4 must be similar. However, in their case, the contact of the grains of sand with the surface of the tooth was more short-lived. Marks T1-T3, with a different, triangular shape, could have formed when the force acting on the grain of sand made it burrow into the surface of the tooth, forming a wide ending point of the trampling mark. On the other hand, no satisfactory explanation has been found for the origin of the IP marks. Possibly, they are the result of trampling too, when the force acting on the surface of the bone was perpendicular – producing pits (points) instead of linear striations. In short, the small density of the marks suggests rather that during the trampling incident, the force exerted on this particular tooth was moderate.

Thus, our analysis of the fossilized shark teeth from Wierzchowo has confirmed the non-intentionality of the marks identified on them, identifying them as taphonomic damage. Since shark fossils are rarely recorded in Quaternary deposits in Poland, the occurrence of two shark teeth in the same site and in the neighbouring square metres is unlikely to be random. We may safely assume that they were brought to the Mesolithic camp site by its settlers. Fossils, shark teeth among them, have long fascinated forager and early farmer communities (Oakley 1985; Jackson and Connolly 2001; Gumiński and Bugajska 2016; Macâne 2020). On the Iberian Peninsula, shark teeth have been recorded in Gravettian deposits, and are next encountered in Solutrean and Magdalenian inventories, as well as on Neolithic, Eneolithic and Bronze Age sites (Cortés-Sánchez *et al.* 2020, table 3). Fossils have been encountered in quite a few Magdalenian sites in the Swabian and Swiss Jura, Rhineland and Thuringia (Eriksen 2002; Płonka 2012, table 38). A fossil shark tooth was found at the Mirkowice 33 site, in palaeosoil together with artefacts of the Hamburgian culture (Chłodnicki and Kabaciński 1998). In the Jura, fossil Gastropod shells traced to Steinheimer, Mainzer and Paris basins, have been found in Early Mesolithic deposits (Eriksen 2002, table 3). The interest of Mesolithic people in these items is confirmed by finds of belemnites, crinoids and other fossils from the cemetery at Dudka, Site no. 1 in Poland (Gumiński 2014; Gumiński and Bugajska 2016), including an undetermined fossil shark tooth found in collective burial no. VI-16 (Late Mesolithic) of eleven individuals (Gumiński 2014, fig. 10: l). One tooth each of a porbeagle (*Lamna nasus*), a shark then in existence, was found in burials at Skateholm I and Skateholm II in Sweden (Jonsson 1986, 1988; Grünberg 2013, 245). Fragments of porbeagle teeth were also found in a collective burial (Grave no. 46), and next to the foot of a 25-year old man (Grave no. XV). Two other burials in these cemeteries produced fossil shark teeth, one of them found by the head of a 40-50-year old woman (Grave no. 36), the other in the fill of a cut with the remains of a 20-year old man (Grave no. XVII). L. Jonsson (1986; 1988) interpreted them as objects with a 'special meaning, rather than the remains of food offerings, proposing they could have been obtained through barter. Porbeagles, regular visitors to the Baltic, late summer to winter, were approximately 2-metres long and could have become stranded on the seashore (Jonsson 1988, 76, 78).

In Scandinavia, fossil urchins are also found at Mesolithic and Neolithic sites (Ljunggren 2019; Nyland 2020). According to Nyland (2020), the finds of fossil urchins in these sites in Rogaland prove that owing to their special properties they played a part in the life of these communities, enmeshed in a subtle network of relationships determined by different contexts and metamorphoses. We cannot hope to grasp their meaning without leaving behind the nature/culture dichotomy inherent in our own education and cognition. Without this dichotomy the world would be a continuum, and different forms of metamorphosis between different spheres identified by us would be something entirely natural for the foragers.

Fossils have played an important role in various early modern hunter-gatherer societies and folk culture. They were used, among other things, for medicinal purposes, due to their apotropaic properties and as ornaments and amulets (*cf.,* Macâne 2020). They were used by First Nations forager peoples of Northern America. The Tlingit in British Columbia used fossil shark teeth as earring pendants (De Laguna 1972). The Blackfoot of the Great Plains used fossils, mostly ammonites, as medicine (Wissler 1912, 242, 243) considering as the most effective those of their fragments which resembled living things – buffalo, humans, *etc*. The Crow prayed to rocks and fossils of a peculiar shape, asking for good fortune and health (Wildschut and Ewers 1960). The Gros Ventre described some fossils with corrugated septa – the dividing walls that separate the chambers of ammonites – as "thunder-stones", and used them as neck ornaments (Kroeber 1908, 275, fig. 44). They were known under the same name among the Assiniboine, while the Blackfoot referred to them as "buffalo-stones" and treated them with great respect. Among the Western Apache people fossils, with other objects from the realm of nature, are used as objects of supernatural power (fetishes) (Reagan 1929). The above examples show that next to playing a major role in the structure of the symbolic world of the forager societies fossils could have been used as objects and ornaments which build the social identity of their owner. At the same time, fossil shark teeth, mainly those with a serrated edge, were used in various regions of the world to make cutting tools (Lowery *et al.* 2011; Gilson *et al.* 2021, 2023). In this case, however, they show traces of modification and/or traces of use on the surface.

CLOSING REMARKS

Use-wear analysis of the fossil shark teeth discussed here identified natural modifications on its surface, identifiable as trampling marks and sedimentary abrasion during redeposition. Contextual analysis suggests that the teeth are not a random element of the Quaternary deposit underlying the site, but they were brought to the camp site by Mesolithic foragers. The described marks probably formed after the teeth had entered the sandy deposits of the lake terrace occupied by the Mesolithic settlers. Therefore, we can assume that the fossilized shark teeth were brought to the camp site due to their symbolic meaning. At the same time, we cannot define their function and meaning more precisely.

Acknowledgements

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