

# Pietrele in the Lower Danube region: integrating archaeological, faunal and environmental investigations

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**ABSTRACT** – *The c. 9m high tell-settlement of Pietrele-Măgura Gorgana, situated close to the Danube river, is one of the westernmost sites of the Kodžadermen-Gumelnița-Karanovo VI cultural complex that spread over the whole Westpontic region during the 5<sup>th</sup> millennium BC. Until recently tells were equated with the site when, in fact, they represent only the outstanding part of a far more complex settlement system as we now know from Pietrele thanks to geomagnetic prospections and subsequent excavations. People living on the tell, together with the inhabitants from the flat area around it, formed a vast community that must have had a strong impact on its habitat and, vice-versa, was strongly affected by the immediate surroundings. During the settlement period a lake covered huge parts of the floodplain. It provided not only a considerable part of the diet, but ensured, through the direct access to the main river, continuous and extensive over-regional exchange.*

**IZVLEČEK** – *Okoli 9 metrov visoka naselbina tipa tell Pietrele-Măgura Gorgana se nahaja blizu reke Donave in je ena najbolj zahodnih naselbin kulturnega kompleksa Kodžadermen-Gumelnița-Karanovo VI, ki se je širil čez celotno zahodno pontsko regijo v času 5. tisočletja BC. V preteklosti so tell enačili z naseljem, danes pa zahvaljujoč geomagnetskim preiskavam in kasnejšim izkopavanjem na najdišču Pietrele vemo, da sama naselbina tell predstavlja le najbolj izjemen del veliko bolj kompleksnega naselja. Tisti ljudje, ki so živeli na tellu, in tisti, ki so živeli v ravnici okrog tella, so bili skupaj del velike skupnosti, ki je morala imeti močan vpliv na okolje, in na katero je tudi neposredna okolica morala imeti pomemben učinek. V času obstoja te naselbine se je v tej ravnici nahajalo veliko jezero. Le-to je predstavljalo pomemben vir za prehrano takratnih ljudi, prek neposrednega dostopa do glavne reke pa je omogočalo tudi stalno in obsežno menjavo na nadregionalni ravni.*

**KEY WORDS** – *Copper Age; Gumelnița-culture; Pietrele; geomorphology; palaeolake; fauna; hunting; fishing; symbols on pottery*

## Introduction

In archaeological investigations, bodies of flowing water are considered the main arteries by means of which groups of human populations disseminated, and with them knowledge and goods also spread. In this regard, the Danube played a special role, as first pointed out by Vere Gordon Childe (1929). He dedicated (1925) one of his first books to this water-

course, although even earlier in his pioneer work *The Dawn of European Civilization* one chapter carries the title 'Danubian Civilization'. In the German literature, the Early Neolithic has been designated as *Donauländischer Kulturkreis* (Buttler 1938), the first farmers being conceived as population groups that immigrated to Southeast Europe from the Near East.

Following the course of the Danube, they spread west, thereby driving out the post Ice Age hunter-gatherers of Central Europe.

Standing bodies of water in Southeast Europe, unlike those in the circum-Alpine sphere, have received far less attention in research. Exceptions are the excavations led by Giorgos Chourmouziades at Lake Orestida in Kastoria, Greece (*Chourmouziades 2002*) and at Ezerovo, near the Lake Varna led by H. Todorova (*Todorova, Tončeva 1975.30–46*). Lakeside settlements or wetland settlements in Switzerland and south-western Germany have been the focus of investigations since 1854 (*Schlichtherle 1997*). Between c. 4200 and 850 calBC, Neolithic and Bronze Age communities built their houses close to the water, in some cases on posts or piles in waterlogged soils which excluded oxygen and thus remained preserved through time (*Wolf 1998.27–35*). In the course of the first measures to regulate the Jura from 1868 to 1891, the decline in the water level of over 2m revealed sites with so-called pile dwellings (e.g., Cortaillod, Lake Neuenburger; *Schlichtherle 1997*).

In contrast, during land drainage measure along the Lower Danube in the 1960s, no traces of prehistoric settlements were noted, although deep channels must have been dug into the meadow ground. Yet, during the drainage of the Danube flood plains in 1961–1967, mainly already known tell settlements were investigated anew by means of soundings by Vladimir Dumitrescu (Gumelnița and Căscioarele: *Dumitrescu 1965.215–234; Dumitrescu 1966.51–99*). Additionally, Eugen Comșa explored the settlement at Radovanu between 1960 and 1970 (*Comșa 1972.44–45*). Although land drainage activities had a dramatic impact on the hydrological balance of the entire Lower Danube, thereby causing extensive changes to the line of adjoining terraces and intrusions

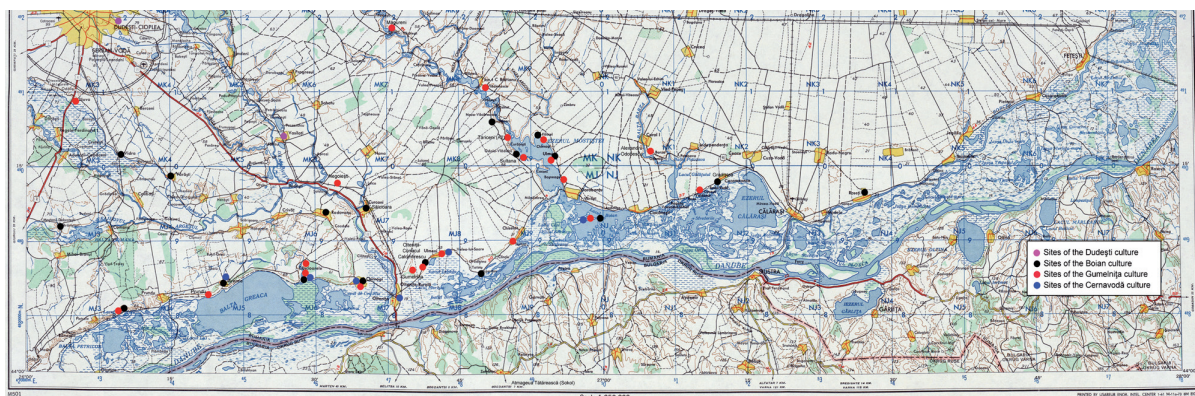
into the soils, none of these consequences were noted in the archaeological literature.

### The Danube flood plain prior to drainage

As late as the 1960s, a number of lakes extended between Giurgiu and Călărași, a lacustrine landscape, which was fed by the Danube and abundant tributaries to the north (Fig. 1). Some of the standing bodies of water west of the Argeș river valley were interconnected; to the west, they ended at about the site of Pietrele (at the edge of the terrace) and Gostinu (in the flood plain). East of the Argeș and as far as the separation of the Borcea canal at Călărași, the lake plateau was supplied by the Mostiștea River. Once a bountiful aqueous biotope, today it is traversed by drainage canals.

Excavations at some tell settlements along the Danube were conducted during or even before World War I. After beginning with a trial trench in 1904, by 1953 the tell near Ruse had been almost completely excavated (*Černakov 2009.30–31*); C. Schuchhardt excavated at Cernavodă until 1917 (*Schuchhardt 1924.9–27*); whereas, unfortunately, the work of Leo Frobenius at Cunești during World War I remained unpublished (*Popescu 1935–36.109*).

In the 1920s, members of the Institute of Archaeology in Bucharest undertook investigations at the tell settlements of Gumelnița (*Dumitrescu 1924; 1925*), Sultana (*Andrieșescu 1924.51–107*), Căscioarele (*Ștefan 1925.138–197*) and the prehistoric settlements on what was then the peninsula in Lake Boian (*Christescu 1925*). The expeditions were immediately published in the first two volumes of the newly-founded journal *Dacia* in the form of detailed preliminary reports. Between 1940 and 1960, during and after World War II and before the Danube mea-



**Fig. 1. Map of the Lower Danube Region (U. S. Army, Corps of Engineers, 1955) with some of the main Neolithic and Chalcolithic sites (A. Reingruber).**

dows were drained, excavations were conducted – as far as verifiable – only in Pietrele and Spantov; smaller investigations were undertaken in Sultana by local museums, but never published. Dumitru Berciu excavated in Pietrele for a maximum of six weeks in 1943 and 1948 (*Berciu 1956.504*); after that, in 1956–1957 he was occupied with work in Tangâr, another tell settlement northwest of Pietrele (*Berciu 1961*). Sebastian Morintz excavated in Spantov in 1952 and 1956 (*Şantierul Spantov 1953; Morintz, Preda 1959.163*).

The aforementioned settlements of the Neolithic Boian and Copper Age Gumelnița cultures appear at regular intervals, at a distance of approx. 20–40km apart. Multi-layered or flat settlements, scarcely visible today, can surely be presumed in the terrain in between. Those sites that have been recognised and excavated, however, suffered the same fate as the tells: the finds recovered from Prundu, Chiselet, Boşneagu, Vărăşti and Alexandru Odobescu remain more or less unpublished.

When plotting these Neolithic and Eneolithic settlements on a map, their relation to the former lake landscape becomes quite obvious; investigated settlements are particularly numerous in areas in which flowing water meets standing water (near the present-day localities Oltenița und Dorobanțu). The absence of higher tells to the south of the present course of the Danube cannot be attributed solely to a gap in research. No larger rivers flow there, except for the Lom, at whose confluence with the Danube the Ruse tell is located (Fig. 2). Moreover, although numerous rivulets drain the Ludgorie plateau east of the Lom, they do not carry water all year round. So, apparently this southern area – with a more limited amount of not only water but also sun in comparison to the northern banks – did not attract prehistoric settlers as the north did.

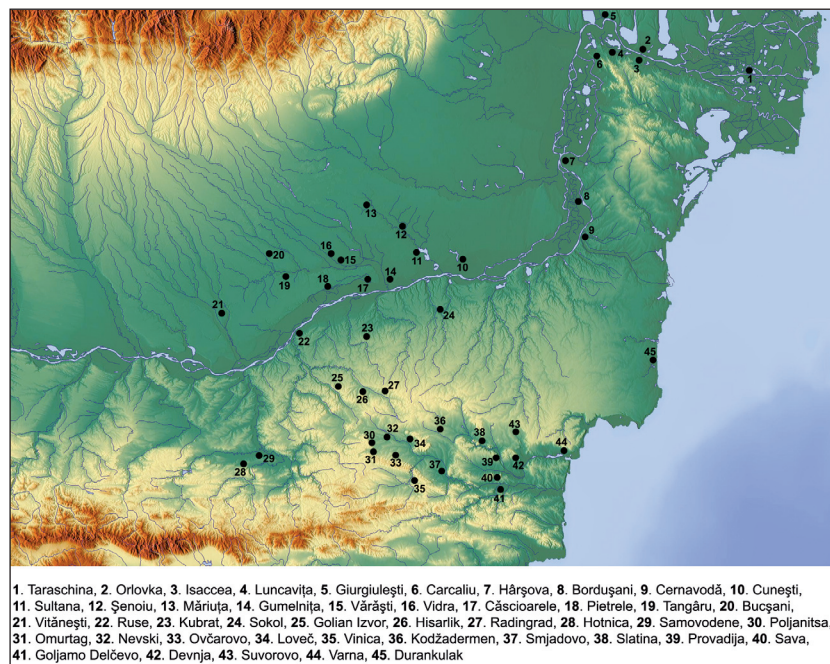
Similarly, no tell-settlements are known from the Neolithic or Copper Age in the area extending from the bend east of Cuneşti near Călăraşi as far as Cernavodă. By contrast, high tells are located along the Da-

nube flowing south-north, such as Cernavodă (at the mouth of the Carasu River into the Danube, that is, with the Danube-Black Sea canal built into the riverbed, 1949–1987), Borduşani and Hârşova (near the confluence with the Ialomîța). Settlements are even more numerous in the area around the northern knee of the Danube, where smaller lakes are found to the south of the river and large lakes to the north (Fig. 2).

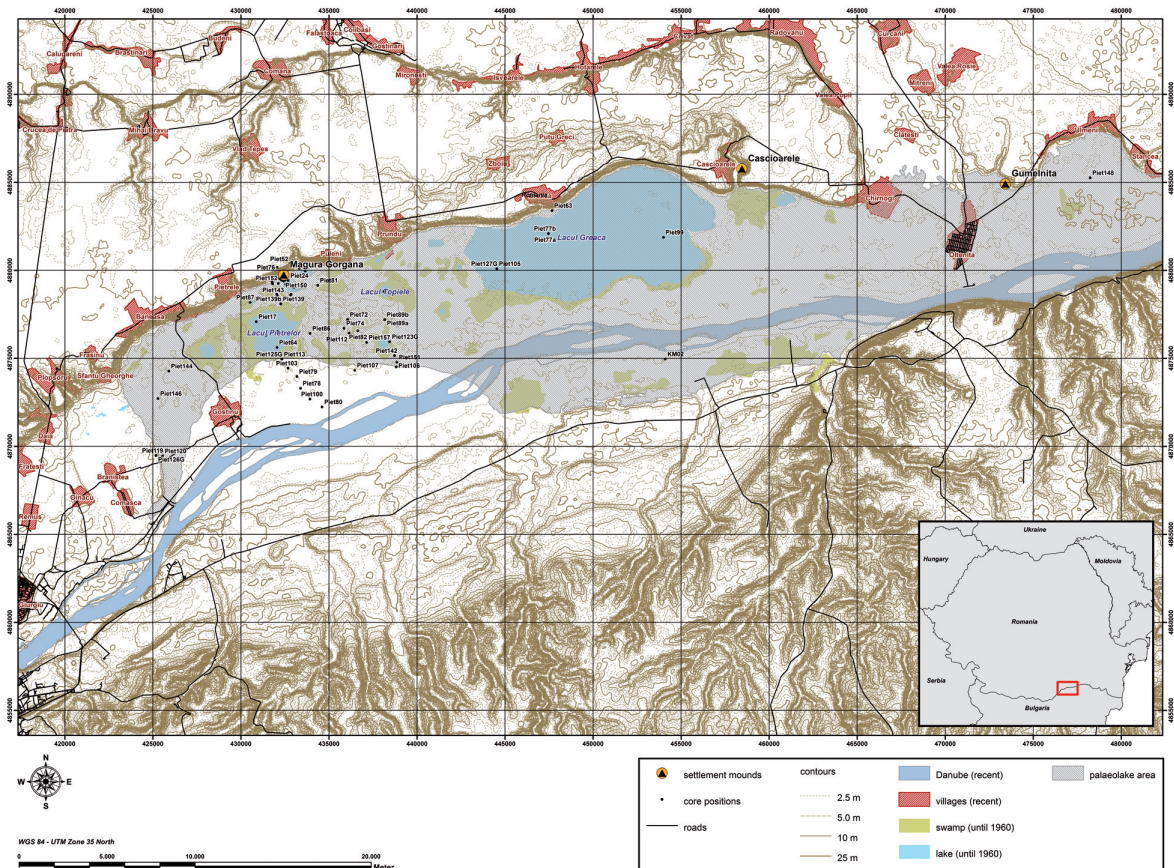
Undoubtedly, this ecological situation cannot be applied directly to the 5<sup>th</sup> millennium BC. Likewise, the morphology of the Danube meadowscape between Giurgiu and Călăraşi, much less as far as the Danube delta, cannot be reconstructed within the time limits of a single project. However, based on more than 160 core drillings in the stretch between the tell sites of Pietrele and Gumelnița, new results regarding the palaeo-landscape of the Danube valley were obtained.

### Reconstruction of a palaeolake in the Lower Danube valley

Until now, studies of the fluvial history of the Lower Danube and of landscape development along that stretch of the Danube are rare. An overall view of the geomorphological and geological setting within the study area was produced by *Institutul de Geologie și Geografie al Academiei Republicii Socialiste România (1969)*. More detailed geoarchaeological research within the framework of the joint Romanian-British Southern Romanian Archaeological Pro-



**Fig. 2. Map of the Lower Danube Region with sites of the Gumelnița-Kodžadermen culture (A. Reingruber).**



**Fig. 3. Topographic map of the study area at the Lower Danube showing the locations of corings, positions of former lakes and the supposed palaeolake with an area of approx. 60km that might have developed in the 7<sup>th</sup> millennium BC and existed for more than 5000 years (D. Nowacki).**

ject (SRAP) project (Howard et al. 2004; Macklin et al. 2011) focused on the Teleorman Valley, about 70km west of Pietrele. Furthermore, Alexandru M. F. Tomescu (2000) and Maria Lazarova and Elissaveta Bozilova (2001) provided information on the regional vegetation history based on palynological studies in southern Romania and northern Bulgaria. Much more research has been conducted on the Holocene and late Pleistocene evolution of the Danube delta and changes in the level of the Black Sea (e.g., Panin 2003; Giosan et al. 2006; Yanko-Hombach et al. 2007). A discussion of the chronology of sea-level changes and the impact on the archaeological sites along the Black Sea coast is still underway.

To have a closer view of the development of the Holocene flood plain within the study area between Giurgiu and Oltenița, a multi-proxy approach based on a variety of methods (e.g., the evaluation of historical and recent topographic maps and satellite images, corings as much as 17m in depth, geoelectric profiling, sedimentological, geochemical, microfaunal and pollen analyses) have been applied (Wunderlich et al. 2012; Nowacki, Wunderlich 2012).

A comparison of historical topographic maps and satellite images allowed the detection of recent geomorphological changes, as natural or anthropogenic modifications to channel beds and the silting up of ancient lakes. Furthermore, these sources provided the geographical background for taking sediment cores, and enabled the regionalisation of data attained from various analyses of the sediments. More than 160 sediment cores were taken by vibro-coring (Fig. 3), using open and closed sections. In addition to grain-size analyses, chemical elements such as iron, aluminium, titanium, strontium, magnesium, calcium, copper, manganese, sulphur, nitrogen, phosphate, total organic and inorganic carbon (TOC, TIC) were identified. Furthermore, conductivity was measured and the remains of microfossils and pollen analysed. The chronological framework of the stratigraphy is based on AMS <sup>14</sup>C and OSL dating.

The corings and following analyses allowed the identification of distinct sediment layers, which can be assigned to different sedimentary environments. The time bar in Figure 4 shows the different litholo-

gical units, starting with fluvial sediments at the base, overlain by limnic sediments, which are mostly covered by channel and flood plain deposits. In detail, the following facies units from base to top could be distinguished:

### **Fluvial deposits**

These sediments are characterised by olive-coloured sand and partly gravel. OSL-dates vary from  $32.7 \pm 1.5$  ka BP (HDS-1570) to  $15.9 \pm 0.9$  ka BP (HDS-1573) indicating that the deposition of this layer occurred at least until the late Pleistocene. It can be attributed to a braided river system.

### **Limnic deposits – grey**

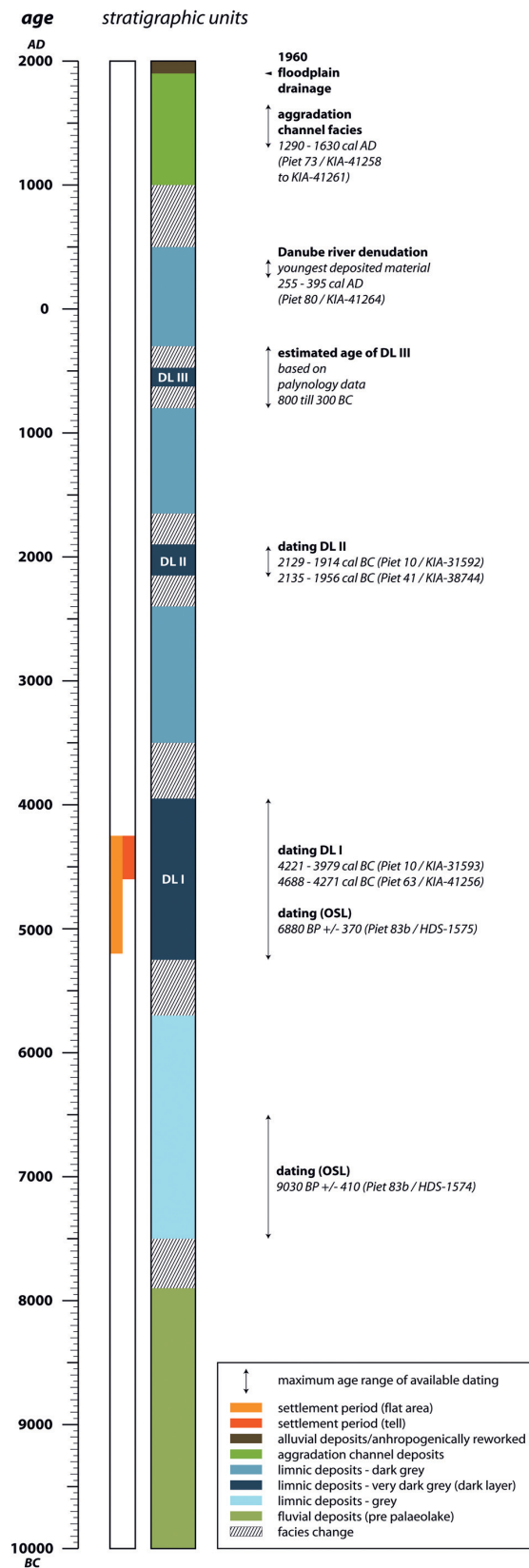
These grey deposits are characterised by a fining upward sequence, but with slightly alternating grain-size distribution in every analysed core. The only OSL date available from the lower part of this layer gives an age of  $9.03 \pm 0.4$  ka BP (HDS-1574; cf. Fig. 4). Due to the results of geochemical and microfossil analyses – for example, comparatively low C/N ratios (e.g., Meyers, Ishiwatari 1993) – these sediments can be attributed to a limnic environment. It can be assumed that vast parts of the Lower Danube valley were inundated as a result of the rapid rise in the level of the Black Sea. The extent of the palaeolake as reconstructed from the corings is depicted in Figure 3. After a period of 2000 years, the environmental conditions changed and the following sequence was deposited. This was when the Neolithic settlement was founded at Pietrele.

### **Limnic deposits – very dark grey/black**

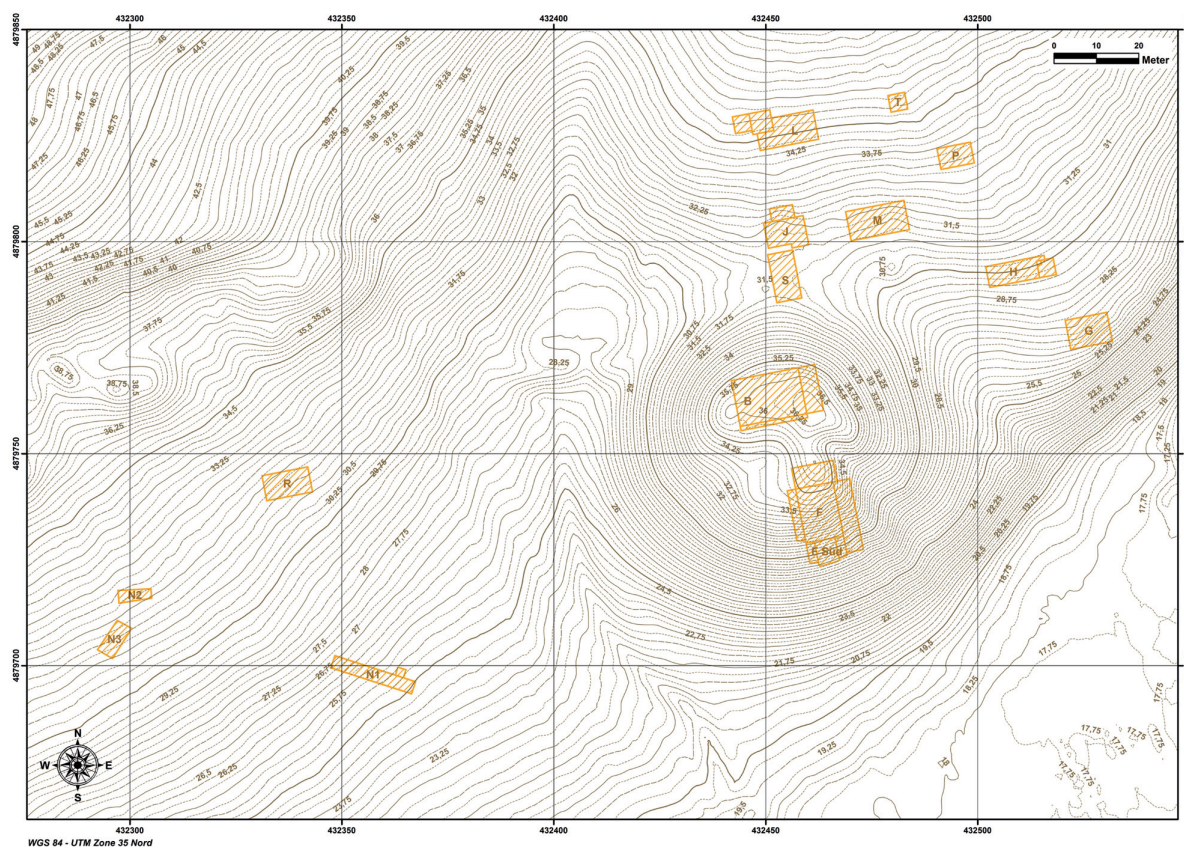
A limnic environment continued to prevail in the study area. However, the sediments of this sequence are characterised by a very dark grey or even black colour. This dark layer (DL I), which could be identified in nearly every core, was dated by several AMS- $^{14}\text{C}$  and one OSL dating to the time span of the Copper Age settlement period (Fig. 4). Near the centre of the palaeolake, DL I is predominantly characterised by clay, whereas next to the littoral, the layer mainly consists of coarser material. This is evidence that the sediments originated from the adjacent slopes, where they were possibly eroded due to increasing human impact.

### **Limnic deposits – dark grey**

The lake sediments above DL I are characterised by a dark greyish colour and consist predominantly of clay and silt, respectively. Further dark layers are intercalated, varying in number and thickness from core to core. For example, the dark layer DL II is not



**Fig. 4. Time bar showing the different stratigraphic units in the sedimentary record of the Danube floodplain derived from more than 160 corings, as well as AMS  $^{14}\text{C}$  and OSL ages providing the chronological framework (D. Nowacki).**



**Fig. 5.** The tell site of Pietrele, Măgura Gorgana and its immediate surroundings with trenches from 2002–2012 (D. Nowacki).

as thick as DL I and occurs only in the western part of the palaeolake. This layer was dated to approximately 2000 calBC (Fig. 4). The whole stratigraphic layer is interpreted as the main palaeolake period, which ended with the silting up of the lake.

#### ***Aggradation channel deposits***

The period of aggradation was characterised by a prograding channel system, which fragmented the whole lake area into smaller basins. This channel system and the small lakes in between existed until the flood plain was drained in the 1960s; the remnants thereof can still be identified in the landscape on recent satellite images and topographic maps. The channel and levee deposits of the ‘aggradation channel deposits’ are separated from the ‘limnic deposits’ below by a sharp unconformity, indicating that the limnic sediments were locally eroded during the aggradation phase. In the small basins between the channels, lake sediments reach the surface. At these locations, lakes prevailed, since they were drained some 50 years ago.

#### ***Alluvial deposits/anthropogenically reworked***

The uppermost stratigraphic layer close to the surface contains reworked material that came up dur-

ing the digging of drainage canals. Furthermore, it consists of alluvial sediments that were affected by pedogenesis after drainage and severe changes in the groundwater table. This stratigraphic layer alternates in grain-size and colour from core to core.

The results presented here of our geomorphological research in the area close to the site provide evidence that during the Neolithic and Copper Age settlement at Pietrele people lived close to a vast lake extending over about 500km<sup>2</sup>. The western boundary of the palaeolake could be located about 10km west of Pietrele. There, the Danube probably entered the lake. To the east, limnic deposits were found as far as Gumelnița, defining the minimum extent of the lake, and even in Bulgaria south of the Danube comparable lake deposits were found. Possibly, the lake extended even further to the east, connecting the settlements of the 5<sup>th</sup> millennium BC. Along the lakeshore, swampy wetlands constituted suitable habitats for wild animals such as wild boar, which was proven to have been a major source of food for the people at tell Pietrele (see contribution by N. Benecke). The finds of fish bones within the settlement layers also corroborate the existence of a lake, as the majority could be assigned to species preferring

still waters (see contribution by K. Ritchie). The changing properties of the sediments within the record of limnic deposit, for example, the dark layer DL I that was partly accumulated during the main settlement period at Pietrele and neighbouring settlements from 4600 to 4250 calBC, might have been due to human impact. Intensified agriculture causing soil erosion as well as the input of organic matter from the settlements around the lake possibly changed the ecological conditions of the palaeolake.

**Pietrele – 1000 years of settlement history**

Still towering some 9m above the surroundings today, the Măgura Gorgana settlement mound near Pietrele was without doubt an imposing feature in the 5<sup>th</sup> millennium BC (Fig. 5). Upon a relatively steep projecting socle of settlement debris, heightened with additional deposits, stood large two-storied structures in close alignment. Settlement mounds were an architectural innovation on the Lower Danube, for never before had such a form of settlement appeared in this region, an otherwise characteristic appearance during the late 7<sup>th</sup> and 6<sup>th</sup> millennium BC in Southeast Europe. However, in the middle of the 5<sup>th</sup> millennium BC, when the Măgura Gorgana tell began to be built, settlement mounds were already an anachronism: this form had been given up elsewhere in Southeast Europe. According to the available data, it seems presumable that the erection of this tell was an organised process that occurred prior to 4600 calBC on the Lower Danube. However, we can establish the beginnings of the settlement hill in Pietrele with certainty only when the corresponding settlement layers have been reached.

It has been a long-held view that the mound represented the settlement as a whole. Our investigations could show for the first time that the tell was only a part of a substantially larger settlement. According to findings made thus far, the surrounding flatland settlement existed long before the mound was built: it existed further during the entire duration of habitation atop the mound and ended c. 4250 calBC with the end of the tell. Excavations conducted in the flatland settlement since 2009 have brought forth astonishing new per-

spectives. The hitherto oldest recorded habitation there can be dated to the last two centuries of the 6<sup>th</sup> millennium BC (*Hansen et al. in press.Fig. 59*). In the north-eastern area of the flatland settlement, habitation layers were uncovered that held pottery from an early phase of the southern Romanian Late Neolithic (*Hansen et al. in press.Fig. 2–3, 28*). Radiocarbon dates of the layers from which the pottery derives are still being processed, but stylistically the vessels can be dated to the beginning of the 5<sup>th</sup> millennium BC. At present, no further radiocarbon dates for the various Late Neolithic find contexts are available, yet all stylistic phases of Boian culture are probably represented in the flat settlement around the tell. The research on the Late Neolithic period in southern Romania is full of gaps (*e.g., Neagu 1999*); hence, it can be anticipated that future excavation in Pietrele will lead to a basic revision of the actual temporal sequence in the cultural development of the Late Neolithic period. There are signs that the settlement existed for some 1000 years, which is a significantly longer time than could have been assumed until now.

With the discovery of Late Neolithic layers in Pietrele, there is now the promising expectation that the development of the settlement until the forma-

species	Danube meadow floodplain forest	slope area water bodies	high terrace
mammals	wild pig red deer polecat	beaver otter	roe deer wolf fox badger hare
birds		ducks geese swans herons, storks cormorant pelican crane	birds of prey birds of prey
fish		all species	
reptiles		pond turtle	
mollusca		river mussels	

**Fig. 6. The ecotope in the surroundings of the settlement at Măgura Gorgana and the wild animals occurring inside as derived from their preference for a specific habitat.**

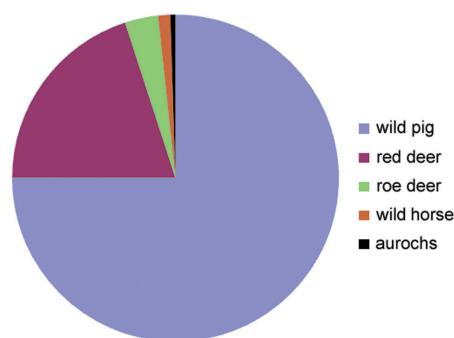
tion of the settlement mound can be followed more precisely, a potential that is of profound importance for explaining the genesis of the 'tell phenomenon' on the Lower Danube. Furthermore, the economic strategies and their changes in the course of a lengthy settlement history can be determined, thanks to abundant plant and animal remains obtained by hand-collecting as well as by dry sieving and flotation.

### Animal husbandry and hunting

Excavations at the settlement mound of Măgura Gorgana in the community of Pietrele have yielded comprehensive collections of animal remains, thanks to the favourable conditions for preservation. The remains enable insight into the economic basis of the settlement site, as well as aspects of local environmental conditions (Benecke 2004; 2006). From a chronological point of view, the finds can be roughly assigned to two phases in time, namely the Late Neolithic Boian culture and the Copper Age Gumelnița culture. Assemblages of animal bones from the time of the Boian settlement phase are available from the outer settlement, although the size of these collections is relatively small. By contrast, excavations on the tell yielded exclusively animal remains of the Gumelnița settlement phase, encompassing very comprehensive inventories. A comparison of finds from these two temporal phases reveals differences in the use or management of animal resources.

The Boian settlement in Pietrele is typical mainly of an agrarian oriented food economy. Animal husbandry focused primarily on cattle. Thus, among the bones of economic domestic animals, c. 70% are cattle, while pig and small ruminants (sheep and goat) are each represented by c. 15%. The small inventories do not enable any deductions about aspects of secondary use. Compared to animal husbandry, hunting played only a minor role in the food supply. The proportion of game among the bones of mammals amounts to only 8%. Wild boar and red deer were among the most frequently hunted wild animals. The number of finds of other, potentially easily obtainable, natural animal resources in the surroundings of the settlement, such as birds, fish, muskels and turtles, suggests that exploitation was very low.

Animal remains from the subsequent Gumelnița settlement attest to the extensive use of natural animal resources as nourishment for the inhabitants and a source of raw materials. Only half of the meat documented in waste deposits derives from domesticated



**Fig. 7. Relative frequency of the principal game species (ungulates only) from the Gumelnița layers in the tell (according to total number of finds).**

animals. In contrast with the Boian settlement, pig is the most frequent among domestic animals, amounting to 56%. The cattle bones amount to 33% and those of sheep/goat are 11% of the bone material. Available data on stock composition (age, sex) show that pig were kept mainly for meat, while cattle, sheep and goat were probably also raised for milk.

Wild mammals comprise a numerically significant group, rich in species, among the finds of the Gumelnița settlement. They include various ungulates such as wild boar, red deer, roe deer, aurochs and wild horse, predators, and beaver and hare. They comprise between 45% and 55% of the mammalian bone material a proportion that allows the conclusion that hunting was widely practiced.

Wild boar is by far the predominant species among game animals (Fig. 6). The surrounding deciduous and mixed forests, alder swamps and aggradation zones of lakes and old coniferous groves with abundant underbrush offered an optimal environment for this species (Herre 1986.51). Considering this beneficial ecotope in the environs of the settlement site, animals probably took advantage of these ideal conditions, especially in the Danube meadows, and, consequently, were hunted. The second most frequent game species is red deer. This species is a typical inhabitant of sparse woods and wooded river valleys and meadows. However, it is also found in open grassland and heather landscapes if they are expansive enough to offer sufficient possibilities of escape (Bützler 1986.125). Accordingly, red deer could be hunted in the surrounding Danube meadows as well as on the high terraces near Măgura Gorgana. Unlike red deer, roe deer is characterised rather by its preference for the periphery of woods (Lehmann, Sägeser 1986.254), where it can seek refuge. However, it also prefers vast open spaces, a landscape that can be presumed to have existed on



high terraces. Roe deer could also appear occasionally in slope areas. The presence of wild horse is relatively clear. As specialised grass eaters and a typical element of the steppe fauna, these animals are primarily assumed to have been inhabitants of high terraces along the Danube. Presumably, sparse wooded cover and park-like landscapes and the steppe were the preferred habitat of auroch (*Requate 1957: 325*). Groups of these large wild cattle probably also inhabited the high terraces. Figure 6 shows potential habitats, including areas of other species of wild game attested in the bone material from Măgura Gorgana.

In addition to wild mammals, bone material found in the Gumelnița settlement phase attests the hunting of various species of birds as well, above all ducks, geese, swans, herons and cranes. Fishing was another important branch of the food economy (see contribution by K. Ritchie). This was augmented by the regular exploitation of mussels and turtles for food. The shells of river mussels (*Unio spec.*) were present in almost every unit of finds, and sometimes whole storage units were discovered, such as in contexts P10L241 and L254, where 5121 mussels were counted. Assuming two shells per complete bivalve, 2560 mussels were disposed. Considering that the shells were disposed of in middens after the organic matter had been consumed, their accumulation cannot indicate the storage of fresh food, as shown by the almost complete absence of mussels that were still closed, *i.e.* complete bivalves. Furthermore, in areas B and F on the tell, species of *Unio* appear mainly in the alleyways. Hence, river mussels must have been part of the common diet. In addition K. Ritchie identified a minimum number of individuals (MNI) of nine turtle shells in area B on the tell in one single unit of finds (feature P12B-246).

All in all, this demonstrates that all of the ecotopes in the surroundings of the settlement site – the Danube meadows and the bodies of water there, the slopes as well as the high terrace – were integrated in the exploitation of natural animal resources. As can be recognised in the compilation in Figure 6, the focus of these activities was evidently on the Danube meadows, where the most frequently hunted animal was presumably wild boar (Fig. 7), but the other attested and quite frequent

kinds of animals or groups also stem from the meadows. Possibly the local animal husbandry made use of the natural sphere as well, in which case, the domestic pig could easily have found food.

### Fish bones in and off the tell

The analysis of fish bones from Pietrele is in its beginnings. The results presented here are based primarily on sieved samples and do not yet include the hand-collected material from these contexts. The samples included have been recovered mainly by wet-sieving using mesh-sizes of 0.5mm (P10F345 and F346, P11 B024, F811 and F821) and 4mm (P12B270). On the other hand, the fish materials included in shell middens P10L241 and L254 (see contribution by N. Benecke) were obtained by manual sorting. Some elements (*e.g.*, loose teeth, ribs, spines) are not included in the totals, because they would bias the results in an unrepresentative manner. It should be noted that it is possible, for example, that *Siluridae* (catfish) are under-represented and *Acipenseridae* (sturgeon) are missing, as most were large individuals, and the bones from these fish were noticed in the field and set aside with the other bone material where they await identification.

The taxa listed in Figure 8 are fish typically classified as limnophilic (preferring still waters), but they also adapt to a variety of habitats (*Dinu 2010; Froese, Pauly 2013; Kottelat, Freyhof 2007*). The one exception to this is *Alosa sp.*, which keeps to the main channel of the Danube during its migration into freshwater (*Kottelat 1997; Whitehead 1985*). Although not present in any of these samples, the identification of *Acipenseridae* (sturgeon) in other contexts by N. Benecke (*2004*) also supports at least oc-

Family	Species	English	Romanian	German
<i>Clupeidae</i>	<i>Alosa sp.</i>	shad	scrumbie	Maifisch
<i>Cyprinidae</i>	<i>Abramis brama</i>	bream	plătică	Brasse
	<i>Cyprinus carpio</i>	carp	crap	Karpfen
	<i>Aspius sp.</i>	asp	pește lup	Rapfen
	<i>Rutilus sp.</i>			
	<i>Scardinius sp.</i>	rudd	roșioară	Rotflosser
	<i>cf. Alburnus sp.</i>	bleak	albișoară	Ukelei
	<i>cf. Phoxinus sp.</i>	minnow	crăiete	Elritze
<i>Esocidae</i>	<i>Esox lucius</i>	pike	știucă	Hecht
<i>Percidae</i>	<i>Gymnocephalus sp.</i>			
	<i>Perca fluviatilis</i>	perch	biban	Barsch
	<i>Sander lucioperca</i>	pike-perch	șalău	Zander
<i>Siluridae</i>	<i>Siluris glanis</i>	wels catfish	somn	Wels

Fig. 8. Species of fish analysed in the units listed in Figure 9.

casional fishing in the main channel of the river, where there are deep, strong currents.

Chronologically, six of the eight collections analysed in this paper are from an early period of the Gumelnița culture: four units derived from the lowest levels excavated in trenches B and F on the tell so far, and two from a coeval level revealed in trench L in the outer settlement. The units belonging to P10F were dated radiometrically to 4500– 4450 calBC; no <sup>14</sup>C dates are available for the two units in trench B, but they are from features that can be typologically dated to the same period as P10F. The features from off the tell in trench L yielded pottery that also date them to an early phase. The other two units in trench F (P11F811 and F821) are considerable younger, dating from the end of the tell-sequence at around 4250 calBC.

The data show that, internally, the samples from trenches B and L are relatively homogenous, although the contexts from trench F display considerable variation (Fig. 9). Because of the small sample sizes and differences in recovery methods, caution is needed when interpreting differences between the samples, and any conclusions must be considered preliminary. However, the available data do show variability between the trenches that is of some interest. Fish bones from the shell middens in trench L are overwhelmingly cyprinids, with a small number of other species included. In trench B, the cyprinids are also the most important species, but here there are larger numbers of pike and fish of the

perch family, and it is in this trench that catfish are most significant. The results from trench F 2011 (P11F) are similar to trench B, although catfish are less common. Trench F 2010 (P10F) has an even larger percentage of pike and perch family remains, although cyprinids still comprise almost half of the identified bones (though note that P10F346 is very similar to trench B). The difference between the absolute dominance of cyprinids from contexts off the tell and the more balanced representation of fish from the two trenches in the tell indicates that the processes responsible for creating these deposits were not the same. Further work is necessary to clarify whether this is the result of contextual, cultural, temporal, or other factors.

One conclusion that can be drawn from these preliminary investigations regards fishing techniques. The presence of many specimens of very small fish, together with *Alosa sp.* (an anadromous fish that does not feed during its migration into freshwater – meaning that it will not respond to fishing methods relying on the use of bait), strongly point to the use of nets or traps in addition to the spears/harpoons and/or fishhooks that were probably employed to catch some of the impressively large specimens present in the assemblage.

### Fishing in Pietrele

The Danube River and the lakes were important food sources for the inhabitants of Pietrele and neighbouring settlements in prehistory and well into modern

	Clupeidae	Clupeidae %	Cyprinidae	Cyprinidae %	Esocidae	Esocidae %	Percidae	Percidae %	Siluridae	Siluridae %	Total
P11B024	1	0.2%	301	69.0%	62	14.2%	55	12.6%	17	3.9%	436
P12B270	0	0.0%	305	63.8%	72	15.1%	75	15.7%	26	5.4%	478
<b>Trench B</b>	<b>1</b>	<b>0.1%</b>	<b>606</b>	<b>66.3%</b>	<b>134</b>	<b>14.7%</b>	<b>130</b>	<b>14.2%</b>	<b>43</b>	<b>4.7%</b>	<b>914</b>
P10F345	0	0.0%	82	26.3%	114	36.5%	115	36.9%	1	0.3%	312
P10F346	0	0.0%	168	60.2%	57	20.4%	42	15.1%	12	4.3%	279
<b>Trench F, 2010</b>	<b>0</b>	<b>0.0%</b>	<b>250</b>	<b>42.3%</b>	<b>171</b>	<b>28.9%</b>	<b>157</b>	<b>26.6%</b>	<b>13</b>	<b>2.2%</b>	<b>591</b>
P11F811	0	0.0%	130	75.1%	27	15.6%	15	8.7%	1	0.6%	173
P11F821	1	0.6%	102	64.6%	28	17.7%	22	13.9%	5	3.2%	158
<b>Trench F, 2011</b>	<b>1</b>	<b>0.3%</b>	<b>232</b>	<b>70.1%</b>	<b>55</b>	<b>16.6%</b>	<b>37</b>	<b>11.2%</b>	<b>6</b>	<b>1.8%</b>	<b>331</b>
P10L241	0	0.0%	181	86.2%	18	8.6%	10	4.8%	1	0.5%	210
P10L254	0	0.0%	196	84.5%	7	3.0%	26	11.2%	3	1.3%	232
P10L241/L254	0	0.0%	378	88.7%	19	4.5%	27	6.3%	2	0.5%	426
<b>Trench L</b>	<b>0</b>	<b>0.0%</b>	<b>755</b>	<b>87.0%</b>	<b>44</b>	<b>5.1%</b>	<b>63</b>	<b>7.3%</b>	<b>6</b>	<b>0.7%</b>	<b>868</b>
<b>Totals</b>	<b>2</b>		<b>1843</b>		<b>404</b>		<b>387</b>		<b>68</b>		<b>2704</b>

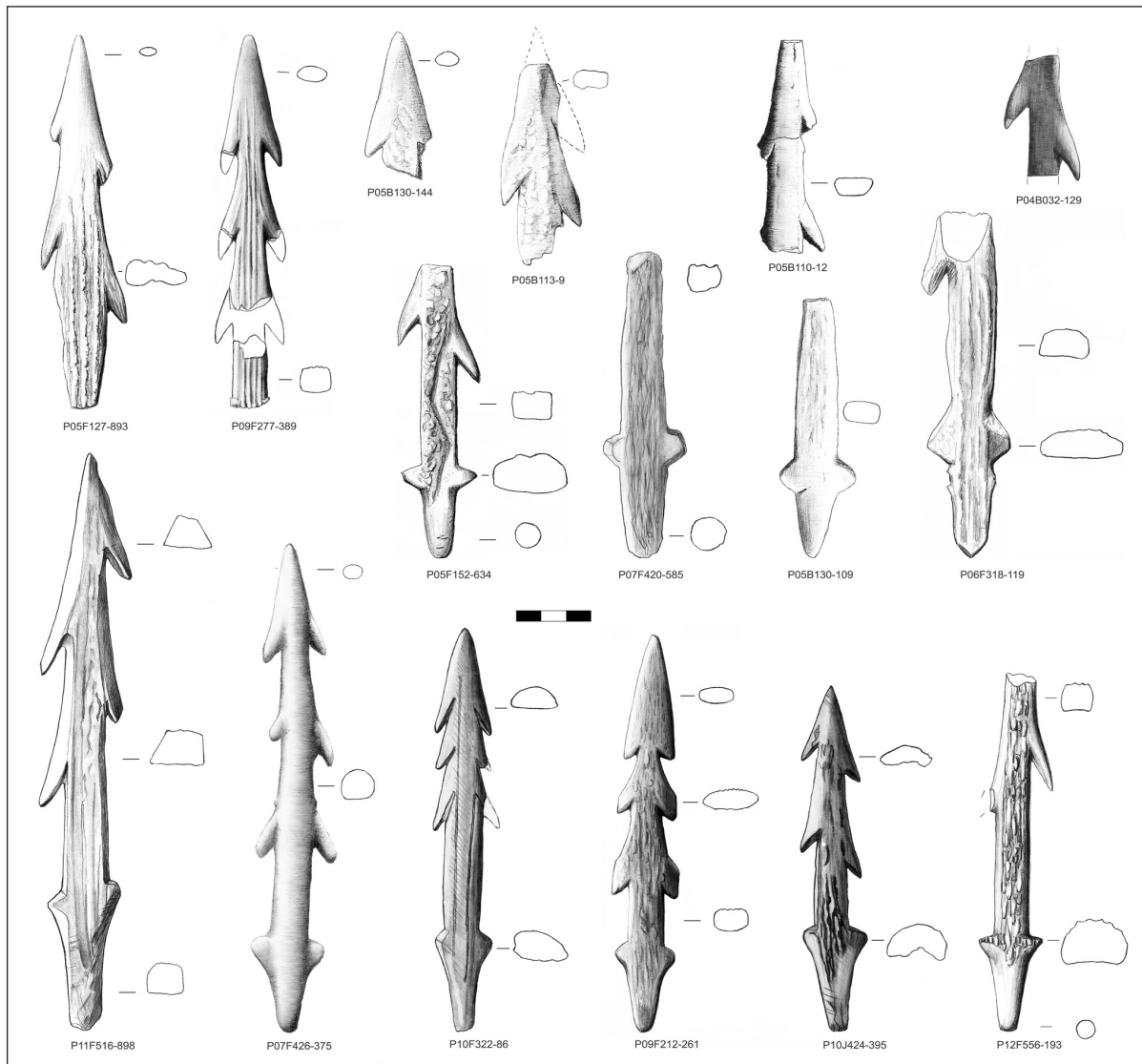
Fig. 9. Fish bones identified in eight features from three trenches in Pietrele.

times, too. Fishing activities in Pietrele, however, came to an end with the drainage of the meadows. Therefore, this traditional quest for food has ceased in Pietrele and the surroundings. Yet, historical studies on Danube fishery are at hand and offer important comparative sources for evaluating the finds from Pietrele (e.g., Zirojević 1995). Ground-laying work on prehistoric fishing was presented by Laszlo Bartosiewicz and Clive Bonsall (2004), upon which further investigations can be based. As attested by faunal remains, fishing played an enormous role in the Copper Age settlement at Pietrele. Only a small quantity of the artefacts used for fishing was preserved. Unlike fishing artefacts found elsewhere in wetland settlements (Mertens 2000; Hartz, Kraus 2009: 209–211), nets, fish traps, wooden anglers and the like were no longer preserved at Pietrele. Net fishing must have played an important role in Pietrele, which would explain the large amount of remains of



**Fig. 10. Pietrele. Perforated clay discs and sherds (photo: S. Hansen).**

smaller fish identified by K. Ritchie. Perforated pottery sherds could possibly have served as net sinkers (Fig. 10).



**Fig. 11. Rod harpoons from Pietrele (drawings: I. Berdženishvili, T. Vachta; graphic C. Schröder).**



**Fig. 12. Toggle harpoons from Pietrele (photo: S. Hansen).**

One of the most impressive groups of finds in Pietrele is of rod harpoons (Fig. 11); made of antler, the longish rod shape has two rows of barbs. The largest preserved example measures 24.5cm in length. A total of 38 harpoons were found in Pietrele, more than is known from other settlements of Gumelnița culture. The majority of finds in Pietrele are fragmentary; only five pieces could be assessed as functional. Presumably, four of these examples had been reworked at least one or several times. Several typological variants can be distinguished, including harpoons with barbs arranged symmetrically or asymmetrically. A more detailed study of harpoons found in Pietrele and neighbouring settlements that would provide information about standard sizes, methods of production and the manner of shafting, among others, is still lacking. The antler harpoons at hand are components of composite tools.

Thus far, harpoons have not appeared in large quantities in find contexts of the Late Neolithic along the Lower Danube. One fragment was found in the settlement of Radovanu, which is dated to the end of the Late Neolithic (Comșa 1986.45, Fig. 1; 1990). Whether or not the tradition of producing rod-shaped harpoons reaches back to the Mesolithic period on the Lower Danube cannot be decided at this point. Apparently, only two rod-shaped harpoons derive from the area of the Mesolithic and Early Neolithic settlements at the Iron Gates, the two examples from Vlasac (Dinu 2010.305).

As far as we know, harpoons first appeared in greater numbers during the Gumelnița culture. A large collection of double-row harpoon tips stems from the settlement mound at Ruse on the right bank of the Danube; it belongs to the narrower circle of Gumelnița culture (Georgiev, Angelov 1952.134, Fig. 104–105; 1957.67, Fig. 28). Further harpoons were found at Ulmeni (Comșa 1986.45, Fig. 2.1–7, Fig. 4.4), Căscioarele (Ștefan 1925.191, Fig. 45.1–13), Vărăști, Station B (Christescu 1925.284, Pl. 25.16–21; Comșa 1986.45, Fig. 2.8–13), Gumelnița (Dumitrescu 1925.88, Fig. 66.20–26), Lișcoteanca, Chiselet (Comșa 1986.45, Fig. 3), Hârșova, Carcaliu (Hașotti 1997. Fig. 90.1–4) and Bordușani (Schuster 2002.168, Pl. 1.5; 169, Pl. 2.4). Only a small fragment of a harpoon has been published from older excavations in Pietrele (Berciu 1956.523, Fig. 34.4). In terms of the quantity of finds, Pietrele is indeed extraordinary.

Another form of harpoon found at Pietrele is the toggle harpoon (ger. *Knebelharpune*): projectile points with barbs and lines (Figs. 12 and 13). These are made from red deer antler. In general, this type of harpoon has not been further elucidated archaeologically. Comparable harpoons are attested in the Ertebølle phase in northern Germany (Hartz et al. 2007.577, Fig. 6.1, 584, Fig. 16.6), where they were used for seal hunting. In southern Germany, harpoons are attested well into the Bronze Age (Torke 1993.59–65).

Transverse fish-hooks (ger. *Querangeln*) are the simplest form known in hook-and-line fishing. In Pietrele, this form has two pointed ends and a thicker middle part (Fig. 14). Besides this 'symmetrical' form, some asymmetrical examples may have served as projectile points (Fig. 15). The best evidence of the transverse hook derives from the settlement at Forschner near Bad Buchau, Baden-Württemberg, where parts of the head of a pike, the remains of a tench (*Tinca tinca*) and such a bone point were found close together (Torke 1993:53–56, Fig. 5; 6.2). Only one end of this transverse hook was pointed; the other was blunt. Therefore, a narrowly functional attribution of the piece is problematic, as is the case with bone tools in general. Comparable artefacts found in the settlement of Arbon-Bleiche 3 have been treated as projectile points (Deschler-Erb et al. 2002:295–296). There, double-pointed rib artefacts functioned as transverse hooks. The symmetrical double-points from settlements on Lake Biel were used as projectile points, as evidenced by the residue of pitch on the objects. A small number of these points have been regarded as transverse hooks (Schibler 2000).

There are clear signs at Pietrele of the existence of specialised households, as was recently identified at other Neolithic and Copper Age settlements (Müller et al. 2013; Hüster-Plogmann 2004:273). Houses in northern trench B were distinguished primarily by signs of grain processing (Reingruber 2010). Textile production also played a role. The preponderant number of artefacts connected with fishing, by contrast, stems from houses in the southerly row of houses lying near the lakes. Distinct differences in the distribution of artefacts for hunting, as well as further indications, suggest that some households in Pietrele specialised in certain activities for generations. In any case, the five superimposed houses in trench F represent a time span of 300 years. This is where the largest concentration of other antler artefacts as well as semi-finished products was noted, allowing the presumption that they were a site of harpoon production.

The large number of harpoons found in Pietrele and other settlements on the 'big lake' is certainly the result of the favourable conditions for preservation present in the settlement mounds. Yet, harpoons are also an element of economic specialisation. They are a kind of hunting artefact that presupposes training and experience. The precise analysis of the distribution of fishing equipment within the settlement and in the various layers is still in progress. In association

with the analysis of fish bones, investigations of fishing implements offer new insight into Neolithic and Copper Age fishing.

### Symbols on Neolithic and Copper Age pottery

The two trenches B and F on the Măgura Gorgana tell near Pietrele have now been excavated to a depth of 4.5 and 6.3m. The five superimposed house phases distinguished so far reflect 300 years of permanent habitation that can be assigned to phases A1 and A2 of Gumelnița culture. A further two metres of settlement layers, verified by core drillings, surely reach back to the Late Neolithic, to the period prior to 4600 calBC; they have not been excavated yet. Accordingly, the ceramic sequence is in a continuous vertical stratigraphy only for the second half of the 5<sup>th</sup> millennium BC. Late Neolithic structures were recorded in the flat settlement around the tell, the horizontal stratigraphy of which has not been completely clarified yet. Nevertheless, two aspects of pottery production should be pointed out here: the cen-

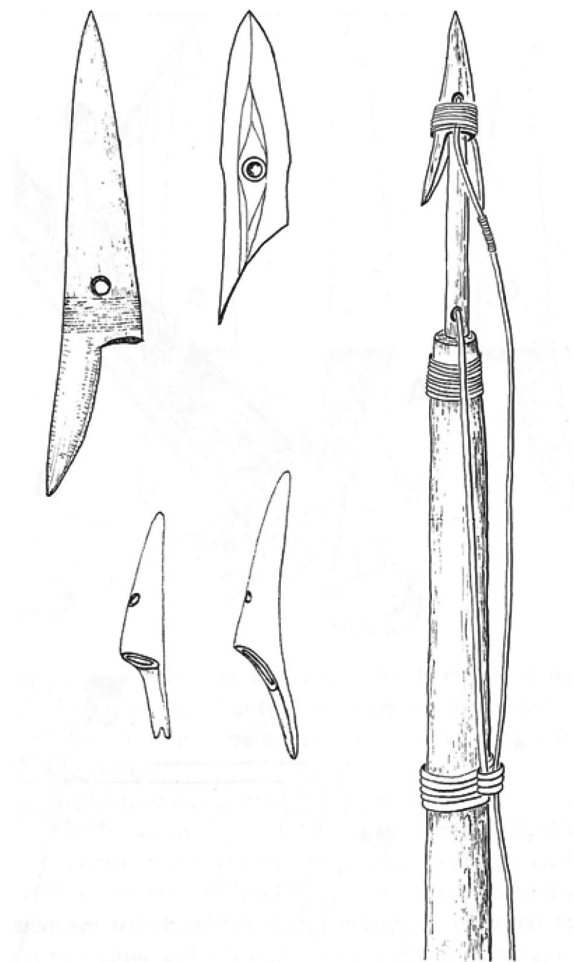


Fig. 13. Reconstruction of a toggle harpoon (after W. Torke 1993).

tral motifs of each period and the techniques in which they were executed.

One motif that stands out in the Late Neolithic material is the helix. This symbol was already present as early as the mid 6<sup>th</sup> millennium BC in the Arapi phase in Greece (*Hauptmann 1981.Pl. B.2*) and in the late Starčevo-Körös-Criş culture, painted in black on a red background. It also occurs incised and then filled with a white paste on vessels of *Notenkopf* pottery. In Pietrele, the helix is rendered as both an incised pattern and as polished ripples as of c. 5200 calBC. It also appears in barbotine, at the beginning of the Copper Age, and until the end of the Gumelnița culture, is incised on large vessels and fashioned with colours after firing (Fig. 16.1). In this way, a white paste colour is often preserved in deep incised lines and a red paste colour in the roughened parts (*Hansen et al. 2011.Fig. 7*). The decorative technique continues in the Copper Age, with the helix remaining a principal symbol until the end of the settlement.

Although the helix was a continued tradition in the Copper Age, the motif was never rendered in graphite; other motifs were depicted with this technique. As early as the lowermost excavated layer on the tell, *i.e.*, c. 4550 calBC, a new kind of pattern appeared, firstly in incised fashion (Fig. 16.3). According to what we know so far, primarily large vessels and their covers were decorated with 3 or 5 identical interconnecting curvilinear motifs. Only one house generation later, the surface of the lids was divided into 2 or 4 symmetrical zones (Fig. 16.2). This motif subsequently predominates in graphite painting (Fig. 17): thereafter, the interplay of the main motif repeated two or four times, with smaller accompanying motifs, dictates the painted outer surfaces of vessel covers and/or the inner surface of wide-mouthed bowls. The surface of beakers and small bowls is often decorated with this motif in a typical twofold or fourfold manner.

The oldest rod-like motif with broadly executed, simple symmetry appears in Pietrele around c. 4550



**Fig. 14. Pietrele. Transverse fish hooks (photo: S. Hansen).**

calBC (Fig. 17.1). Only one generation, later rods with one rounded end emerge, interpreted in the literature as ‘snakes’ (*Todorova 2003.307*) and ‘sun symbol’ (*Gimbutas 1982.89–90*) or neutrally designated as an ‘S-motif’ (*Voinea 2005.Pl. 52*) (Fig. 17.2–3). The result of doubling the rounded ends can be seen as a breaking wave, especially compared with the strongly curvilinear versions on later examples (Fig. 17.4), and additionally bearing in mind the incised wavy motifs (Fig. 16.3). A further motif is the ‘drop’, often executed positively (Fig. 17.5); circles also serve as fill elements. These motifs are bound within a scheme of a geometrically quartered surface with broad stripes; occasionally, one broad central stripe consisting of a rhombic net pattern divides the painted surface into two halves (Fig. 17.2,4). On pottery from later layers, these stripes have become thin bundles of lines and the rhombuses a net-like web or complex mesh, precisely measured in millimetres (Fig. 17.5).

In the manner of abstract modern logos, these motifs are universally interpretable, even if the original meaning really cannot be deduced. So, not everyone is aware that the logo of BMW is based on the rotation of a propeller; yet, it conveys the idea of dynamics and movement to the viewer. It is quite pos-



**Fig. 15. Pietrele. Projectile points (photo: S. Hansen).**

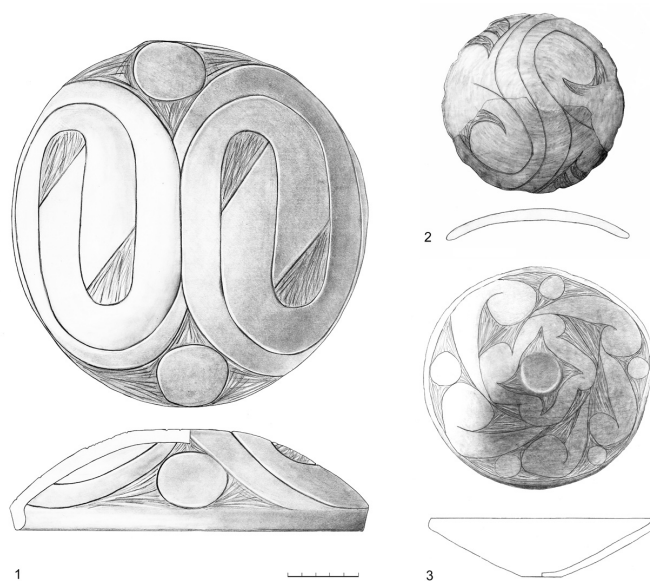
sible that this was also the message of these motifs in Gumelnița culture. Considering the close relationship to nearby waterways, the symbols could be abstractions of the wavy movement of water and drops or spray. They are framed by bundles of lines made with very narrow, single strokes. One of several possible interpretations of this motif is the net that was thrown into moving water to catch fish. Whatever these motifs did indeed convey, it is surely not unfounded to see a distinct allusion to water in the symbolism at Pietrele as of c. 4550 calBC.

### Conclusions

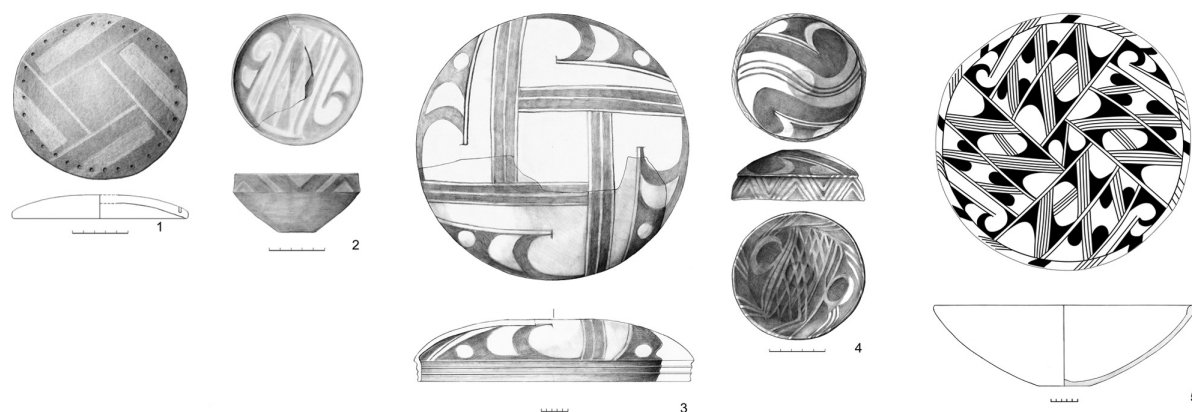
The existence of a lake surface of more than 500km<sup>2</sup> in the Danube valley has been confirmed by core drillings carried out in the study area along a 60km transect. It is quite possible that the lake extended even farther east, so that most of the settlements of the 5<sup>th</sup> millennium BC were interconnected through this body of water. Based on <sup>14</sup>C and OSL dates it can be placed within a time frame from the 8<sup>th</sup> millennium BC to the 1<sup>st</sup> millennium AD.

The results achieved through interdisciplinary investigations have shown that the lake did not initially have the economic importance attested after 4600/4500 calBC by the archaeological material. During that

time, the settlement at Pietrele and neighbouring lakeshore settlements reached their acme. The increased anthropogenic impact on the ecological conditions can be detected as a dark layer (DL I) in the lake sediments. Analyses of the faunal remains of lacustrine and terrestrial animals clearly show that hunting first increased with the onset of the Copper Age: hunting of large game was then complemented by fishing with harpoons. Nets and transverse hooks were used for fishing, above all, for limnophilic species that preferred calm waters. The numerous mus-



**Fig. 16. Pietrele. Incised helixes and waves (drawings: 1 I. Berdženishvili, 2 H. Nørgaard, 3 E. Gavrilă).**



**Fig. 17. Pietrele. Graphite painted motifs: rods, simple and breaking waves, net-like motifs (drawings: 1 T. Vachta; 2 H. Nørgaard; 3–4 C. Georgescu; 5 W. Rust).**

sel deposits and turtle shells show that aquatic resources were a firm source of nutrition.

Seen against this background, the inhabitants of Măgura Gorgana near Pietrele may not be viewed as sedentary farming communities, but far more as fishers and hunters. Moreover, the Copper Age community was apparently quite differentiated: specific activities were conducted by individual groups, as demonstrated by the distribution of artefacts and tools in the settlements. Not all households were engaged in hunting or fishing. With the change in economic strategies at the transition to the Copper Age came an innovation in the set of decorative motifs as exemplified on pottery: c. 4550 calBC new motifs appeared with those known from Neolithic times, symbols that display a strong link to water.

With all this the contours of a European lacustrine culture become visible. It is older than the lake Neo-

lithic in Switzerland, where the lakeshores were settled only as late as c. 4300 calBC due to climatic deterioration. The fundamental, interdisciplinary results gained for interpreting the Copper Age on the Lower Danube should form a point of departure for future field research, especially surveys and aerial photography, in order to recognise further sites and thus to gain a realistic picture of the process of settlement on lake shores in the 5<sup>th</sup> millennium BC.

#### ACKNOWLEDGEMENTS

We would like to thank Acad. Prof. Dr. Alexandru Vulpe and Meda Toderas for their invaluable cooperation and assistance. The project would not have been possible without the financial support of the German Research Foundation (DFG), to which we are much obliged. Dr. Emily Schalk translated the German parts of the text in her professional and perceptive manner.

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