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ISLAND, PIGS, AND HUNTING PLACES – COMMENT ON PRECEDING PAPER BY ACHILLES GAUTIER CONCERNING ANIMAL BONES OF THE FORAGER SITE DUDKA

Some doubtful conclusions appearing from the Gautier paper concerning mammal bones of the Stone Age forager site Dudka in NE-Poland is discussed. The choice particularly an island for yearly, seasonal encampment is argued as economical profitable – for fishing and hazelnut gathering, but ungulates hunting carried on the mainland. Traces of keeping semi-domesticated pigs on the island are searching mainly in palaeobotanical data. The controversial method for distinguishing domesticated mammals from their wild relatives is discussed. Some individual bones (of bison, horse, dog, and pig) are re-examining, because their correct identifications are important for the history of these species in the Polish Plain – time of occurrences, status in hunter-gatherer society including eventual local domestication.

KEY WORDS: Stone Age economy, hunting, fishing, domestication, archaeozoology, palaeoenvironment, Masuria

INTRODUCTION

Dudka (NE-Poland) yielded one of the most numerous faunal remains of the Holocene hunter-gatherer sites in the European Plain therefore the final paper presenting mammal bones from the site has been expected for a long time. It is worth adding that bones have been recorded from exceptionally long period i.e. 7,500 radiocarbon years and in almost all cases, it was possible to match the bone with a particular chronozone and/or archaeological affiliation.

At the very beginning, Professor Dr. Achilles Gautier (Ghent University, Belgium) and me, we decided to write a common paper concerning bones of Dudka. He was supposed to provide faunal statements and my duty was to work up the topics such as the nature of the site, its stratification, chronology and other 'archaeological matters', as well as maps and photographs. Professor told me that it would be better if I waited with my part until he had finished his task.

Soon after his last visit in Warsaw in spring 2001 Professor wrote to me that the paper was almost ready. He pointed out, that he was not definitely convinced that Dudka was an island during the

Stone Age settlement. Unfortunately, instead of sending me his manuscript, he informed me about having engaged a third contributor to our paper – a specialist of satellite photographs interpretations Prof. Dr. R. Goossens (Ghent University, Belgium), whose task was to demonstrate that Dudka was in fact a peninsula connected with the mainland.

Two years passed. In the meantime, I got contradictory messages from Professor Gautier. According to one of them – Prof. Goossens proved that Dudka was not an island, according to others – ...he has not already proved it. At the same time I presented once more to Professor Gautier (during his last private visit in Warsaw in spring 2003) all formerly published data, as well as new ones, indicated that Dudka site had the insular character.

Actually, taking into account Professor's scepticism in this matter and taking into consideration the time going by and my obligations in the Institute concerning Dudka, I proposed him to include both opinions regarding the character of the Dudka site in our (?) paper. Unfortunately, I did not receive any answer to my suggestion. Moreover, still I had no access to elaborated faunal determinations and general results done by Professor Gautier. Finally, in autumn 2003 I received a final paper, in which the only thing I was supposed just to do was to make some trifling editorial corrections and a map supplement. I have done it, and such a version is published in the same volume of the *Przegląd Archeologiczny*.

Nevertheless, I decided to back out my name from the paper in question, due to my disagreement with general conclusion and most of new interpretations concerning some issues.

My comment on the preceding paper would not have been written at all, if the only disagreement between Professor and me concerned the matter if Dudka was an island or peninsula. In fact, Professor Gautier in his paper contradicts most of my already published hypothesis and conclusions regarding Dudka. I used archaeozoological determinations as one of the most important data and arguments to characterize the type of settlement and subsistence, sedentary and territoriality, seasonality and hunting strategy, origin and role of domesticated animals, and changes in environment including history of the local fauna as such.

Professor Gautier stresses however that "Gumiński used some preliminary faunal data in his general papers. Since these data were preliminary, incomplete, perhaps not well decodable, some of the inferences based on these data have to be reconsidered. I also had doubts about the geographical context of Dudka: was it really an island?" (Gautier 2005: Introduction). And at the end he concludes: "Some inferences about the relation between people and animals based on preliminary identifications have to be withdrawn" (Gautier 2005: General conclusion, the last sentence).

Moreover, arguments used by Professor Gautier to contradict my former statements are in my opinion strange. Therefore, I should not leave them with any comment. Below I refer to some crucial matters, which Achilles Gautier touched. I suggest we start with.

THE QUESTION OF ISLAND

Achilles Gautier (2005: chapter 1 & 7) dubiously accepts formerly published statement that Dudka was an island during the Stone Age, particularly in the light of bone analysis as well as of common sense. According to his opinion, Dudka was either a peninsula and as such was useful for trapping animals or if it was a real island, all bones of terrestrial animals found there, were the result of protracted hunting on the island. In the second case, it makes the false impression of regular hunting on the mainland. Let us start with review concerning indicators of the insular character of the Dudka site.

1. The map of Staświny Meadows (where the Dudka site is located) made by The Institute of Drainage and Greenland in Falęty (IMUZ), whose simplified and modified version was published in the beginning of archaeological research in the area (Kempisty & Sulgostowska 1986: fig. 1). Unfortunately, the published map omits one of the drilling cores situated just in the essential zone – west of the Dudka (1) site. There, the distance to the main-

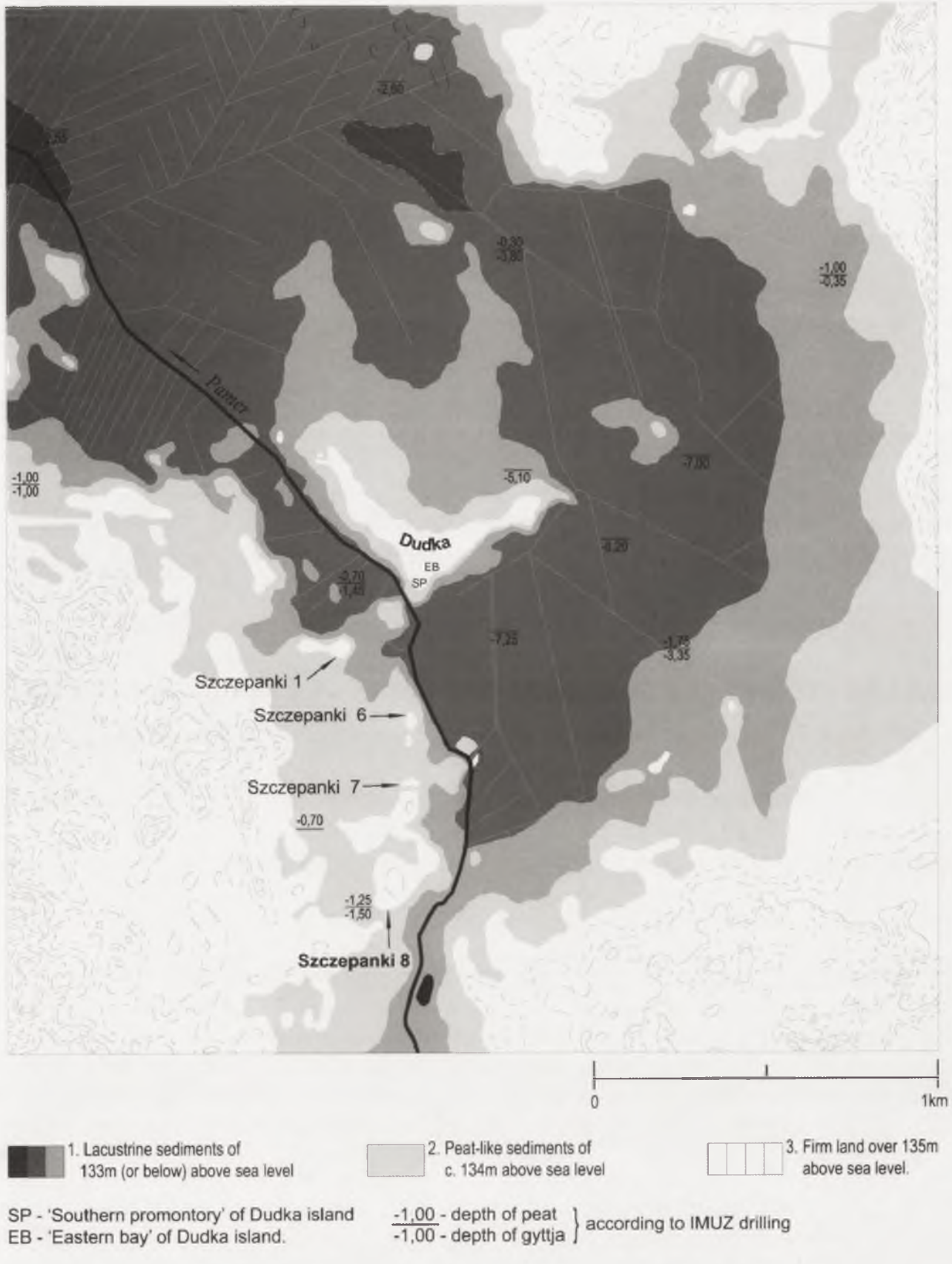

Fig. 1. Southern part of Staświny Meadows with marked sites of the Stone Age (after M. Matusiewicz, IMUZ, with additions).

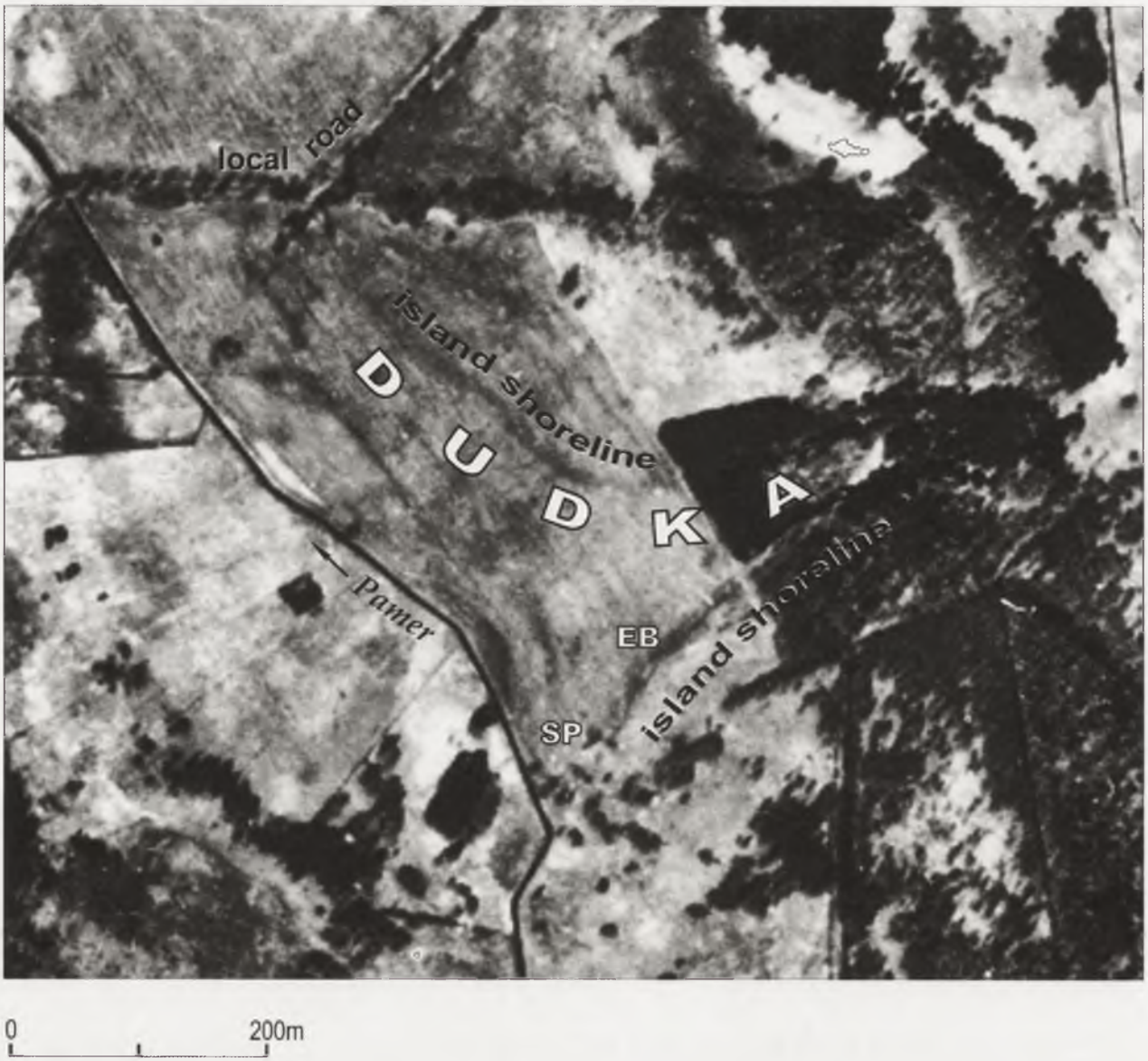

Fig. 2. Aerial photography of Dudka (SP – 'southern promontory', EB – 'eastern bay').

land (or other islands) is the shortest and possible land-bridge could exist. The omitted drilling point is situated c. 200m west from the southern promontory of the Dudka island (fig. 1). On original IMUZ map, it has No 266 with the following data: 0.70m – peat-like deposit from the top and – 1.45m gyttja type sediment below. This clearly indicates that lake existed there of the minimum water depth 1.45m, or more plausible – 2.15m or so.

2. Map of Staświny Meadows made by geologist Marek Matusiewicz (as MSc thesis in the Geological Institute, Warsaw University), whose part around the Dudka site is published below (fig. 1) with kind permission of its Author. The map is based on five sources of data. (a) The network of drilling cores done and interpreted by M. Matusiewicz (including some formerly known from IMUZ). (b) Geomorphology of Staświny Meadows banks (including those of islands) which indicates that they had been formed by lake waters. In other words, current banks of the Meadows were the banks of the former lake. (c) Topography and altitudes of the Meadows taken of the detail map 1:10 000. (d) Detailed map of the Dudka site 1:500 (made by MSc Jan Olchówka), whose generalised version with marked archaeological trenches is

published among others within Gautier paper (2005: fig. 2). (e) The altitudes of water-table of particular periods of the Stone Age deduced from the highest level of lacustrine origin layer(s), such as gyttja, detritus, sapropel, or sands with lake's mud.

During the Late Palaeolithic and Mesolithic the water-level of the Staświny Lake fluctuated between 132.3m and 133.7m above sea level. From the beginning of the Paraneolithic, the direct data do not exist because instead of clear lacustrine sediment, peat was accumulated. However, as a rule such deposit grows just at the border of land and water. Anyhow, the water-level subsided to c. 132.5m-131.9m a.s.l. (Gumiński 1995: 14-17, figs. 4, 5). Cited levels do not include the minimum depth of water necessary for lacustrine sedimentation. To conclude, the average water level during the Stone Age oscillated about 133m above sea level.

3. In fact, generalised geological map 1:50 000 (Szczegółowa Mapa Geologiczna Polski, *sheet* 143 – Miłki) shows a possible narrow land-bridge i.e. grounds of a boulder-clay joining westward the north-western promontory of Dudka with the mainland. The land-bridge however (currently with a local road on it) is distinctly marked as a man-made dam on both more detailed topographical maps 1:10 000 (Główny Geodeta Kraju, *sheet* 224.124 – Siemionki) and 1:25 000 (Archeologiczne Zdjęcie Polski, *sheet* 20-75). A fixed datum point of 133.29m above sea level located just below the dam shows that the area adjoining the dam lays under the former water-table of at least the Middle and Late Mesolithic lake's extend.

4. From the late Atlantic period (during the Zedmar), lake began intensively shallowing and overgrowing from shores (including those of islands), so peat-like sediments were deposited over typical lacustrine ones. Professor Dr. Sławomir Żurek and his followers (of the Institute of Geography, Świętokrzyska Academy) took twenty drillings around Dudka island and recorded that peat sediments of the early Subboreal (the Middle and Late Neolithic) came up to 1.2m thickness. Nevertheless, the peat is thinning out quite close to the island, i.e. dozen or so meters away from the firm-land. Gyttja-like sediment still exists there at the same level as peat and in some places slopes to 8m down (Żurek 2003: 157-8). These twenty cores clearly suggest that peat formation could not join the Dudka island with the mainland even in the Late Neolithic.

5. New excavations at Szczepanki (8) site[1] that is also located on an island within the same Staświny Meadows (fig. 1) confirm the same as at Dudka fluctuation of water-level in according periods. The lacustrine sediment of greyish mud and yellowish sand interbeddings of the Younger Dryas origin (the Late Palaeolithic) and partly washed out in the Late Boreal (Middle Mesolithic) came up to c. 133.90m above sea level (Gumiński 2005: footnote 3, figs. 5, 6). In the middle Atlantic period (the Late Mesolithic) following lacustrine sediment of grey-greenish sandy mud reached c. 133.70m a.s.l. (exactly as at Dudka). Next, in the late Atlantic (the Early Zedmar) swampy peat with packages of sand indicates that water-table subsided to c. 133.30m a.s.l. Nevertheless, new formally 'terrestrial' land was very narrow and quagmire. The situation must have been similar during the transition to Subboreal (the Zedmar period) and it probably remained to the Late Neolithic. At that time water-level could not subside significantly, since peat still accumulated intensively (Gumiński 2005). It means that at least until the end of the Zedmar lake waters covered altitude of c. 133.00m above sea level, therefore the lake was still quite extended, although it began overgrowing intensively from some shores. Actually, the firm-land (including islands) of 135m above sea level (or higher) was suitable for habitation during the Stone Age. The altitude of c. 134m a.s.l. (including minimum water depth to lacustrine sedimentation) most probably delimits extension of lake in the middle Holocene, however some parts of the Staświny Lake were probably shallow (fig. 1).

6. Finally, the aerial-photography of the Staświny Meadows including Dudka site (fig. 2) (Gumiński & Michniewicz 2003: fig. 17.2) clearly shows the shoreline all around the island (less visible at north-western promontory partly destroyed by local road). This, triangular in outline, dark line well overlaps with contour line of c. 135m above sea

[1] Investigations of the Institute of Archaeology, University of Warsaw, under my management from 2002.

level (cf. fig. 1, 2) and in fact exhibits banks of the island.

Neither the arguments presented above[2] nor the negative results of two years work of Prof. Goossens[3] (Gautier 2005: chapter 7) convinced Prof. Gautier to the idea of the insular character of the Dudka site. Finally, he admits such an interpretation, under the condition that terrestrial mammals were hunted at the Dudka site. In other words, he regards Dudka as the killing site (Gautier 2005: chapter 7).

WHY DID PEOPLE COME TO THE ISLAND?

Considering above, the question is not – whether Dudka site was an island or not, but rather – why did prehistoric hunters choose the island for yearly, seasonal encampments? Moreover, why did they settle exclusively at the south-eastern shore of the island? (Gumiński 1999: figs. 4-7). It seems that two kinds of factors might have decided about it – the utilitarian and, other more hidden – the spiritual one.

FISHING ALONG THE SHORES OR EXCLUSIVELY AT PARTICULAR PLACE(S)?

The main utilitarian factor probably appeared soon after, since one of the most common and biggest fish species in the Staświny Lake, namely pike (*Esox lucius*) (and after also other fish) began to spawn regularly just at the SE shore of Dudka island (Gumiński 1995: tab. 6; 1998: tab. 12.3). In the Allerød and Dryas-3 (the Late Palaeolithic) any traces of human activity at Dudka are very seldom and scattered on a large area (Fiedorczuk 1995: 56, fig. 3). No fish bone from these periods was found, instead, the remains of water birds suggest the main purpose for coming to the island (Gumiński 1999: 40-43; in press; Gumiński & Michniewicz 2003: 120-122; Tomek & Gumiński 2003: tab. 1).

In the early Preboreal (Friesland and Dryas-4, decline of the Late Palaeolithic) fish bones, exclusively of pike (Makowiecki 2003: 61), appeared for the first time at the site and made at once c. 37% of all bone remains. Together with water birds, which were undoubtedly hunted also on the island (Tomek & Gumiński 2003; Gumiński in press), bones of animals caught on (or from) the island comprised c. 60% of the total bone remains. Therefore, during the Late Palaeolithic the main cause, which attracted hunters to occasional visits to the island, were big water birds (cormorant and gees) and later, beginning with the terminal Late Palaeolithic also fish (at first exclusively pike).

Fortunately, for the Mesolithic hunters of the temperate zone, most of big sizes freshwater fish species spawn in spring – the most difficult season to survive from starvation. Moreover, each species spawn in different time of spring. As a first begins pike (*Esox lucius*) – early spring, after which follows perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), and bream (*Abramis brama*) and in late spring/early summer – tench (*Tinca tinca*) and wels (*Silurus glanis*) spawn (Brylińska *ed.* 1986; Gerstmeier & Romig 2002; Makowiecki 2003: tab. 4, fig. 13). Furthermore, each fish species common at Dudka (Gumiński 1995: 21-2, tab. 6; 1998: 105-6, fig. 12.3, tab. 12.3; 1999: tab. 3; Makowiecki 2003: 61-9) chooses similar and even the same spawning-grounds, which are characterised by very shallow and overgrown waters (Brylińska *ed.* 1986; Gerstmeier & Romig 2002).

Exactly such conditions occurred at Dudka, particularly at the south-eastern shore of the island (Gumiński 1995: figs. 4B, 5). Already in the Preboreal the shallow littoral was overgrown by different water-plants, such as water milfoil (*Myriophyllum spicatum*), pondweed (*Potamogeton*), white waterlily (*Nymphaea alba*) and yellow waterlily (*Nuphar*) (Nalepka 1995: fig. 3: -118cm

[2] Actually, Professor Gautier did not know arguments no 4 and 5, since they appeared in the autumn 2003, simultaneously with his manuscript in my hands.

[3] I do not have any results of this work.

Table 1. Fishing at Dudka and Szczepanki (8) sites of the former Staświny Lake. (* – area of trenches excluding those situated at the centre elevations where bones did not preserved; x > – times more at a given site).

	Dudka (652m²)*		Szczepanki (150m²)*	
Number of fish bones	34 780	11 x >		3 170
Density of fish bones	53/m²	2.5 x >		21/m²
Share of fish bones	27.3%	1.5 x >		17.6%
Density of fishhooks	0.15/ar		9 x >	1.33/ar
Angling method (IAM rate)	0.03		21 x >	0.63

and -97cm). These aquatic plants usually create extensive floral submerged assemblages, which grow well only on the lee (sheltered) side of the lake (Podbielkowski & Tomaszewicz 1979: 145-7, 357-8, fig. 16; Kłosowscy 2001: 20, 94-5, 106-15, 120). Such places are the most densely populated in fish, attractive there due to the best conditions for food foraging and for spawning, which concerns all of fish species mentioned above (Gerstmeier & Romig 2002: 46-9, 70-4).

It is unknown, how often and where similar conditions appeared in the Staświny Lake, but certainly not "round along the shores" as Professor Gautier suggests (Gautier 2005: chapter 7). For instance, mentioned above similar site Szczepanki (8) that is also exposed to the south-east (fig. 1), shows quite different sediments in the littoral zone. Until the late Atlantic there were mainly sands (Gumiński 2005: 55-58, 99, fig. 5, 6), therefore conditions for spawning might have been quite different and it is most probable that they were indeed.

Fish bones at the Szczepanki site composed 17.6% of the total game remains while at Dudka – average 27.3% (Gumiński 2005: tab. 1; Tomek & Gumiński 2003: 11). It means that fishing was one and a half more intensive in subsistence at the Dudka site (tab. 1). Moreover, density of fish bones per area of trenches was two and half times higher at Dudka than at Szczepanki. Besides, two fishhooks have been found already at Szczepanki (Gumiński 2005: fig. 13b, c), but only one at Dudka (fig. 3d), although the total area of trenches was over four times bigger at the second site. This suggests that fishhooks were in average nine times more common at Szczepanki than at Dudka, if only area of trenches is taken into consideration (tab. 1).

This difference is more distinct, if number of fishhooks is compared with number of fish bones at both sites. This comparison, let's call as IAM-rate, simultaneously estimates *intensity of angling method* in fishing activity. IAM-rate at particular site is just a quotient of number of fishhooks and number of fish bones and the result is multiply by one thousand. The enclosure table (1) clearly suggests that angling method in fishing was over twenty times more often used at Szczepanki than at Dudka.

The lack of fishhooks at Dudka seems not to be a discrepancy with regard to fishing at spawning time, when fishhooks are not necessary or perhaps useless. Instead, any clubbing devices and (or even exclusively) big basket(s) are sufficient for (Prof. Dr. Michał Iwaszkiewicz†, ichthyologist, pers. comm., Poznań, cited already: Gumiński 1998: 105). If the spawning-grounds were situated at the south-eastern shore of the Dudka island indeed, regular camping at this particular place does not seem to be the "conundrum" as Professor Gautier wonders.

It was not indispensable to ask Dr. Daniel Makowiecki – "whether good fishing grounds were available along the shores of the mainland?" (Gautier 2005: chapter 7). Dr. Makowiecki is certainly a good specialist in ichthyo-archaeology, but not necessarily a good fisherman, and even if so, he does not have any additional data (apart from fish remains) concerning distribution of fish within the

Fig. 3. a – fishing platform of pine-tree at the 'southern promontory' of Dudka (early Boreal) and fishing tackle found nearby the platform; b – wooden club of ash-tree (early Atlantic); c – wooden hook of juniper root (Allerød); d – bone fishhook with rest of willow-bast fish-line covered by a tar (late Preboreal); e – antler axe (early Boreal).

former lake. Fish, particularly predatory fish stay at the end of the trophic chain, so their distribution depends on many factors stimulated by preceding links of the chain. The trophic chain begins from an abiotic characterisation of water (temperature, water current, transparency, chemical composition etc.) because it stimulates distribution of plankton and flora, and those influence on small fauna (worms, molluscs, crustacean, insects etc.) on which fish feed. In other words, fish, as well as other vertebrates or even plankton live at particular biotope(s) (place) within a lake (Gerstmeier & Romig 2002: 44-50). As it was said above, neither abiotic conditions, nor water vegetation were similar at investigated sites of the former Staświny Lake. My answer to the question above is – good fishing grounds probably occurred also in some other places, but certainly not around along the shores. Other potential fishing places could be simply not as good as for example the one at the 'eastern bay' of the south-eastern shore of Dudka (figs. 1, 2).

Just over there (trench no III at the 'eastern bay'), the rough platform(s) of floating trunks and branches was uncovered. Besides, an oak stake was found, pointed and singed from one end, which on other end had specially cut sprout forming a hook for fastening the platform down (Gumiński 1995: 33-5, figs. 6, 7). Below the platform, several sunken antler axe-like implements as well as wooden ring net-float and spirally decorated fishing-rod of ash-wood were excavated (Fiedorczuk 1995: figs. 4a, d, f, g, 6g, h; Gumiński 1999: 49, footnote 17). All of the items were used clearly for fishing, in particular by clubbing method during spawning season. The platform(s) and fishing tackle are dated in the early and middle Atlantic, i.e. the Late Mesolithic (Gumiński 1995: 22-4, 33-5; 1999: 48-9).

Another fishing-spot, the older one, situated c. 60m westward of the above-mentioned platform has been excavated at the eastern part of the 'southern promontory' (figs. 1, 2, E part of trench no I and trench XII; Gautier 2005: fig. 2). The place was in use mainly in the Early Mesolithic, from the late Preboreal to the early Atlantic, though perhaps as early as in the Allerød. There, in the early Boreal, the big pine-tree had been cut-off and moved-down to the island shore in such a way that trunk laid perpendicularly towards the lake (fig. 3a). Proximal, wider part of the trunk was set on the sandy beach, and its upper side was partly flattened by hewing and burning. The distal part of the trunk reached out, far into the lake. The crown-end of the pine-tree (not unearthed) either floated more or less on the water-table, or was fixed by its sunken branches into the bottom. The whole part of uncovered pine-trunk had no branches. Undamaged 'new' antler axe was found in the same layer (the early Boreal) within few meters of the trunk (fig. 3e). The axe had no handle, although other wood from the layer L.13, where the axe was found was preserved normally. The axe probably fell off the handle, sunk, and was lost during fish clubbing.

Other fishing tackle were found nearby the same spot, though some were older, other – younger of the pine-trunk. The bone fishhook (fig. 3d) mentioned above is dated at the beginning of the late Preboreal (bottom of layer L.14). The fishhook is in excellent condition and have still attached rest of willow-bast fibre[4], carefully tied and covered by tar-like substance. It clearly indicates that fishhook was tear off just at the fishing place. Even older – coming from the Allerød layer (L.16) is the hook-like implement made of juniper root[4] (fig. 3c). This wooden artefact might have been used as pick-up device by fish-branchia, since fish keep branchiae gaping during they spawn[5] (Brinkhuizen 1983: 10). The next wooden artefact – club made of ash-wood[4] (fig. 3b) was found within the early Atlantic layer (L.8). This was probably the most useful fishing tackle during spawning season. The findings above suggest that the eastern part of the 'southern promontory' was the second best place for fishing.

Concluding, two fishing places were used at Dudka during very long period of the Stone Age settlement. There, special platforms were made for fishing purposes and fishing tackle was found around or evens under the platforms. It should be stressed that neither construction, nor eventual

[4] Determined by Maria Michniewicz (IAE PAN).

[5] Similar applies to already published hook-like implement made of pine-wood, which was found within Boreal layer in the 'eastern bay' – trench no. III (Fiedorczuk 1995: fig. 6h).

fishing equipment was found at any other trench dispersed along c. 200m shoreline. It applies to the south-western bay (trenches no. VII and VIII) as well to the cape of the southern promontory (trench no. II and SW part of trench no. I).

If one takes into account just two fishing places and extremely rare finds of 'classic' fishing equipment on the one hand, and almost 35 thousands fish bones on the other – clubbing and picking up techniques during spawning seasons should be the most common and effective fishing method at Dudka. If spawning-grounds with easy attainable fish were located yearly, in spring at the same particular spots of Dudka, hunters of the region certainly quickly noticed such time and place and this circumstance led them up to regular camping on the island, particularly in spring and at the south-eastern shore.

LIVING ON THE ISLAND AND HUNTING ON THE MAINLAND

Usually, the force of habit becomes a ritual. Encampment on the island offers also other benefits. First, it clearly separates exclusively 'our land and home' from the rest of the world, both in physical and mental meaning.

Habitation on the island enabled to control the whole lake with its surroundings, i.e. searching and properly reacting to every change with keeping one's distance. Simultaneously encampments on the island do not frighten away the terrestrial game. Most, if not all, wild mammals avoid the noise from human settlement and the smell of campfire. Furthermore, it was easier to transport any killed animal, even as big as elk or aurochs, by water (on raft for instance) than on shoulders. Any big animal, if it were killed at other spot on the island than at the campsite, would be much more difficult to transport on the ground to the campsite, than by water across the lake. For instance, from the north-western promontory of Dudka to one of the campsite at the south-eastern shore is about five hundred meters (fig. 1). Otherwise, if an animal were killed not far from the lakeshore, e.g. close to the watering-place the distance to move or to bear it would be much shorter.

Just the island seems to be a very good place for hazel cultivation (Gumiński & Michniewicz 2003: 123-4). Formally, plantation of hazel could be located on the mainland as well, as Professor Gautier suggests (Gautier 2005: chapter 7). However, cultivation demands supervision, particularly when the nut crop ripens up. In that time, other creatures appear abundantly willingly ready to harvest and eat. Hazelnuts were liked and sought for by strangers, rodents, and wild boar/pigs as well. Since the hazel plantation was situated on the island, this was at least partly separated from competitors. It is significant that hazel cultivation at Dudka totally disappeared as soon as pigs began to hold on the island in the early Zedmar period (Gumiński & Michniewicz 2003: 126, fig. 13).

The large Dudka island (a dozen or so hectares) and its natural water borders could make an excellent pig-run and self feeding ground for a herd of semi-domesticated pigs (Gumiński 1995: 25-6; 1997a: 100; 1998: 107-8; 1999: 52-3; 2003a: 63; Gumiński & Michniewicz 2003: figs. 13, 14).

HUNTING ON THE ISLAND?

Professor suggests that hunting took place on the Dudka island in opportunistic way, i.e. few animals appeared by chance on the island each year, and then were killed there, created false impression of regular hunting on the mainland (Gautier 2005: chapter 7 & 8).

Indeed, Dudka was inhabited throughout c. 7500 years and if one multiplies it by 'few' animals – many thousands of bones should have had appeared. However, some periods at Dudka were very long, protracted c. one thousand years, but only very few bones produced, e.g. the Late Palaeoli-

thic, or the Middle Mesolithic. Other periods, however, were relatively short, for instance Zedmar that lasted 200-300 years, but yielded over thirty thousands bones and fragments of only terrestrial mammals. These enormous differences in density and frequency of bones reflect distinct contrasts in intensity of habitation in particular periods (Gumiński 1998: 104-5, fig. 12.2, tab. 12.2; 1999: 52, 62, 74, tab. 4).

Taking into account the duration of the Zedmar period and number of bones coming from it, an average c. hundred (preserved) bones of terrestrial mammals per annum appear. However, approximately one tenth of the main Zedmar camp area has been excavated (Gumiński 1999: fig.6b) so average one thousand (preserved) bones of terrestrial animals should be expected from Zedmar layers yearly. It is very difficult to estimate, how many bones disappeared completely during multiple taphonomy factors, but certainly the bulk, as Professor Gautier rightly noticed (Gautier 2005: chapter 7). Anyhow, it is clear that much more than average 'few' terrestrial mammals were killed each season during Zedmar period.

Another doubt arises when we think why more intensive human habitation (that manifested itself from extremely high density of bones, flint artefacts, and pottery fragments) led to terrestrial mammals visiting the island more often – as it consequently stems from his suggestion (Gautier 2005: chapter 7). As far as I know, it should be rather conversely, if it did happen at all.

Theoretically, all mammals can swim but it is proper to remind that the shortest distance from the mainland to the Dudka island is about 500m (fig. 1). Only beaver (*Castor fiber*) and otter (*Lutra lutra*) could appear on the island frequently, effortlessly. Other, smaller fur-bearing animals (particularly mustelids) perhaps permanently inhabited there. Such species, however, are in distinct minority among the bulk of ungulate bones (Gautier 2005: tabs. 1, 3, 5). Ungulate mammals, which were the base of diet, rather avoid long distance swimming, with except of elk (*Alces alces*). However, bones of this largest deer were comparatively often found in earlier periods, but during the Zedmar, it reached less then ten percent (Gautier 2005: tab. 3). It was assumed already that elk (but rather exclusively this species) could have been deliberately attracted to the Dudka, particularly in the Middle Mesolithic. Perhaps, particular tree species were burned purposely in order to produce young sprouts that elk especially like (Gumiński & Michniewicz 2003: 124, figs. 17.10-11). Other ungulates rather did not appear on the island 'by chance' because there was no reason to cross the lake straight on to the human campsite.

Dudka as an insular hunter-gatherer campsite with plenty of terrestrial fauna bones is not an exception, but rather a common example. Within Masurian Lakeland two other forager sites were located on the islands as well – Łajty, inhabited in the early Holocene (Sulgostowska 1996; Żurek 2003: 153-6) and Zedmar A, from which the name of the earliest ceramic culture was taken for (Bohne-Fischer 1941: 63-4, fig. 22; Timofeev 1991: fig. 2). Similar localisation had many other Mesolithic sites of the European Plain including most famous one. There were sites within Duvensee peat-bog (Bokelmann 1991: fig. 3), Mullerup within Maglemose (Sarauw 1903: 149, fig. 1), Ulkestrup Lyng and others within Åmose (Andersen et al 1982: 87, figs. 2, 3; Andersen 1983: figs. 1-23), few sites of Ageröd (Larsson 1983: 124-126; Derndarsky 2000: figs. 1, 2), and Lammasmägi hill within Kunda peat-bog (Martin 1995: 245, fig. 4; Åkerlund et al. 1996: fig. 1a-b; Karukäpp et al. 1996: fig. 5). Other sites were located on dune-islands within Rhine/Meuse flooding delta (Raemaekers 1999: 26-7, fig. 3.1-2; Louwe Kooijmans 2003: fig. 77.1) or on islands within former fjords or lagoons, as Vedbæk (Brinch Petersen 1989: 326, figs. 1, 2, 4) and Skateholm (Larsson 1988: figs. 3, 4). Some groups of hunters settled even on the Baltic islets (Johansson 1995: 92, figs. 2, 4, 5; Wigfors 1995; Lindqvist & Possnert 1997: 35, 39, 46; fig. 1; Storå 2000). All above-mentioned sites yielded series of bones of big terrestrial mammals.

COLLECTING AND COUNTING BONES

In the section concerning bones from dog graves A. Gautier (2005: chapter 2) noticed that "As it is clear that not all bones were collected". I am surprised by this sentence, because Professor knows very well that during excavations, all of visible bones (and artefacts) were hand collected, and after, whole-excavated sediments were additionally sieved through a mesh of 3-4mm. He even wrote himself about it in the "Introduction". Next, a part of dog bones from both graves were sent for C-14 analysis and their lists are always kept in the boxes together with the remaining bones. Professor was aware of it. I showed photographs, drew documentation, and talked about the dog graves, emphasising that they were certainly secondary burials. It means that the dogs had not been put into the graves entirely, soon after death, but much later, they had been transferred from temporary burials. In consequence, the dog skeletons were dismembered, not in anatomical order and lacking some bones. The same burial custom was practised at Dudka toward humans as well (Gumiński 2003b). In this case, the phrase "not all bones were collected" refers to Early Zedmar people, rather than to me.

The second notice refers to counting of tortoise carapaces. From 129.300 bones and fragments, I picked out 1100 fragments of carapaces (Tomek & Gumiński 2003: 11). Independently, Professor Gautier from the same loads of bones distinguished 263 such pieces, including a few postcranial remains, which I am not able to identify (Gautier 2005: chapter 2, tabs. 1, 3). His result came as four times lower than mine did. He tries, however, to burden me with the following notices "no doubt carapace remains belonging to a single individual were counted separately" and in a further chapter "such fragments evidently derived from one carapace or individual as exemplified by a find in DI-B3" (Gautier 2005: chapter 1 & 2).

I always count bones and fragments after refitting possible elements of one bone together. Such refitting bone (or still fragment) is counted as one specimen. In the case of singular carapace, that found as one shell *in situ* (trench VI, between graves), though crashed, I counted it as one specimen although not all pieces could be refitted after excavations. On the other hand, numerous fragments of carapaces coming from wider area of a given trench and layer were counted by me separately, since no one fragment more could be refitted. For instance mentioned by Professor Gautier: DI-B3 (Zedmar layer within trench no I) yielded in fact 583 pieces of carapaces (two times more than Professor distinguished for the whole site). Other thing that those fragments look alike, as it is in the case of all other, particular bones found within the same layer.

PRELIMINARY VERSUS AUTHORITATIVE DETERMINATIONS

Professor Gautier (2005) stresses out, that the earlier papers, in which animal bones of Dudka were discussed "were based on incomplete, preliminary data", moreover, they were "not always well decodable". So then, "inferences based on these data have to be reconsidered" (Gautier 2005: Introduction). At the end, he concludes that those former statements "based on preliminary identifications have to be withdrawn" (Gautier 2005: General conclusions – the last sentence).

Such statement hardly contradicts to most of my former papers. All my works concerning mammal bones of Dudka were based first on MSc Małgorzata Nawrocka analyses (former of the State Archaeological Museum PMA). I also used some other determinations of small assemblages or even individual bones made by other archaeozoologists, including Professor Gautier, as well as Prof. Dr Alicja Lasota-Moskalewska (of the Warsaw University) and some of her followers, MA Anna Grężak, MA Przemysław Florek, and Katarzyna Stefanowicz, in most cases consulted with their Master. Particular, very important bones were additionally identified or consulted by Prof. Dr. Henryk Kobryń,

Dr. Bodil Bratlund and Dr. Daniel Makowiecki at different times and occasions. Indeed, these bones are very meaningful because some were found in lowest, Late Pleistocene-Earliest Holocene layers; others came from specific archaeological contexts, namely graves.

CERTAINLY NO DOGS (?)

One of such assemblages contained the remains of human temporary burial, dated to the Middle Mesolithic – the late Boreal period (Gumiński 1995: 35-6, fig. 6; 2003b: fig. 3). Among other findings, there were also two bones of undoubtedly carnivores. The rib (fig. 4a) of probably small young dog (according to M. Nawrocka) appeared to be less exactly identifiable according to other consultants. The common opinion suggests that the rib comes from any, middle-sized carnivore, but more precise determination is very difficult. The second bone (fig. 4b) of the same assemblage, namely the canine tooth of *Canis* sp., most probably domesticated medium/large sized dog (according to Nawrocka) has got similar opinions to the former determination. Some of archaeozoologists, however, were not so convinced that the tooth comes from domesticated dog, but everyone said with certainty that it is the fang of carnivore, most probably the canine one. The tooth in question came back from Ghent to Warsaw unfortunately in a very bad condition, with enamel part damaged, nevertheless it was possible to determine it as it is referred above.

According to Professor Gautier, however, and several of his colleagues "it was not a fang and canid, but could not offer a definite identification" (Gautier 2005: chapter 2, cf. chapter 8 – General conclusion). Specialists can have own and different opinions in the same mater, but if one of them is not able to offer any identification, perhaps it is not yet proved against the former estimation. Moreover, one can expect rather stronger arguments if new scientific statement contradicts the former one. Anyhow, A. Gautier conclusion that „Dudka does not offer evidence for Mesolithic dogs, and graves with people and dogs" does not convince me.

CONFUSION WITH A HORSE

The second confused determination concerns very well preserved and big bone (fig. 4d) found in the multiple grave VI-2. The bone lay on the chest of a deceased child along with his left arm (Gumiński 1997b: 22). The bone was shown to most of above-mentioned archaeozoologists, and they all agreed that it is the radius of a horse (*Equus ferus*). In the table 2 of the Gautier paper including material from graves, bones or rather, species representing unknown bones are listed, but horse is not included at all. Unfortunately, it is still open, whether the horse bone is missing by chance, irresolute, or Gautier regarded it as a bone of elk, red deer, or rather a wild boar? (Gautier 2005: tab. 2). Although such a mistake is highly improbable[6] for a high range specialist, the confusion remains. The lack of any anatomical determinations and present only taxonomic ones makes eventual other corrections or more sophisticated analyses to be impossible.

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[6] Among European Holocene fauna exclusively horse has anatomically immovable fusion between radius and significantly shorter ulna, which reduced distal end adhesives to the middle of the radius shaft (Sych & Pucek 1984: 317; Lasota-Moskalewska 1997: fig. 75; Krysiak, Kobryń & Kobryńczuk 2001: 171-2, 179, fig. 114, 115).

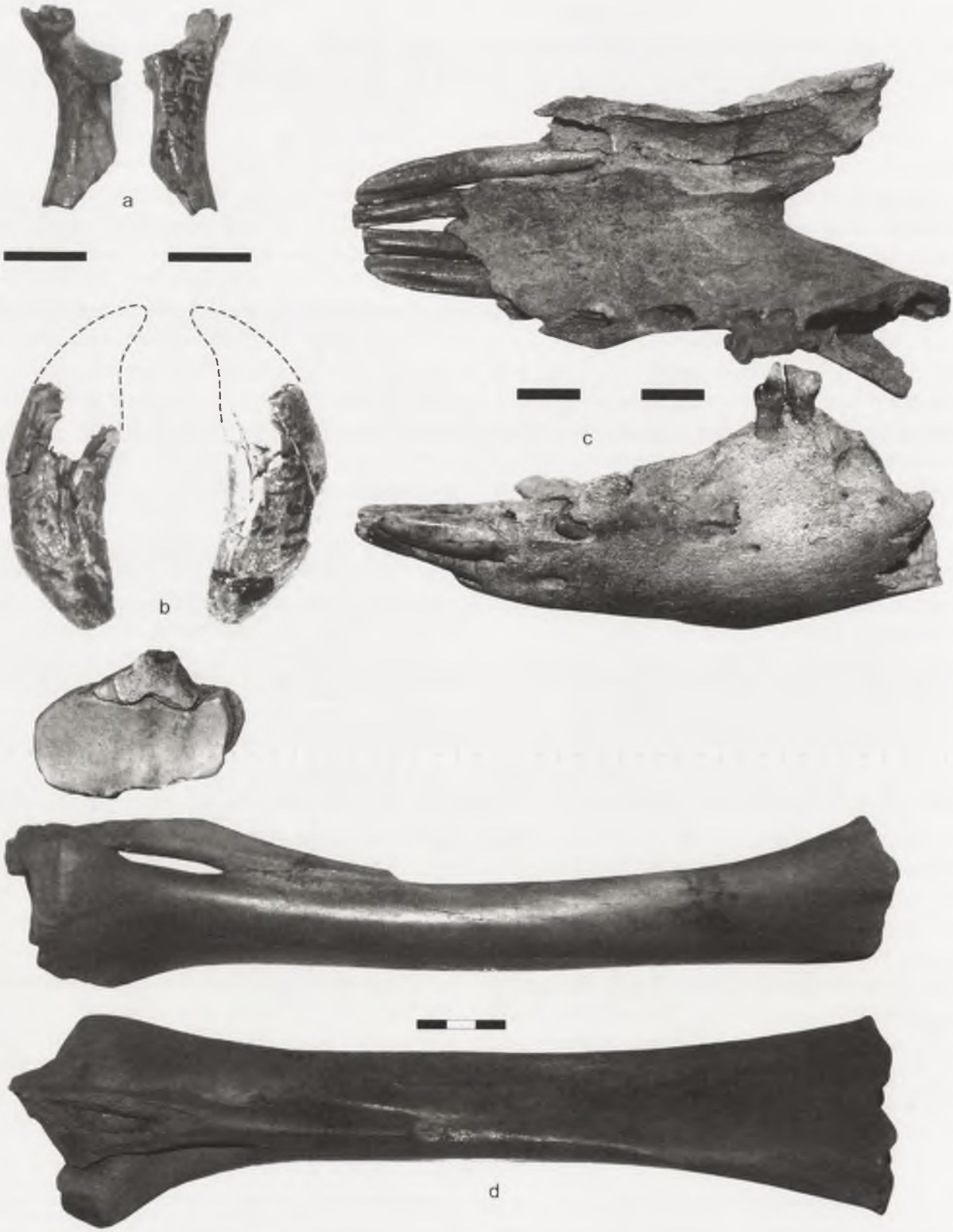

Fig. 4. Dudka, bones of graves: a, b – temporary human burial no α, the Middle Mesolithic (late Boreal) (trench IIIa, layer B6); a – rib of middle sized carnivore; b – fang (canine tooth) of canid (*Canis lupus* f. familiaris?); c – jaw (mandible) of pig (*Sus scrofa* f. domestica?) of the dog's grave VI-8, the Early Zedmar, AMS C-14: 5690±25 BP (KIA-19171); d – left radius of horse (*Equus ferus*) of the human grave VI-2, undated.

WILD OR DOMESTIC?

The third determination coming from the grave is not as obvious as the previous one. The question concerns nuance of differences between wild and domesticated form of the same species, namely wild boar and pig (*Sus scrofa*). The bone in question comes from the dog's grave VI-8 and it is undoubtedly a lower jaw (mandible) of a subadult suid (fig. 4c; Gautier 2005: pl. II-1). According to A. Gautier, this bone, as well as all the other swine bones of the Dudka site, belongs exclusively to the wild boar. P. Florek, separately, worked on bones of dogs' graves from Dudka under the supervision of Prof. A. Lasota-Moskalewska and according to their opinion this mandible comes from already domesticated form of pig. The indicating feature in this case is the row of teeth, which is shorter than in the wild form (fig. 4c; Florek 2001). The exact determination became more important, since the grave got the AMS C-14 date: 5690±25 conv. BP (= 3740±25 conv. bc) (KIA-19171), which indicates the beginning of the Early Zedmar period (the Late Atlantic) for the whole assemblage.

I have already discussed the status of swine at Dudka (Gumiński 1995: 20, 25-6; 1997a: 100, fig. 8; 1998: 107-8; 1999: 52-53; 2003a: 63, fig. 2; Gumiński & Michniewicz 2003: 126-7, figs. 13, 14). Here, it is appropriate to remind that apart from clearly wild boar remains, M. Nawrocka distinguished other bones, which she could not certainly attribute to wild boar or domestic pig. Next, eight such bones, one of the Early Zedmar and seven from the main Zedmar period were additionally microsectioned analysed by Nawrocka with collaborators. According to the microscopy view, they supported former morphological statement. Furthermore, the relative fluctuation of wild boar/pig bones towards other ungulate remains, as well as simultaneously converse fluctuation of some tree species preferable by swine – suggest semi-husbandry of pig already in the Early Zedmar.

Professor's opinion on this matter is quite different. He rejects above possibility on the grounds of "definite analysis of the suid remains". As Gautier elucidates "the definite analysis takes into consideration the conditions of preservation bones" (that is all!). As he further explains "Any practising archaeozoologist knows, bones of domestic animals are generally less well and differently preserved with respect to those of their wild relatives, because their bones are less compact; they are moreover more easily destroyed". It should be stressed, however, that this method of "definite analysis" has been applied to "Smaller remains which might in certain contexts indicate the presence of domestic pig (*Sus scrofa* f. domestica) have been assigned to smaller, immature and female wild boar" (Gautier 2005: chapter 2).

The Author does not explain why Dudka did not realise necessary conditions for the presence of domestic pig. What kind of "certain contexts" would be indicated for? It is interesting that, according to Professor Gautier, the site simultaneously fulfils such conditions for keeping a flock of sheep and/or goats (*Ovis/Capra*). This is particularly incomprehensible because these small ruminants need open grasslands. Such landscape could appear within middle Holocene forests of the European Plain only as an effect of considerable anthropogenic transformation.

Further, A. Gautier explains the reason why definitely, and exclusively wild boar declined more than twice from the Zedmar (Atlantic/Subboreal) to Post-Zedmar period (early Subboreal), i.e. from 18.9% to 7.7% (fig. 5) among all mammal bones (wild game and sheep/goat). "The wild boar prefers deciduous forest, so the decline of the forest in the Subboreal accounts for the decrease of this game animal in this period." (Gautier 2005: tab. 3, chapter 5).

WHAT CAUSED THE DECLINE OF SWINE?

Indeed, according to the pollen profile of Dudka NAP increased from 10% to 18% (fig. 5) in the beginning of the Subboreal, i.e. from the main Zedmar (AT/SB) to Post-Zedmar period (e.SB). It means that herbivore plants grew up in some places previously taken by a forest. Analysed case,

however, concerned mainly the local vegetation on the island, since the pollen profile belongs to the local type (Nalepka 1995).

The nearest available regional pollen diagram for the Masurian Great Lakes District (for which Staświny Lake belongs) was worked out to the Mikołajki Lake. There, NAP in the late Atlantic (Early Zedmar) and in the turn of the period (Zedmar) attained c. 6%, while during the early Subboreal (Post-Zedmar) slowly increased to c. 8% (fig. 5) (Ralska-Jasiewiczowa 1989: fig. 1). So, the landscape in Masuria was generally similarly forested in those periods. The difference between both curves of NAP, shown at the fig. 5, indicates the increase of deforestation but only at Dudka. This process began in the late Atlantic (the Early Zedmar), and was caused by intensifying habitation and probably (as I think) by keeping a herd of pigs on the island.

Pine (*Pinus*), the only coniferous tree in the local forest increased during the period from Zedmar to Post-Zedmar (AT/SB-e.SB) from 9% to 13% in the pollen spectra (Nalepka 1995: fig. 3; Gumiński 1995: tab. 3), and from 6% to 8% in dendro-samples (Gumiński & Michniewicz 2003: fig. 3). Nevertheless, in the middle Atlantic (the Late Mesolithic) when the share of wild boar bones was the highest – 23.8% among ungulates (data from Gautier 2005: table 3), the pine was more common in the forest. This tree composed 25% to 16% in the pollen spectra, and 13% to 3% in dendro-samples. In the light of above data, the forest in Masuria practically did not change during the period in question, including small fluctuations of pine in generally deciduous forest. Anyhow, those insignificant changes could not explain the considerable decline of wild boar during the Post-Zedmar period (e.SB).

Further oak (*Quercus*) and hazel (*Corylus*), – very important trees for a wild boar, in view of acorns and hazelnuts, attained the highest Holocene values in the Masurian forest (particularly oak) in the early Subboreal – critical for suid at Dudka. This period is even called *Corylus-Quercus* (hazel-oak), because both species reached in pollen spectra a dozen or so percent each (fig. 5) (Ralska-Jasiewiczowa 1989: 97-99, fig. 1). In the local forest surrounding Staświny Lake, the curves of both trees during the second half of the Atlantic were similar – increasing oak and slightly decreasing hazel. From the turn of the Atlantic, however, both curves went down, oak from 10% to 6% (still higher then in the middle Atlantic), hazel from 15% to 9% (fig. 5) (Nalepka 1995; Gumiński 1995: tab. 3).

On the other hand, macro remains directly from Dudka indicate that oak occurred on the island in the same degree from the late Atlantic (Early Zedmar) to the early Subboreal (Post-Zedmar). During those periods, oak composed 9-10% of the tree-stand. Moreover, it was almost twice higher than in the middle Atlantic – considered to be the most favourable for wild boar (fig. 5) (Michniewicz 2004)[7].

The drastic decline of hazel-bush at the Dudka island significantly appeared just at the time (late Atlantic, the Early Zedmar) when the beginning of swine domestication is suggested. The drop of hazel-bush on the island (dendro samples) preceded the general decrease of hazel in the neighbourhood (pollen spectra) by a good few hundreds years (fig. 5). Similarly, the drop of swine bones at Dudka had taken place much earlier than hazel began decline in Masuria.

The strongest vegetation argument is based on the totally disappearance of fruits of both trees, i.e. hazelnuts and acorns. As soon as semi-domesticated pigs appeared on the island, i.e. in the late Atlantic (Early Zedmar) both kinds of fruits vanished (fig. 5). In the previous early-middle Atlantic period of the Late Mesolithic, the hazelnuts and nutshells, as well as acorns (rather not edible by man) commonly occurred within dendro-samples (62% and 16% of the given tree-species accordingly). From the beginning of Zedmar, none were found, though oak-trees and hazel-bush still existed. The case with acorns is more emphatic, because fruits of oak never occurred again, and oak trees even increased in local tree-stand in comparison with the Late Mesolithic times (fig. 5).

Elm (*Ulmus*) as well, supports the hypothesis of keeping a herd of pigs on the island. It is known

[7] According to former, not fully elaborated data (Gumiński & Michniewicz 2003: fig. 17.3) oak composed: 6% in the middle Atlantic, 2% in the late Atlantic, and 5% in the Atlantic/Subboreal of the tree-stand.

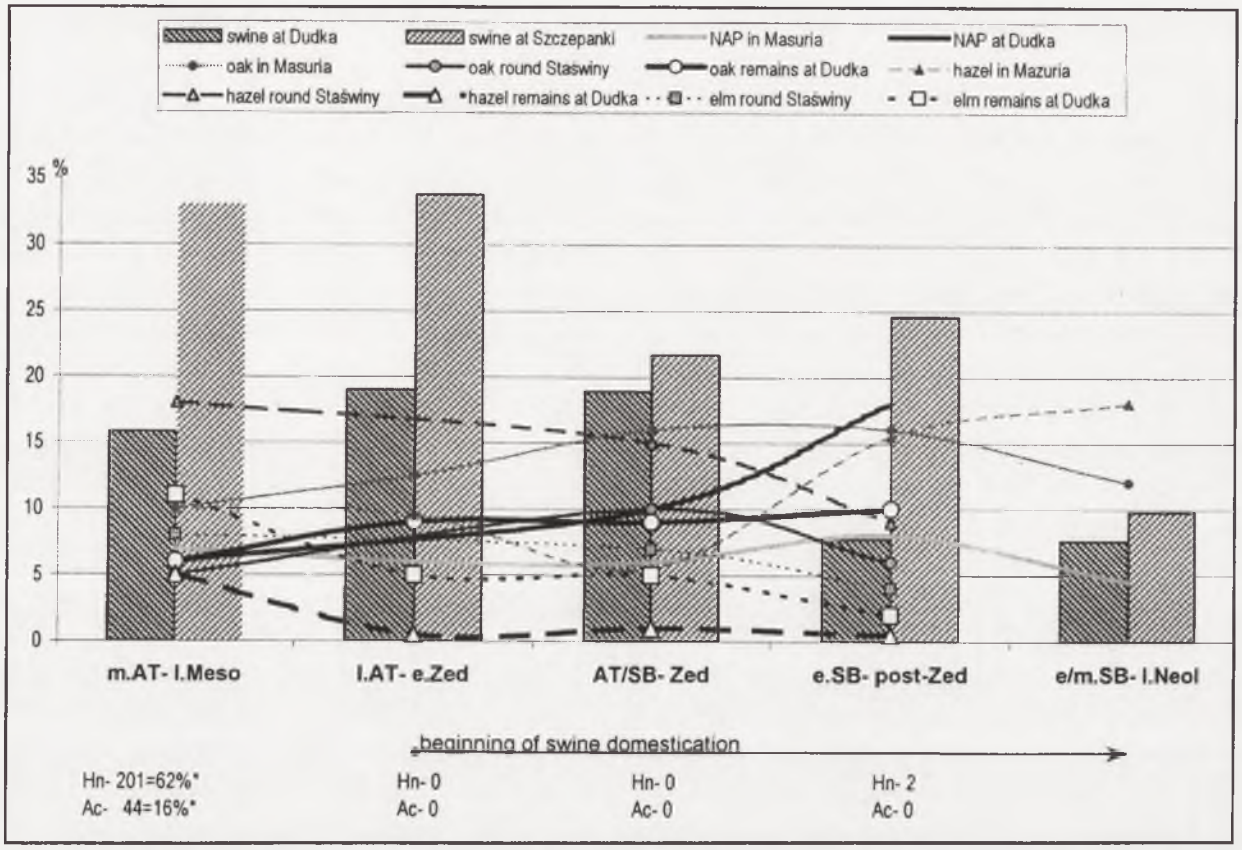

Fig. 5. Swine (*Sus scrofa*) bones (% of mammals) and vegetation (Hn – hazelnuts, Ac – acorns, * – of given species remains) (data from: Gautier 2005; Gumiński 2005; Michniewicz 2004; Nalepka 1995; Ralska-Jasiewiczowa 1989).

that "pigs in particular have a great love for elm, both the leaves and the bark" (Iversen 1973: 81). According to pollen spectra, the elm kept the similar position (8%-7% of AP+NAP) from the middle Atlantic to the Atlantic/Subboreal transition. Just at the beginning of the early Subboreal it decreased to 4% (Nalepka 1995; Gumiński 1995: tab. 3). In the light of dendro remains coming directly from the Dudka island the elm fold down more than twice, from 11% to 5% in the tree-stand already during the late Atlantic (the Early Zedmar), when the appearance of pigs is suggested (Michniewicz 2004; Gumiński & Michniewicz 2003: fig. 17.3)[8]. The next decline, down to 2% took place in the early Subboreal simultaneously with the decrease of swine bones (fig. 5).

The research of fauna in the Białowieża Primeval Forest (NE-Poland) indicates that the yearly density of wild boar population depends on two factors – abundance of acorns and the thickness of snow-cover if it extends average 15cm during three winter months (Jędrzejewska & Jędrzejewski 2001: 58, fig. 2.15). The first factor – fluctuation of oak (producer of acorns) has been discussed above and oak generally increased in Masuria as well as at Dudka island during the decline of swine bones. Acorns, however, vanished because were eaten to the 'last grain'.

The second factor – the average thickness of snow-cover correlated with its duration in the early Subboreal winters is rather difficult to determine. Generally, the early Subboreal is considered as rather cooler and more continental than the previous late Atlantic period. On the other hand, ivy (*Hedera*) and mistletoe (*Viscum*) which pollen still appear in the early Subboreal spectra from Masuria well indicate that climate deterioration could not be serious in this period (Ralska-Jasiewiczowa

[8] According to earlier published data (Gumiński & Michniewicz 2003: fig. 17.3) this fluctuation was similar, 9% in the middle Atlantic, 4% in the late Atlantic, and 5% in the turn of the period.

1991: 181, fig. 91). Particularly important is the occurrence of ivy as this evergreen creeper survives only if winter temperatures, are not lower than 1.5°C below zero (Troels-Smith 1960: 6-7, fig. 1). It suggests that thaws during the early Subboreal winters were rather common and the snow cover was then reduced. The real barrier for wild boar, which delimits the range of species in Europe to the north-east is snow-cover exceeding 50cm during winter months (Dzierżyńska-Cybulko & Fruziński 1997: 29).

The next factor, suggested by A. Gautier – deforestation, does not apply to the wild boar. Just this species is easy adaptable to partly anthropogenic environment and often goes out on fields and meadows (During 1986: 121-2; Pawłowski 1991: 173; Amann 1994: 248-251; Dzierżyńska-Cybulko & Fruziński 1997: 28-33; Hofmann 2003: 188). The former cattle pasturage within the Białowieża Primeval Forest had not influenced the density of wild boar. Similar independence applies to all of other wild ungulate animals as well, perhaps apart from European bison (*Bison bonasus*), for which cattle was the real competitor in food (Jędrzejewska & Jędrzejewski 2001: fig. 2.9).

At the mentioned above site Szczepanki (8), situated within the same lake (fig. 1), the decrease of (taken together) wild boar/pig bones appeared for the first time in the main Zedmar period (the Atlantic/Subboreal transition), i.e. earlier than at Dudka. For the second time, in the Late Neolithic (the early/middle Subboreal) the drop of swine bones was more clear (fig. 5; Gumiński 2005: tabs. 3, 4). The decline of swine bones at Dudka, which was not synchronised with the similar process recorded at Szczepanki, suggests exclusively local cause for this phenomenon. Certainly, it could not be the thickness and duration of snow-cover, as well as the shortage of acorns, or other nuts, and elm-trees in surrounding forests on the mainland. Steadily high number of swine bones at Szczepanki (8) during the early Subboreal – almost 25% of mammals (fig. 5) additionally suggests that general condition for suid could not have deteriorated – if they were still exclusively wild. Moreover, three times higher share of swine bones at Szczepanki comparing with Dudka in the same period (early Subboreal) is difficult to explain other than just through domestication.

DIFFERENCES IN PRESERVATION OF BONES

Let us back to Gautier's decisive method for distinguishing between wild and domestic form of swine. "As any practising archaeozoologist knows, bones of domestic animals are generally worse and differently preserved than wild relatives" (Gautier 2005: chapter two). This is truth, particularly if one compares bones of definitely wild-living mammal species with bones of animal, which have had at least few thousands years of domestication and then at least one thousand generations behind. Moreover, the difference is much more distinct, if creatures had no any possibility of crossbreeding with their wild relatives.

Good example for such differences can be the comparison of two small ruminants common at prehistoric European sites – roe deer (*Capreolus capreolus*) with sheep or goat (*Ovis/Capra*). The first belongs to the local wild fauna, while sheep and goat already had (in the European Late Neolithic) a few thousand years of history as exclusively domestic animal cross-breeding without exception with individuals of the same status in Europe. Nevertheless, distinguishing bones between fully domesticated sheep or goat and wild-living roe deer can be used as additional, but certainly not the main method. Furthermore, comparing bones should have had first the same taphonomy process behind. It means, they ought to come from similarly conditioned layer, or pit(s), or grave(s), and had been subjected to similar butchering, cooking, and other processes in prehistory.

Application of method proposed by Professor Gautier, as the only one employed in order to distinguished bones of definitely wild boar from semi-domesticated, partly free keeping herd of swine in the early process of domestication (as this was stressed in my former papers) seems to be improper. As it is a common procedure, similar pro-

blems concerning distinguishing between bones of domesticated animals from their wild relatives (e.g. dog, pig, cattle or horse) are found traditionally basing on osteology, including morphological and measuring methods, and different ways of comparison such data. Additionally, sometimes sex and age structures are taken into consideration as well (e.g. Albarella & Payne 2005; Benecke 1987; 1993a; 1993b; 1999; Clutton-Brock & Noe-Nygaard 1990; Degerbøl 1961; During 1986; Jonsson 1986; Lasota-Moskalewska 1997; Sobociński 1984, 1986; Spassov & Iliev 1997; Street 2002; Teichert 1993; and many others). Some more advanced techniques as microsections, searching DNA or isotopes are being used lately. The case with Dudka is incomprehensible, because the Author of reviewed paper formerly used the classical archaeozoological methods, including anatomical register of determined bones and measurements (Gautier 1993).

If one will take the Gautier's method literally, in consequence simply better preserved bones could be acknowledged as coming from wild fauna. Taking into account that only 4% of terrestrial fauna bones have been determined (Gautier 2005: Introduction) and that those bones were certainly better preserved, all others (96%) poorly preserved bones and crashed into many fragile pieces could be regarded as coming from domestic animals. Obviously, such an argumentation goes into an absurd.

It is proper to remind that some layers at Dudka distinguish themselves by significantly different acidity (pH between 5.0 and 8.0) (Gumiński 1995: table 2). This factor, with no doubt seriously influenced the state of preservation of bone material. Such criterion, however, is very difficult to employ to estimate, how many bones completely disappeared or were preserved in very bad condition caused by low pH. Summing up, the state of bone preservation is very low credible for determination between wild and domestic form of given species. It concerns in particular the case of swine at Dudka.

SELECTIVE INFALLIBILITY

Other surprising statement refers to Author's conviction of definite distinction between wild and domestic form among swine, as well as bovine bones, and simultaneously he admits possibility of own conceivable "number of incorrect identifications" between horse and larger deer, or between large bovid and elk (Gautier 2005: chapter 1 & 2). The example of such a mistake concerning horse has been pointed out above (fig. 4d).

I would like to discuss here another important example of rather incorrect distinction between large bovid and large cervid. It concerns very well preserved (all diagnostic elements) scapula of large bovid (fig. 6a). The bone was found in gyttja (layer L.15) dated to the Friesland[9], i.e. the initial stage of the Preboreal and the decline of the Late Palaeolithic. For the comparison, the scapula of incontestable elk (*Alces alces*) (killed several years ago in the eastern Poland) is shown below (fig. 6b). The reader is probably able to spot clear differences.

Even if one agrees that discussed scapula belongs to the large bovid (not elk), there is another problem to solve i.e. to which of the species does it belongs – to aurochs (*Bos taurus*) or to European bison (*Bison bonasus*). The most useful features to distinguish between scapulas of bovid are the morphology and general proportion of scapular glenoid-cavity (frontally seen at the left photo, fig. 6a) (Bibikova 1958; Lasota-Moskalewska, Kobryń & Świeżyński 1985). The distinctly oval shape of the glenoid-cavity, measured by its width to length index (= 80) suggests that the scapula comes from the European bison (*Bison bonasus*). The ratio for aurochs (*Bos taurus*) is higher, always over 90, and general shape is almost circular (Bibikova 1958: 24; Lasota-Moskalewska, Kobryń & Świeżyński 1985: 298-9, 304). Taking into account the Late Pleistocene/Earliest Holocene age of the finding, the scapula in question perhaps

[9] The charcoal found just together with the scapula in question got AMS C-14 date: 10100±60 BP (Poz-13121). The date well confirmed its stratigraphic position.

Fig. 6. a – the Late Palaeolithic (Friesland, see footnote 9) bone of Dudka (trench XII: the right scapula of European bison (*Bison bonasus*) or steppe bison (*Bison priscus* or *Bison* f. *arbusto-tundrarum*); b – modern bone of elk (*Alces alces*): the right scapula.

comes from the steppe bison (*Bison priscus* or *Bison* f. *arbusto-tundrarum*) rather than from wisent (*Bison bonasus*). The last mentioned species, which were restored in the Białowieża Primeval Forest is typical for the Neo Holocene and forested areas (Lepiksaar 1986: 57, fig. 3:3; Pucek & Głowaciński 2001: 100).

The identification of such a bone is very important from paleoenvironmental and historical point of view. Any bones from the Late Palaeolithic at Dudka are extremely rare (Gautier 2005: tab. 3), what applies generally to the Masuria and the whole Polish Plain. So, every incorrect determination can seriously change our knowledge of the fauna succession from the Pleistocene to the modern Holocene. According to A. Gautier (2005: tabs. 1 & 3), first bovid (exclusively aurochs) appeared at Dudka relatively late, i.e. in the Late Mesolithic, not before the middle Atlantic. In this case Dudka appears to be an exception, since in both western and north-eastern lands of the Polish Plain large bovids were typical in the Late Pleistocene and the Early Holocene. The Preboreal period is even called as 'bison-horse period', and the Boreal – as 'aurochs period' (Aaris-Sørensen 1988: 130, 150, 163; 2001: 20-6; Lepiksaar 1986: 57-59; Ekström 1993: 58-77, fig. 53; Benecke & Heinrich 2003: 19, 31-3).

Just M. Nawrocka (and lately K. Stefanowicz) found bovid bones in the assemblages coming of the earliest Holocene layers at Dudka. Moreover, she was not sure if they belong to the bison (*Bison*

bonasus) or to the aurochs (*Bos taurus*) and therefore she properly used the name of taxon in more broadly meaning, i.e. bison/aurochs or even (large) ruminant. Such determinations I repeated in my papers (Gumiński 1995: tab. 7; 1997a: tab. 2, fig. 8; 1998: tabs. 4, 5; 2003: 67-8, fig. 5; Gumiński & Michniewicz 2003: 122, fig. 9, 10). Such undecided identifications are in common use in archaeozoology and these do not mean that they are "preliminary and have to be withdrawn".

CONCLUDING

Obviously, some of former identifications ought to be checked up; using more detailed and advanced method(s). Yet, the base for re-identification and new outcomes concerning re-examined bones are usually published in the way of detail registers of measurements or indexes, tables, graphs, diagrams etc. As a rule such "revisited" data disclose quite new or additional characteristic of the given assemblage (e.g. Grønnow 1987; Bratlund 1991; 1999; Lasota-Moskalewska, Kobryń & Świeżyński 1985; Legge & Rowley-Conwy 1989; Rowley-Conwy 1998). Professor Gautier, however, whilst focused on quite new, own vision of the Dudka site omitted grounds for his new conception.

The list of species with numbers of belonging to them bones within particular trench and period, and general, short comments to each species (Gautier 2005: tab. 1, 2, chapter 2) give the impression of a superficial examination rather than with the great care. So, the following general statement that former identifications "were not well decodable" and then earlier interpretations should be "reconsidered" or "withdrawn" seems to have week grounds.

Perhaps some of determinations made by M. Nawrocka (example at fig. 4a) and some made by followers of Professor Lasota-Moskalewska were false. Moreover, they are certainly preliminary, as probably all scientific analyses are, including archaeozoology (Legge & Rowley-Conwy 1989: 225, 230; Rowley-Conwy 1998: 87). However, I am not convinced that those worked out by Professor Gautier are faultless. Reviewed paper, contrary to his Author persuasion is also preliminary, similarly to all of mine, including previous and the current one. Future will show, which one ought to be withdrawn.

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REFERENCES

Aaris-Sørensen K.
1988 *Danmarks forhistoriske Dyreverden*, København (Gyldendal).
2001 *The Danish fauna throughout 20,000 years from mammoth steppe to cultural steppe – a guide to an exhibition about the changeability of nature*, Copenhagen (Zoological Museum, University of Copenhagen).

Åkerlund A., Regnel M., Possnert G.
1996 *Stratigraphy and chronology of the Lammasmägi site at Kunda*, PACT, vol. 51, p. 253-272.

Albarella U. & Payne S.
2005 *Neolithic pigs from Durrington Walls, Wiltshire, England: a biometrical database*, "Journal of Archaeological Science", vol. 32 (4), p. 589-599.

Amann G.
1994 *Ssaki i zwierzęta zmiennocieplne*, Warszawa (Multico). (Original edition: *Säugetiere und Kaltblüter des Waldes*, Augsburg (Weltbild Verlag GmbH) 1991.

Andersen K.
1983 *Stenalder bebyggelsen i den Vestsjællandske Åmose*, København (Fredningsstyrelsen).

Andersen K., Jørgensen S. & Richter J.
1982 *Maglemose hytterne ved Ulkestrup Lyng*, "Nordiske Fortidsminder", Serie B – in quarto, Bind 7, København.

Benecke N.
1987 *Studies on early dog remains from Northern Europe*, "Journal of Archaeological Science", vol. 14, p. 31-49.
1993a *Zur Kenntnis der mesolithishen Hunde des südlichen Ostseegebietes*, "Zeitschrift für Archäologie", vol. 27, p. 39-66.
1993b *The exploitation of Sus scrofa (Linné, 1758) on the Crimean Peninsula and in Southern Scandinavia in the Early and Middle Holocene. Two regions, two strategies*, (in:) *Exploitation des animaux sauvages à travers le temps. XIIIe Rencontres Internationales d'Archéologie et d'Historie d'Antibes*, APDCA, Juan-les-Pins, p. 233-245.
1999 *The domestication of the horse*, (in:) *Domestication of Animals. Interactions between veterinary and medical sciences*, J. Schäffer (ed.), Berlin (DVG), p. 9-21.

Benecke N. & Heinrich D.
2003 *Neue Daten zur Entwicklung der Huftierfauna im Tieflandgebiet zwischen Elbe und Oder im Spätglazial und Altholozän*, "Archeozoologia", vol. 21, p. 19-36.

Bibikova V.I.
1958 *O nekotorych otličitel'nych čertach v kostjach konečnostej zubra i tura*, "Bjulleten Moskovskogo Obščestva Ispytatelej Prirody. Otdel Biologičeskij", vol. 63, p. 23-35.

Bohne-Fischer H.
1941 *Ostpreussens Lebensraum in der Steinzeit*, Königsberg-Berlin (Ost-Europa-Verlag).

Bokelmann K.
1991 *Duvensee, Wohnplatz 9. Ein präborealer Lagerplatz in Schleswig-Holstein*, "Offa", vol. 48, p. 75-114.

Bratlund B.
1991 *Die spätglazialen „Opfertiere" von Meiendorf und Stellmoor, Kreis Stormarn*, "Offa", vol. 48, p. 41-73.
1999 *A survey of the Ahrensburgian faunal assemblage of Stellmoor*, (in:) *Tanged points cultures in Europe*, S.K. Kozłowski, J. Gurba & L.L. Zaliznyak (eds.), "Lubelskie Materiały Archeologiczne", vol. 13, Lublin, p. 47-59.

Brinch Petersen E.
1989 *Vænget Nord: Excavation, documentation and interpretation of a Mesolithic site at Vedbæk, Denmark*, (in:) *The Mesolithic in Europe*, C. Bonsal (ed.), Edinburgh (John Donald Publishers), p. 325-330.

Brinkhuizen D.C.
1983 *Some notes on recent and pre- and protohistoric fishing gear from northwestern Europe*, "Palaeohistoria", vol. 25, p. 7-53.

Brylińska M. (ed.)
1986 *Ryby słodkowodne Polski*, (*Freshwater fish of Poland*), Warszawa.

Clutton-Brock J. & Noe-Nygaard N.
1990 *New osteological and C-isotope evidence on Mesolithic Dogs: Companions to hunters and fishers at Star Carr, Seamer Carr and Kongemose*, "Journal of Archaeological Science", vol. 17 (6), p. 643-653.

Degerbøl M.
1961 *On a find of a Preboreal domestic dog (Canis familiaris L.) from Star Carr, Yorkshire, with remarks on other Mesolithic dogs*, "Proceedings of the Prehistoric Society", vol. 27, p. 35-55.

Derndarsky M.
2000 *Ageröd III. Eine mesolitische Siedlung in Schonen*, "Offa", vol. 57, p. 7-71.

During E.
1986 *The fauna of Alvastra. An osteological analysis of animal bones from Neolithic pile dweling*, "Ossa", vol. 12, supplement 1, Stockholm (University of Stockholm).

Dzierżyńska-Cybulko B. & Fruziński B.
1997 *Dziczyzna jako źródło żywności*, Poznań (Państwowe Wydawnictwo Rolnicze i Leśne).

Ekström J.
1993 *The Late Quaternary history of the urus (Bos primigenius Bojanus 1827) in Sweden*, "Lundqua Thesis", vol. 29, Lund.

Fiedorczuk J.
1995 *Mesolithic finds at Dudka 1, Great Masurian Lakeland, and their chronological-taxonomic relations*, "Przegląd Archeologiczny", vol. 43, p. 47-59.
Florek P.
2001 *Dwa pochówki psów z cmentarzyska w Dudce, gm. Wydminy, woj. warmińsko-mazurskie*, Instytut Archeologii UW, manuskrypt.
Gautier A.
1993 *The faunal remains*, (in:) M. Kobusiewicz & J. Kabaciński, *Chwalim. Subboreal hunter-gatherers of the Polish Plain*, Poznań (IAE PAN), p. 79-89.
2005 *Dudka island revisited: the general archaeozoological sequence*, "Przegląd Archeologiczny", this volume.
Gerstmeier R. & Roming T.
2002 *Słodkowodne ryby Europy. Przewodnik*, Warszawa (Multico). (Original edition: *Die Süsswasserfische Europas für Naturfreunde und Angler*, Stuttgart 1998).
Grønnow B.
1987 *Meiendorf and Stellmoor revisited: an analysis of Late Palaeolithic reindeer exploitation*, "Acta Archaeologica", vol. 56 – 1985, p. 131-166.
Gumiński W.
1995 *Environment, economy and habitation during the Mesolithic at Dudka, Great Masurian Lakeland, NE-Poland*, "Przegląd Archeologiczny", vol. 43, p. 5-46.
1997a *Corded Ware at the Dudka peat-bog site, NE Poland. A case of migration or local development*, (in:) *Early Corded Ware Culture. The A-Horizon – fiction or fact?*, P. Siemen (ed.), "Arkæologiske Rapporter", nr. 2, Esbjerg (Esbjerg Museum), p. 93-103.
1997b *Cmentarzysko społeczności zbieracko-łowieckich w Dudce*, (w:) *Działalność Naukowa PAN 1997*, L. Kuźnicki (ed.), Warszawa (PAN), p. 21-22.
1998 *The peat-bog site Dudka, Masurian Lakeland: An example of conservative economy*, (in:) *Harvesting the sea, farming the forest. The emergence of Neolithic societies in the Baltic region*, M. Zvelebil, R. Dennell & L. Domańska (eds.), Sheffield (Sheffield Academic Press), p. 103-109.
1999 *Środowisko przyrodnicze a tryb gospodarki i osadnictwa w mezolicie i paraneolicie na stanowisku Dudka w Krainie Wielkich Jezior Mazurskich*, (*Natural environment – and the mode of economy and settlement in the Mesolithic and Paraneolithic at the Dudka site in the Masurian Lakeland*), "Archeologia Polski", vol. 44, p. 31-74.
2003a *Big game and sparse forest – Relations between mammal species and surrounding environment at the prehistoric fishing campsite of Dudka in Masuria, NE-Poland*, "Archeozoologia", vol. 21, p. 59-72.
2003b *Scattered human bones on prehistoric camp site Dudka, NE-Poland, as indication of peculiar burial rite*, (in:) *Préhistoire des Pratiques Mortuaires. Paléolithique – Mésolithique – Néolithique*, E. Derwich (ed.), ERAUL, vol. 102, Liège, p. 111-120.
2005 *Szczepanki 8. Nowe stanowisko torfowe kultury Zedmar na Mazurach*, (*Szczepanki 8. A new peat-bog site of the Zedmar culture in Masuria*), "Światowit", fasc. B, vol. 5 (46) – 2003, p. 53-104, Pl. 15-38.
in press *Bird for dinner. Stone Age hunters of Dudka and Szczepanki, Masurian Lakeland, NE-Poland*, "Acta Archaeologica", vol. 76 – 2004.
Gumiński W. & Michniewicz M.
2003 *Forest and mobility. A case from the fishing camp site Dudka, Masuria, north-eastern Poland*, (in:) *Mesolithic on the move*, L. Larsson et al. (eds.), Oxford (Oxbow Books), p. 119-127.
Hofmann H.
2003 *Ssaki*, Warszawa (Muza). (Original edition: *Naturführer. Säugetiere*, München 1986 (Gräfe und Unzer GmbH).
Iversen J.
1973 *The development of Denmark's nature since the Last Glacial*, "Danmarks Geologiske Undersøgelse", V series, no. 7-C, København.
Jędrzejewska B. & Jędrzejewski W.
2001 *Ekologia zwierząt drapieżnych Puszczy Białowieskiej*, Warszawa. (Original edition: *Predation in vertebrate communities. The Białowieża Primeval Forest as a case study*, Berlin - Heidelberg 1998).
Johanssson A.D.
1995 *The Ertebølle Culture in South Zealand, Denmark*, (in:) *Man and Sea in the Mesolithic*, A. Fischer (ed.), Oxford (Oxbow Books), p. 87-94.
Jonsson L.
1986 *From wild boar to domestic pig – a reassessment of Neolithic swine of northwestern Europe*, (in:) *Nordic Late Quaternary biology and ecology*, L.-H. Königsson (ed.), "Striae", vol. 24, p. 125-129.
Karukäpp R., Moora T. & Pirrus R.
1996 *Geological events determining the Stone Age environment of Kunda*, PACT, vol. 51, p. 225-230.
Kempisty E. & Sulgostowska Z.
1986 *Badania rozpoznawcze wokół torfowiska Łąki Staświńskie, woj. Suwałki*, (*Reconnaissance of the area around the Łąki Staświńskie peat-bog in Suwałki province*), "Sprawozdania Archeologiczne", vol. 38, p. 57-76.
Kłosowscy S. & G.
2001 *Rośliny wodne i bagienne*, Warszawa (Multico).
Krysiak K., Kobryń H. & Kobryńczuk F.
2001 *Anatomia zwierząt. Aparat ruchowy*, Warszawa (PWN).

Larsson L.
1983 *Ageröd V. An Atlantic bog site in Central Scania*, "Acta Archaeologica Lundensia", series in 8°, N° 12, Lund.
1988 *The Skateholm Project. Late Mesolithic settlement at a South Swedish lagoon*, (in:) *The Skateholm Project. I. Man and environment*, L. Larsson (ed.), Lund, p. 9-19.
Lasota-Moskalewska A.
1997 *Podstawy archeozoologii. Szczątki ssaków*, Warszawa (PWN).
Lasota-Moskalewska A., Kobryń H. & Świeżyński K.
1985 *Zabytki pochodzenia zwierzęcego z grobu mezolitycznego w Janisławicach, woj. skierniewickie*, (*Animal remains in a Mesolithic grave in Janisławice, Skierniewice voivodship*), "Archeologia Polski", vol. 30 (2), p. 287-309.
Legge A. & Rowley-Conwy P.
1989 *Some preliminary results of a re-examination of the Star Carr fauna*, (in:) *The Mesolithic in Europe*, C. Bonsal (ed.), Edinburgh (John Donald Publishers), p. 225-231.
Lepiksaar J.
1986 *The Holocene history of theriofauna in Fennoscandia and Baltic Countries*, (in:) *Nordic Late Quaternary Biology and Ecology*, L.-K. Königsson (ed.), "Striae", vol. 24, p. 51-70.
Lindqvist C. & Possnert G.
1997 *The subsistence economy and diet at Jakobs/Ajvide and Stora Förvar, Eksta parish and other prehistoric dwelling and burial sites on Gotland in long-term perspective*, (in:) *Remote Sensing, Vol. I: Osteo-anthropological, economic, environmental and technical analyses*, Burenhult G. (ed.), "Theses and Papers in North-European Archaeology", vol. 13:a, Stockholm, p. 29-90.
Louwe Kooijmans L.P.
2003 *The Hardinxveld sites in the Rhine/Meuse Delta, the Netherlands, 5500-4500 cal BC*, (in:) *Mesolithic on the move*, L. Larsson et al. (eds.), Oxford (Oxbow Books), p. 608-624.
Martin E.
1995 *Early inhabitants and the changing shoreline of Estonia*, (in:) *Man and Sea in the Mesolithic*, A. Fischer (ed.), Oxford (Oxbow Books), p. 243-246.
Michniewicz M.
2004 *Historia przemian lokalnej pokrywy roślinnej na stanowisku archeologicznym Dudka wraz ze wskazaniem elementów presji antropologicznej*, Warszawa (Instytut Archeologii i Etnologii PAN, manuscript).
Nalepka D.
1995 *Palynological investigations of an archaeological site at Dudka (Profile D1-26)*, "Przegląd Archeologiczny", vol. 43, p. 61-64.
Pawłowski J.
1991 *Przemiany fauny od pleniglacjalu do czasów współczesnych*, (in:) *Geografia Polski. Środowisko przyrodnicze*, L. Starkel (ed.), Warszawa (PWN), p. 159-177.
Podbielkowski Z. & Tomaszewicz H.
1979 *Zarys hydrobotaniki*, Warszawa (PWN).
Pucek Z. & Głowaciński Z.
2001 *Bison bonasus (Linné, 1758). Żubr. European bison (wisent)*, (in:) *Polska czerwona księga zwierząt. Kręgowce, Polish Red Data Book of Animals. Vertebrates*, Z. Głowaciński (ed.), Warszawa (Państwowe Wydawnictwo Rolnicze i Leśne), p. 100-105.
Raemaekers D.C.M.
1999 *The articulation of a 'New Neolithic'. The meaning of the Swifterbant Culture for the process of neolithisation in the western part of the North European Plain (4900-3400 BC)*, Leiden.
Ralska-Jasiewiczowa M.
1989 *Type region P-x: Masurian Great Lakes District*, "Acta Palaeobotanica", vol. 29 (2), p. 95-100.
Rowley-Conwy P.
1998 *Meat, furs and skins: Mesolithic animal bones from Ringkloster, a seasonal hunting camp in Jutland*, "Journal of Danish Archaeology", vol. 12, 1994-95, p. 87-98.
Sarauw G.F.L.
1903 *En Stenalders boplads i Maglemose ved Mullerup, sammenholdt med beslægtede fund*, "Aarbøger for Nordisk Oldkyndighed og Historie", 1903, p. 148-315.
Sobociński M.
1984 *Szczątki kostne zwierząt z osady mezolityczno-neolitycznej w Dąbkach, gmina Darłowo*, "Archeozoologia", vol. 9, "Roczniki Akademii Rolniczej w Poznaniu", vol. 154, p. 101-128.
1986 *Materiał kostny zwierzęcy z osady mezolityczno-neolitycznej w Dąbkach*, "Archeozoologia", vol. 11, "Roczniki Akademii Rolniczej w Poznaniu", vol. 172, p. 111-125.
Spassov N. & Iliev N.
1997 *The wild horses of Eastern Europe and the polyphylethic origin of the domestic horse*, "Anthropozoologica", vol. 25-26, p. 753-759.
Starkel L. & Ralska-Jasiewiczowa M.
1991 *Zmiany klimatu i stosunków wodnych w holocenie*, (in:) *Geografia Polski. Środowisko przyrodnicze*, L. Starkel (ed.), Warszawa (PWN), p. 177-182.
Storå J.
2000 *Sealing and animal husbandry in the Ålandic Middle and Late Neolithic*, (in:) J. Storå, *Reading bones. Stone Age hunters and seals in the Baltic*, Stockholm, "Studies in Archaeology", vol. 21, (Original edition in: "Fennoscandia Archaeologica", vol. 16 (1), p. 57-77).
Street M.
2002 *Ein Wiedersehen mit dem Hund von Bonn-Oberkassel*, "Bonner zoologische Beitrage", vol. 50 (3), p. 269-290.

Sulgostowska Z.
1995 *The earliest Mesolithic settlement of North-Eastern Poland*, (in:) *The Earliest settlement of Scandinavia and its relationships with neighbouring areas*, L. Larsson (ed.), "Acta Archaeologica Lundensia", Series in 8°, No 24, Stockholm, p. 297-304.

Sych L. & Pucek Z.
1984 *Nieparzystokopytne – Perissodactyla*, (in:) *Klucz do oznaczania ssaków Polski*, (English edition: *Keys to vertebrates of Poland: Mammals*, Z. Pucek (ed.), Warszawa (PWN), p. 316-319.

Teichert L.
1993 *Zur Körpergrösse der Haushunde (Canis lupus f. familiaris) vom mesolithischen Wohnplatz bei Friesack, Kr. Nauen*, "Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam", vol. 27, p. 16-25.

Timofeev V.
1991 *Neolithic sites of the Zedmar type in the Southeast Baltic Area*, (in:) *Regions and Reflections. In Honour of Märta Strömberg*, "Acta Archaeologica Lundensia", Series in 8°, No 20, Lund, p. 15-26.

Tomek T. & Gumiński W.
2003 *Bird remains from the Mesolithic and Neolithic site Dudka, Masuria, NE Poland*, "Acta Zoologica Cracoviensia", vol. 46 (1), p. 9-18.

Troels-Smith J.
1960 *Ivy, mistletoe and elm. Climate indicators – fodder plants*, "Danmarks Geologiske Undersøgelse", IV series, vol. 4, no. 4, København.

Wigforss J.
1995 *West Swedish Mesolithic settlements containing faunal remains – aspects of the topography and economy*, (in:) *Man and Sea in the Mesolithic*, A. Fischer (ed.), Oxford (Oxbow Books), p. 197-206.

Żurek S.
2003 *Torfowiska Pojezierza Mazurskiego i ich związek z działalnością ludzi w późnym glacjale i holocenie*, (in:) *Ewolucja Pojezierzy i Pobrzeży Południowobałtyckich*, R. Gołębiewski (ed.), Gdańsk (Uniwersytet Gdański), p. 149-159.

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