ENDURING RECORDS

THE ENVIRONMENTAL AND CULTURAL HERITAGE OF WETLANDS

Edited by Barbara A. Purdy

Oxbow Books

Published by
Oxbow Books, Park End Place, Oxford OX1 1HN

ISBN 1 84217 048 1

A CIP record for this book is available from The British Library

This book is available direct from
Oxbow Books, Park End Place, Oxford OX1 1HN
(Phone: 01865–241249; Fax: 01865–794449)

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Printed in Great Britain at
Information Press, Oxford

17. Neolithic watercraft: Evidence from Northern Greek Wetlands

Christina Marangou

Introduction:geography and chronology

In a mountainous and partitioned country like Greece, mountains, steep slopes and water expanses have always, and particularly in prehistory, hindered inland communications between agricultural lands concentrated in restricted areas, isolated one from the other (Faugères 1989:88–89). Depressions and inner basins being still occupied by lakes and swamps during the Neolithic (Demoule *et al.* 1993), the importance of any means of transport, in particular across or along water, is obvious.

Two areas of Northern Greece, which have given evidence about Neolithic watercraft, are considered in this paper:Thessaly and Western Macedonia. Regarding the Neolithic phases of these regions, we follow here the subdivisions proposed by Demoule *et al.* (1993:366, fig. 2; *cf.* the slight differences of the chronological table in Andreou et al. 1996:538):The boundary between Early Neolithic (EN) and Middle Neolithic (MN) is situated around 5800BC calibrated (cal.), while the Late Neolithic (LN) starts about 5300BC cal., and the Final Neolithic (FN) begins about 4500BC cal. and ends around 3200BC cal.

Rivers, floodplains and lakes in Neolithic Thessaly

Surrounded by mountains attaining more than 2000 m, Thessaly, at the southern end of a system of mountains and valleys that stretches in a south-easterly direction from the Balkans into Central Greece (Demitrack 1994:37), contains the most extensive lowland basins of Greece (Johnson 1996:271) (Map 17.1). The Larissa (eastern) plain is about 1000km^2 and the Kardhitsa (western) basin about 2200km^2 (Johnson 1996:283). The chain of low hills separating the two basins do not hinder communication between them, neither did in prehistory (Gallis 1992:23).

In the Oligocene the Thessalian plain sheltered a shallow sea and then a regional lake. The Larissa basin was formed during the Middle Pleiostocene. When the basin subsided, the ancient river Peneios eroded the Tempi gorges, retaining its outlet to the Aegean sea, while its southern drainage network turned to a large and shallow lake, Karla (ancient name:Viviis; in Greek:Βοιβηίς) (Demitrack 1994:37). A second lake, which disappeared several centuries ago, named Nessonis in ancient times, located to the north of Viviis/Karla, was not clearly separated from the latter, since there are no natural boundaries (Gallis 1992, 27).

The Peneios, flowing to the east across the two main basins, created wide Late Pleistocene floodplains, that were settled about 8,500 years ago by Neolithic farmers. According to recent research, in the Middle Holocene the rivers created an alluvium which covered the edges of EN and MN mounds, showing that the corresponding settlements were built on an active floodplain (Van Andel *et al.* 1995:131). Late in the MN the settlements acquired their present position 3–15 m above the river and the mounds rose above the plain (Van Andel *et al.* 1995:134). A later (MN to LN, 7000–6000 BP) alluviation may be related to human activity on the plain (Demitrack 1994:38). It appears in the lake Karla basin as well as on the floodplain and followed a period (between the EN and MN) in which many settlements on the marl slopes of the Middle Thessalian hills were abandoned in favour of plain sites (Demitrack 1994:38). In the LN new settlements were established in the alluvial plain, between earlier ones (Demoule *et al.* 1993).

Evidence from the site of Platia Magoula Zarkou indicated (Van Andel *et al.* 1995:140) that EN and MN farmers had settled in this active floodplain in order to take advantage of periodic flooding, for the cultivation of fresh, moist silt and spring-sown crops. Such early settlements must then have been occupied intermittently, perhaps even

limits depended on the flooding waters of Peneios, as well as on fluctuations in precipitation, since the plain slopes gently (Demitrack 1994:39). In the recent past the extent of the lake varied from 45,000 to 180,000 *stremmata* (one *stremma* = 1000m^2; Gerakis *et al.* 1996:220). The location of the Neolithic lake-shore probably reflected variability of the lake level as well as in rainfall (Demitrack 1994:39). The prehistoric settlements identified till now probably followed the movement of the western lake-shore, while change of the lake level was not of much consequence for the eastern shore (Grundmann 1939, pl. 37; Gallis 1992, map 3). Besides shore settlements, some at least Neolithic sites were located on islands within the lake (such as Magoula Hadzimisiotiki:Grundmann 1939; cf. Gallis 1992:25).

Large draining schemes (1936–1969), isolated the lake from the flooding waters of the Peneios. The fauna disappeared or was reduced on the neighbouring mountains, and the chain along the air corridor of Eastern Greece for the migratory species was interrupted. Before the draining, the plain population near the lake Karla were agriculturers, and the mountainers fishermen. A very rich and varied bird population of 143 species, 430,000 water birds, were registered in 1954, and 600 tons of fish were captured per year. The negative effects from the floods did not disappear completely (Gerakis *et al.* 1996:220–226).

The ubiquity of water in this region in ancient times was also reflected in Greek mythology:it was a king of Thessaly, named Deukalion, who was believed to have survived after the flood, acting the part of the biblical Noah.

The lake and basin of Kastoria, Western Macedonia

In Western Macedonia (Map 17.2), the drainage basin of Kastoria (304km^2) is situated in the valley of river Aliakmon (average altitude 200m), between two mountain chains, Pindos in the west and Verno in the east (Vafeiadis 1983:1). The river crosses towards the north-east a plateau of an average altitude of 600m, containing the lakes of Vegoritis, Petres and Heimaditis (Psychoyios 1992:23).

In such isolated basins of western Macedonia, at 500–600m of altitude, the forest may be thick. Early farmers would have met, in Epirus and Macedonia, a densely forested land of deciduous oaks, elms, ash, limes, hazel, and pines on the slopes (Demoule *et al.* 1993). Around 8000–4000 BP, in the area to the north-east of Pindos, flora included pine, beech and fir on the heights, associated to oak, birch, lime, juniper, pistachio, hazel and elm on the slopes, while typical aquatic plants thrived near the lakes (Faugères 1989:101, fig. 3, 103). Data about the Holocene climate, mostly from palynological cores from Northern Greece, suggest a Mediterranean climate, with winter rains and dry hot summers, but regional differences were important (Demoule *et al.* 1993).

Several prehistoric lake-sites or river-shore sites are attested in neighbouring areas, such as Maliq and Dunavec in the Korçë basin (Albania), and, among numerous settlements in the plains of Pelagonia (Hammond 1972:218, 223), Usta na Drim in Struga, by the lake of Ohrid (Former Yugoslavia). Ancient classical authors, e.g. Herodotus V.16, described lake settlements located in these regions, between the rivers Aliakmon and Strymon. The latter forms a natural frontier between Central and Eastern Macedonia.

The lake of Kastoria (30km^2, at about 620 m above sea level), located within the basin, was formed after the gradual subsidence of the basin in the middle Miocene. The lake surface decreased in the Pleiocene to its present form (Vafeiadis 1983:115–116). An open lake, its surplus waters directed to the river Aliakmon, it is surrounded by alluvial and karstic water bearing formations (Vafeiadis 1983:119). The climate is humid mesotherm, transitional between Mediterranean and continental, with a mean rainfall 671mm/annum (Vafeiadis 1983:116, 120).

The deepest point of the lake is 8.5m, at the northern extremity of the peninsula of Koritsa, where the town of Kastoria is built (Vafeiadis 1983:46). The lake level has lowered in the thirties and in the sixties, revealing large numbers of piles (Keramopoullos 1938; Moutsopoulos 1973–1974). It can till now be regulated artificially (0.4–0.6m; Vafeiadis 1983:46).

The prehistoric settlement of Dispilio, excavated since 1992 by a team under the direction of Professor George Hourmouziadis, University of Thessaloniki (Hourmouziadis 1996), is located 7 km south of Kastoria, by (and under) the lake. The topography of the lake shore on the south being almost horizontal, and because of the periodical fluctuations of the ground water, these areas were seasonally overflown with water (Vafeiadis 1983:46).

Communication across the lake of Kastoria was made preferably by boat till recently, before the construction of the modern road, in particular at Dispilio, as the shore was also easily accessible. The shortest crossing is 1400 m from Kastoria to the village of Mavrohori to the east (Tsolakis 1992, fig. 1).

Evidence about Neolithic watercraft in Northern Greece

In such environmental conditions as described above, both in Thessaly and Western Macedonia, some sort of watercraft would have been very useful for communication, fishing and waterfowl hunting, crossing, transport of heavy and bulky materials, animals and humans also during the Neolithic.

In Greece, the results of such an aquatic mobility,

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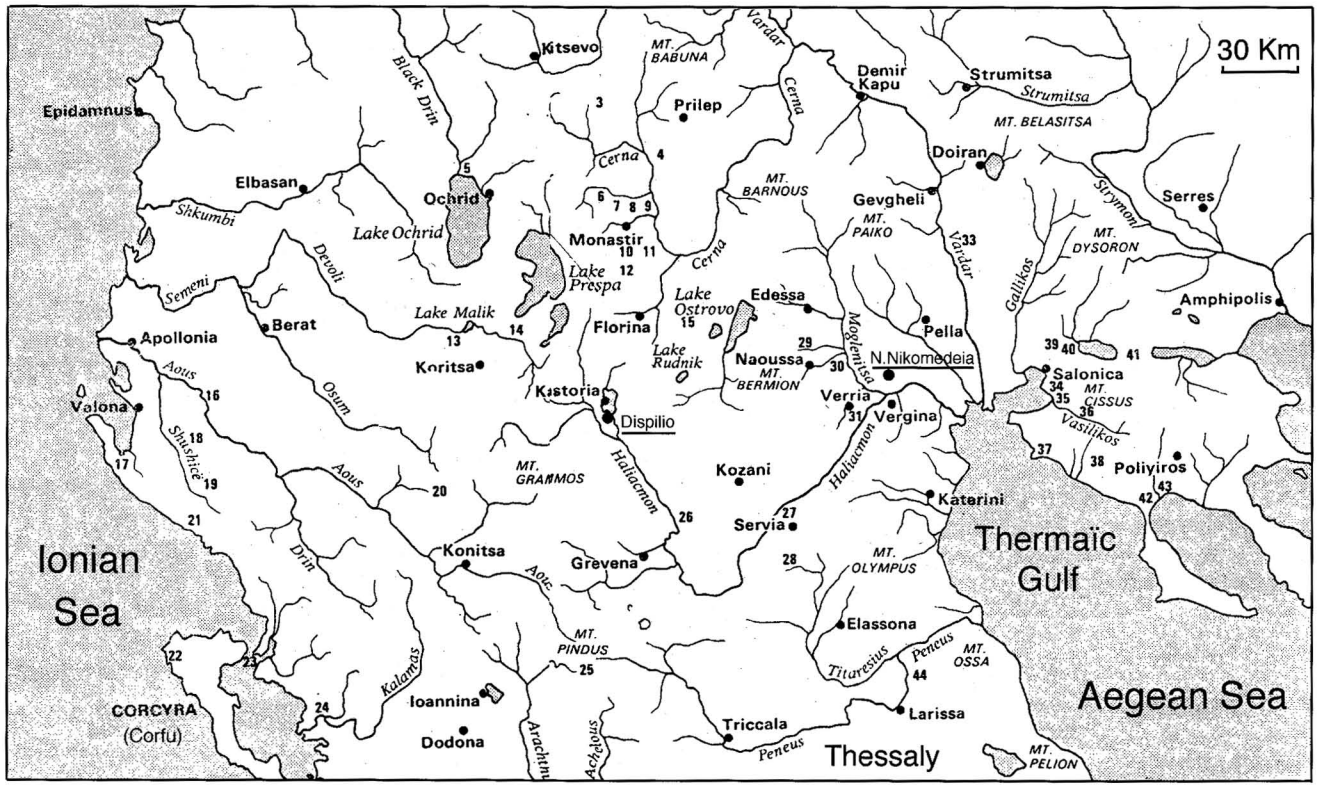

Map 17.2. Neolithic Western Macedonia and adjacent areas. Adapted from Hammond, 1972, 216–217, map 19.

including long distance transport of raw materials (obsidian) across the Aegean sea, and deep sea fishing, attested since the pre-Neolithic, are tangible and multiple (overseas raw materials and artefacts, fish bones, fishing gear). In the MN, besides lithics, stone and shell ornaments and stone vases made of material of foreign origins, with a low rate of circulation over long distances are involved (Demoule *et al.* 1993). In the LN, besides intensification of obsidian trade, among other manufactured products, *Spondylus Gaederopus* bracelets, marble figurines and grinding tools were transported overseas or from coastal sites to the hinterland (Demoule *et al.* 1993), probably along waterways. In the FN, utilitarian as well as prestige goods travelled over long distances, including from the islands to the mainland (Demoule *et al.* 1993).

Hints about the types of watercraft used come from two categories of evidence, which are boat-shaped:- Middle and Late Neolithic iconographic material, with all the expected difficulties of identification:it consists of clay models from various sites in Thessaly and from Dispilio; several others were found in Balkanic sites. As usually with models, we can not always be sure about the *scale* of reproduction. This means that sometimes the models might represent house equipment, such as wooden containers for bread preparation or troughs, for example:shape and raw material are similar to those of dugouts (Marangou 1991:23–24). Also – boat gunwale outlines (Late Neolithic) are preserved in the soil at Dispilio.

Boat models as indicators of watercraft types and raw materials used

Logs

The dugout seems to be expected in inland waters in the Neolithic, depending on technological possibilities and availability of suitable tree trunks, all the more so, since preserved evidence from excavated examples from the Mesolithic onwards consist mostly of logboats (cf. lately Arnold 1995, 1996). The majority of recorded Neolithic boat models (Marangou 1991; 1996a; 1996b; 1998; Höckmann 1996) also seem to represent dugouts.

Identified clay models date from the Middle, Late and Final Neolithic of Greece and corresponding periods of the Balkans, including the Karanovo, Gumelnitsa, Bakarno-Gummo and Vinca cultures, the Middle, Late and Final Neolithic of Thessaly (Marangou 1991, 1996a) and the Middle and Late Neolithic of Dispilio (Marangou 1996b, 1998).

Boat models, often fragmentary, occur in various sizes,

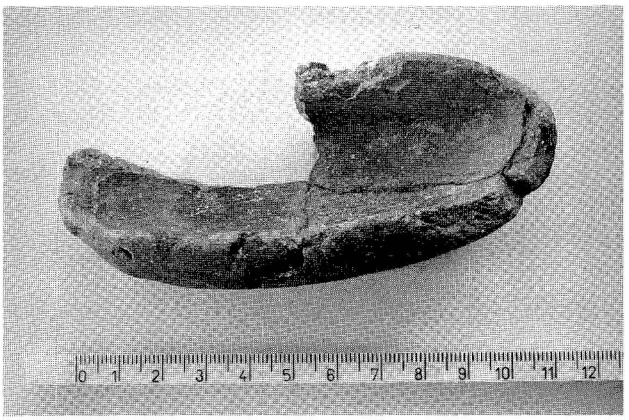

Figure 17.1. Dugout model from Dispilio, beginning of the Late Neolithic (length: 11.09 cm).

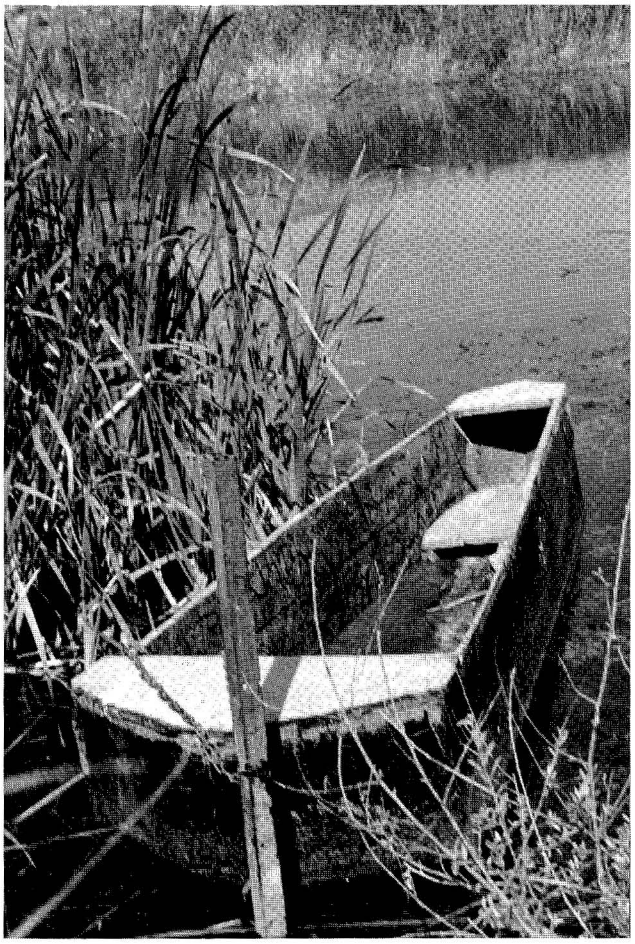

Figure 17.2. Traditional modern manoxylo, *moored at Dispilio (1993).*

their length varies from 6 to about 28 centimetres (mostly 10–25) (estimated original dimensions), and their breadth from 2.5 to about 14 cm, their height/depth from 2 to 7.2cm. As far as their often-fragmentary state permits to see, they may be subdivided in various categories, probably following a variety of types of the originals. They may be asymmetrical (example from Osikovo, Bulgarian Chalcolithic (FN); Frey 1991:197, fig. 2) or symmetrical, and have ellipsoid or approximately quadrangular, transversal sections. Their extremities are trapezoïdal or oval, occasionally bearing horizontal perforations, the sides more or less straight or tapering, and the length:breadth ratio (when the original dimensions are known or assumed) varies from 2 to 3.4 and even 5.8. They may be of the simplest type (e.g. example from Chalcolithic (FN) Drama in Bulgaria:Frey 1991:196, fig. 1.1) (*cf.* Figure 17.1). Another Bulgarian example (Telis-Redutite; Frey 1991, fig. 1.2), Chalcolithic (FN), shows a dugout with fitted transoms on both ends.

Technological possibility for woodworking in the Neolithic hardly needs to be stressed. Hundreds of suitable stone tools have been collected, among other places, from the Kastoria lake since several decades by local people and the excavations at Dispilio have yielded numerous tools (Hourmouziadis 1996:30, fig. 5b) and piles and post-holes of buildings (Hourmouziadis 1996:27, fig. 4; 34, fig. 7a; 35, fig. 7b). Several possible candidates for logs existed in Neolithic Dispilio, among others oak and pine, also used in the construction of houses. Oak was also used in other sites, such as Maliq (Albania) and Nea Nikomedeia (Western Macedonia), already in the Early Neolithic (Zohary *et al.* 1988:191). Modern flat, plank-boats of the area of Dispilio, called *manoxyla* or *monoxyla* (= logboats) (Figure 17.2), are made from pine, chestnut or elm (oral communication (1993) by I. Kallinikos). Traditional boats of local types from other Greek lakes or lagoons are made from the trees available in the surroundings:oak, chestnut, pine, poplar or elm (Pantzopoulos 1989:42).

The exceedingly large breadth of some Dispilio models with a length:breadth ratio of 2:1, while other models from Thessaly have a ratio of up to 6, is particularly astonishing (see further). It has been suggested about balkanic examples, that two or three trunks or longitudinal elements had been joined together for the construction of large extended dugouts (Frey 1991:196, 197, fig. 2 and 199, fig. 4). Höckmann has proposed a similar interpretation of the Thessalian complex boat model from Tsangli (see further).

An exceptional find of the 1970s from Prodromos, situated at the edge of a large, marshy area periodically flooded, in the western Thessalian basin, with important changes of temperature, shows how far the EN technology could go. The wooden roof of a building (10 × 10 m), was

made from branches and logs of trees, some of them, of a diameter of 30 cm, had been worked into planks or squared beams and were assembled by means of wooden pegs (Hourmouziadis 1971). Some evidence about possible use of planks is also available in the later phases of Dispilio. This means that advanced types of boats such as extended logboats with added elements are not excluded in the Neolithic. Such complex types are attested in Neolithic Denmark (Christensen 1990, fig. 11–12) and Italy (lake of Bracciano; *L'Archeologo subacqueo* I.3, September-December 1995:3).

Animal hide

Two models from Dispilio, dating from the end of the Middle Neolithic (Figures 17.3–17.4), do not look like usual dugouts, although they present a rather symmetric breadth shape and a more or less flat bottom. A flat bottom may as a matter of fact help for the stability of the model. Yet not only do they have exceedingly large breadth, with a length:breadth ratio of 2 (see above); they are also comparatively deep. Besides, they have one at least pointed end, slightly raised. This happens also on a third, Late Neolithic, smaller model. A Neolithic clay model from the Lake of Bracciano also presents pointed and slightly raised ends (illustrated in *L'archeologo Subacqueo* I, 3, 1995:3).

Since poplar is attested, it could have been used for expanded dugouts, which have pointed and raised extremities. Yet, the transversal hull section of the models is trapezoïdal, not elliptical, as would be the case for expanded dugouts (see for example Arnold 1995:150–151). Furthermore, if they were expanded, their sides should be low -the Dispilio models being, on the contrary, comparatively deep- unless, of course, strakes had been added to them.

Moreover, one Dispilio model bears an external lateral protrusion under the pointed extremity (Figure 17.3), although this could also be accidental, because of the rough modelling. Furthermore, a cavity can be seen in the interior of the same pointed end. On the second model from the same site, which also has a pointed, raised extremity, the other end shows in relief an external "rib" (Figure 17.4). On both models, the gunwale is irregular. It even consists of an applied, roughly modelled coil in one case, the sides being slightly curved inwards near the gunwale. The sides of the other model rise considerably amidships (Figure 17.4). Heights of stern and bow would be originally almost equal.

One might suggest, in these cases, a representation of the framework of a boat on which hide was extended, such as on a late 17th century A.D. drawing by Captain Phillip, of curraghs with a woven wickerwork and an external keel and stem element (McGrail 1998:fig. 10.2). Hornell (1938:35–7) criticised this drawing, since there was no corroborating evidence. Nevertheless, in the Middle Ages,

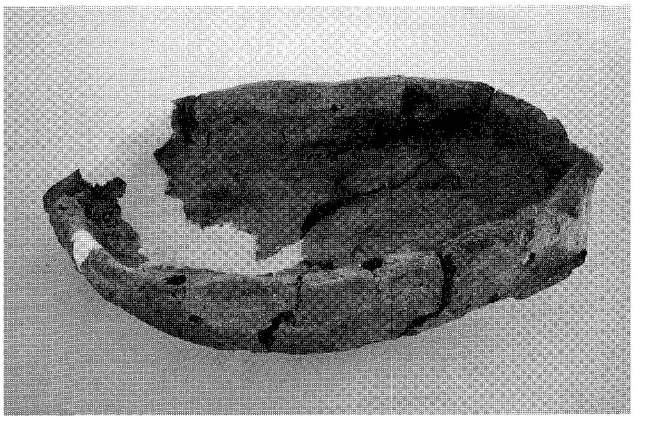

Figure 17.3. Boat model from Dispilio, end of the Middle Neolithic (maximum length: 20.2 cm).

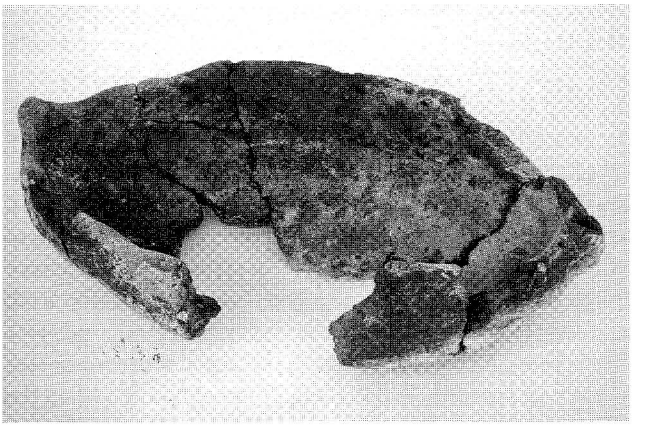

Figure 17.4. Boat model from Dispilio, end of the Middle Neolithic (maximum length: ca 28 cm).

there are descriptions of curraghs with keels, and it is not excluded that before the nineteenth century British and Irish hide boats had an external keel like Phillip's boat or an internal one like the *umiak* (McGrail 1998:178, 182). In fact, the central longitudinal member of the *umiak*'s framework may be compared to a keel or a keelson, since it is inside the hide cover (McGrail 1998:182).

Skin boats had probably been used already in the Upper Paleolithic and Epipaleolithic (Ellmers 1986; Arnold 1996:36). Some Neolithic and Bronze Age rock carvings from Skandinavia may represent boats made from animal hide (Coles 1993; Greenhill 1995:93, fig. 83). An unpublished possibly Neolithic burial discovered in the last century in northern Germany was made in a hide canoe, while an Early Bronze Age *coracle* used in a similar way is

attested in Scotland (Höckmann 1996:41, and fig. 12.2). Besides, a piece of wood from a burial mound in Ireland of the 10th century AD has been interpreted as having belonged to the frame of a hide boat (Greenhill1995:92; for a discussion about early use of hide craft see McGrail 1998:186).

Occasionally, some clay models have been interpreted as representing *curraghs*. They date from the Hungarian Early Neolithic (Höckmann 1996:37, fig. 9.2–4; 41, fig. 12), as well as from Bronze and Iron Age Ireland and Wales (Ellmers 1986:fig. on p. 31; McGrail 1998:186, 187, fig. 10.9). *Curraghs* and *coracles* (Hornell 1946:111–148; McGrail 1998:179, fig. 10.3, 180, fig. 10.4 and 10.5; Greenhill 1995, fig. 56, 80, 81), rounded and respectively long narrow boats, originally consisting of animal hide covering and a simple wooden and basket frame, have been used till recently in Wales or Ireland for example. Furthermore, an incised pattern on a Late Neolithic sherd from the Grabak cave (island of Hvar) in Dalmatia (Novak 1955:320, pl. 194) has been interpreted as a hide boat (Bonino 1983:66, fig.7B). A Late Neolithic incised ceramic bowl with an applied animal(?) head and a series of dots below the rim from Eastern Macedonia (Dikili Tash) could also represent a simple hide craft (Theocharis 1973, pl. 199). The preserved extremity of a boat (?) model fragment from Otzaki Magoula in Thessaly is modelled as an animal head with perforated eyes (Milojcic 1983, pl. 23, nr. 10).

Classical texts referring to the mythical beginnings of navigation often mention floats, rafts or boats of animal hide which would have been used for the first attempts to cross the sea in the north-east of the Aegean, after the flood. They are occasionally compared to hide floats used for crossing rivers, such as the Danube. The main source is Lycophronis Alexandra, 72–80:"...Atlas' daughter's diver son, who of old in a stitched vessel, like an Istrian [=Danubian] fishcreel with four legs, sheathed his body in a wineskin and, all alone [or:"with one oar"], swam like a petrel of Rhithymna, ... what time the plashing rain of Zeus laid waste with deluge all the earth" (translation:Lewis 1959:24).

Animal furs and hide were certainly used in the Neolithic. The floors of some LN Thessalian houses may have been covered with furs; bears are represented by feet bones only, which indicates the introduction of skins with distal extremities still attached (Demoule et al. 1993). In fact, in Thessaly, as well as in Macedonia, wild animals (deer, boar, auroch, fox, hare, beaver, birds and fishes) have been found in LN sites in very small proportions. They must have been exploited mostly for their furs, feathers or antlers rather, than as food supplements (Demoule *et al.* 1993). Hide would also be available from domesticated animals from the beginning of the Neolithic, since sheep, goats, pigs, cattle and dogs are present, sheep being predominant in number of remains, and *Bos* in terms of meat yields in most sites (Demoule *et al.* 1993). At Dispilio, not only real bones of large animals, but also, among a number of animal figurines, a large horned animal head (preserved length ca. 20cm) was found. It has been argued that sites located by lake Karla would have the possibility to keep bovines for tillage, a great advantage counterbalancing the drawback of a flooded area (Halstead 1977). In the recent past, herding was also practised near the lake of Kastoria, while bears are scarcely perceived on the surrounding mountains.

Among other sites, Prodromos (Hourmouziadis 1971) gave large quantities of bones of domesticated and wild animals, as well as bone tools specialised for the work of soft materials, such as hide, besides stone tools for woodworking, but few tools related to food processing.

Willow and Pistacia could provide branches suitable for a frame, possibly covered by hide.

Reeds and basket

The same branches could be used as a frame for a wickerwork/basket boat, covered with waterproof material. Numerous imprints of basket under the base of vases during all phases of the Neolithic (Treuil 1989:151) show the use of basketry, in that case for supporting unbaked vases during pottery making.

A model from Eridu (5200 BC), constructed from clay coils, with inward curving of the sides towards the gunwales, probably represented a reed bundle boat, coated with bitumen. Protuberances on the outer surface may represent "throughbeams" (Qualls 1985). Later iconographic Mesopotamian evidence shows crescent-shaped craft, either reed boats or wooden boats imitating the reed craft form (Vosmer 1996:225). Representations of *papyrus* boats from Predynastic Egypt (mostly 4th millennium BC), used for fluvial navigation, engraved on rocks or painted on pottery (Basch 1987:33–34, fig. 65–66; 49, fig. 76; 50, fig. 78), are particularly abundant.

Besides, ethnography and experimental archaeology give evidence for the possible use of reeds for boat construction in the Aegean Sea since the Mesolithic (9000BP), when obsidian was brought from the island of Melos to Franchthi in the Peloponnese (Southern Greece). The Hellenic Institute for the Preservation of Nautical Tradition crossed the sea from Central Greece to this island in 1988 (Tzalas 1995), in a flat, paddled craft, with inward-curving pointed ends. This consisted of a wooden (cypress) frame, on which bundles of *Scirpus lacustris L. ssp. Lacustris* were fastened with lashings of vegetal fibre rope (Tzalas 1995:445–446, 453–454, 456, note 8). The craft imitated a traditional raft (McGrail 1998:164) or boat (*papyrella*) used till recently in the shallows off the island of Corfu (north-western Greece).

Wicker-work or reed bundle boats, covered with waterproof material may have been used in the sea around the middle of the 3rd millenium BC, in the Arabian gulf and western Indian Ocean (Ra's Al Jinns, Oman). Some pieces of bitumen with impressions of bundled reeds lashed together, basket weave, and wooden planks lashed, stitched or sewn together, bear remains of barnacles on the surfaces opposite the impressions. Therefore, it was concluded that these surfaces were immersed in seawater and consequently that the bitumen had coated the hulls of vessels (Vosmer 1996). As a matter of fact, reeds were the main material worked with flint tools at Mesolithic Franchthi (Jacobsen 1999). Reed structures are attested at Dispilio, among others, possible standing fishing weirs, and convenient raw material should be available by the lake in the Neolithic.

Combinations of various materials for boat construction in prehistory have also been assumed:it has been suggested that an Early Dynastic boat model from Egypt represented a papyrus boat covered with animal hide (Nibbi 1993).

Bark

The intriguing ribs, the pointed raised ends, and indeed the raised sides amidships of some models, may also recall bark canoes (Adney et al. 1964, for example, figs. 106, 115, 118; Marshall 1985:9; McGrail 1998:89, fig. 7.1). Bark boat originals have exceptionally been proposed for some Hungarian Late Neolithic examples (Höckmann 1996:37 and fig. 9.1).

Bark boats are attested mostly at certain latitudes, in North America, Siberia, Scandinavia, Chile and Australia (McGrail 1998:88, table 7.1). The most suitable tree species for bark in North America (35° – 65° N) is birch, but second-rate trees may also be used, such as elm and chestnut (Adney *et al.* 1964:14–15; McGrail 1998:89–90, table 7.2). Use of bark in the area of Dispilio is not as impossible as that, since, according to palynological evidence, birch did exist around 4000–6500 BP, in the north-east of the Pindos mountains, at an altitude of 800–1100 m (Faugères 1989:101, fig. 3, 103), which is, 150 to 450 m higher than the Kastoria lake. Elm and chestnut are indeed used for modern plank boats of Dispilio, and willow or hazel could do for the frame (cf. Adney *et al.* 1964:17; McGrail 1998:90, table 7.4).

Thus evidence shows the possibility of a parallel existence and use of different boat types made from various raw materials, even on the same site. This co-existence of varied types has also been suggested concerning rock-carved boats from Bronze Age Scandinavia (Coles 1993).

One could argue that some constructional traits of boat building originated in other building traditions, as it happened with carry-overs from skin boat to plank boat traditions (Crumlin-Pedersen 1972) and that some at least examples simply copied features characteristic of one material, transposing them in a different material. All this remains of course hypothetical, as long as preserved finds of hide/reed/bark – real boats cannot be added to the numerous dugouts.

Boat gunwale outlines; from models to real boats

Precisely, about these "real" boats:If the boat models are only attested for the moment from the older phases of Dispilio (B2–B3/C1), when the presence of water seems to be more palpable, the boat outlines date from the latest phase (A0).

In the latest Neolithic of Dispilio, in the upper strata (where wood is not preserved), three outlines (*cf.* Crumlin-Pedersen 1991) of boat gunwales have appeared till now, as a colour variance in the soil, in two contiguous trenches. The outlines are 3.3, 3.0 and 3.5 (preserved) meters long and 0.80, 0.73 and 1.40 m wide (maximum breadth).

The first outline (A) (Hourmouziadis 1996, fig. 12; Marangou 1999, fig. 6), probably of a dugout (Figure 17.5) is asymmetrical, with a pointed and a larger, more or less trapezoïdal end. It has not yet been excavated. Traditional wooden *manoxyla* (see above) of similar dimensions and asymmetrical shape are still used in this particular area of the lake for fishing (Figures 17.2, 17.6).

The second outline (B) (Marangou 1996b) has the same south-east – north-west orientation and approximately the same size, but it has two more or less pointed ends. The outline, about 4 centimetres wide, seemed to "move" towards the west during its excavation up to a depth of some centimetres, when it disappeared. This could suggest that it consisted only of a wooden frame, and, consequently, that it was a hide-boat gunwale frame, but could also be due to the bad preservation of the bottom of a dugout, reversed or not.

Both outlines may be related to a number of postholes, with several alternative interpretations (Marangou 1996b). One large (30x22 cm) posthole at the northern end of outline B could have been a mooring post; today manoxyla are fastened with a chain to wooden posts (Figure 17.2).

Besides, pairs of small postholes are repeated with a constant span (60–70 cm) between them on the external limit of the eastern side of both outlines. These postholes could be supports for a fishing trap or signs over water level of the location of sunken boats (Marangou 1996b).

The boat outlines would confirm the aquatic environment of Neolithic Dispilio. They are situated to the east of a "channel"-like linear feature, which surrounds the excavated part of the settlement on the east and the north. They might be in a fishing location (*cf.* Andersen 1985:55), or they might have sunk or been abandoned in the periphery of the settlement; changes of water level and periodic floods

Figure 17.5. Boat gunwale outline (A) in Dispilio, end of the Late Neolithic. Photograph kindly provided by Professor G. Hourmouziadis.

could be involved. However, the excavation has not been extended to the east of the outlines, and the outlines' connection with the "channel" is not yet clear. Moreover, the houses of this phase consist of land structures of clay bricks and floors and the precise location of the lake then is still unknown.

A fishing and water-fowling function of the boats seems probable, as is their use for the transport of reeds and tree trunks for building. Fish vertebrae and fishing gear (Hourmouziadis 1996:44, fig. 13), even a fish-shaped stone pendant have been discovered at Dispilio. Among other bird bones, possible swan or eagle bones were occasionally used for the construction of bone flutes (Hourmouziadis 1996:fig. 17; Malea *et al.* 1997).

The third outline (C) appeared two strata below B, in a stratum following a stratum with possible standing fishing weirs. It has a pointed end, but the other end disappears in the non-excavated margin of the trench. The port and starboard sides were not completely joined at the northern pointed end (bow?), which therefore was probably not completely closed. The gunwale was preserved to a maximum depth of 4 cm. Besides, there is a transversal thinner (2 cm wide) linear element near the preserved end. If not the transom of a dugout, this could well be the transverse member – a thwart? – of a hide boat with its gunwale frame preserved. Moreover, the ratio length:breadth of this outline -2.5 – implies a craft of quite different proportions than the first two (length:breadth about 4.1), and consequently of different type, unless this is the result of its circumstances of preservation.

Contextual information

Not only real watercraft, but also models occur in groups. Most Dispilio models come from an area of two or three neighbouring trenches, dating from the end of the MN and the beginning of the LN. The settlement in this period was probably located in a marshy environment, the post-houses had floors consisting of layers of clay, wooden beams and stone structures.

A number of boat models and oval ("boat-shaped") vases were found in a restricted sector, in 2 or 3 successive strata. Some of them were situated in relationship to a possible storage or cooking space, as well as several vases of different types (jars, "fruitstands", saucers and bowls), and miniature vases and figurines. Burnt and disintegrated wood remains from piles, structures and floors, a lot of animal- and some fish-bones, as well as a number of postholes, possibly from light structures, complete the picture (Marangou 1996b).

In such a context, the role of boat models, as that of figurines, could have been protective or magic, for instance. This does not necessarily exclude a practical function of some examples (such as lamps, "incense/odoriferous substances -burners" or simply containers), while their sizes vary considerably. No analyses have been made yet, so the last point cannot be resolved for the moment.

Discovery of boat models in a Neolithic domestic context is not unique. An exceptional find from a Late Neolithic house in Battonya (Hungary) consisted of seven possible boat models (Höckmann 1996:38). A model from Chalcolithic Cascioarele (Romania) was also found in domestic context, as well as several anthropomorphic and zoomorphic figurines and miniature vases, and various tools (Stefan 1925:142–143, 164). Another example comes from Middle Neolithic Selevac in Serbia, at some hours from the rivers of Morava or Danube, where fish consumed on the site must have been caught. A concentration of pottery, tools, figurines and miniature objects, including a boat model with perforated ends, was found in association with

Figure 17.6. Traditional fishing manoxyla *moored among the reeds near Dispilio (1993).*

the floor of a post-hole house, related to an oven (Tringham *et al.* 1990:336, pl. 10.5, no (02–1178); 373). Again, it is not excluded that the boat model had a (parallel?) practical function, for example, as it is suggested in the publication, that of a loom piece or weight (see comments in Marangou 1996a). Similar ideas have been discussed concerning a possible functionality of boat models from early 5th millennium Eridu (Strasser, 1996; J. Bourriau and J. Oates, 1997).

It is possible that a comparable to Selevac situation, a scene of several figurines and a boat(?) with pointed upturned ends, upper surface decorated with transversal parallel incisions and quadrangular section was represented in miniature, in an early Late Neolithic model of the interior of a house. This was found under the floor, near the hearth of a real Thessalian house, in Platia Magoula Zarkou, located at a distance of 800 m from the Peneios now. Earlier Neolithic layers were contemporary to flooding, although it is not possible to estimate its frequency. It has been argued that Neolithic occupation in Thessaly was intermittent (see above) and took place only outside the flood season, while during the flood dry sites were occupied (Van Andel *et al.* 1995:138). In the 19th and 20th centuries, the flood season lasted from December to May. After the Peneios flood in spring 1982, a large area near Platia Magoula Zarkou turned into a shallow lake (Van Andel *et al.* 1995:138).

Boat models, as well as figurines and other models (Marangou 1998), often come from house floors and garbage:one at least of the Dispilio fragmentary examples comes from a probable garbage space and models from Otzaki and Vucedol were found in pits (Marangou 1991:29). Boat models would thus be connected to limited in time everyday activities. They would be related to few households, since they occur rarely, while occasional concentrations in certain domestic sectors are difficult to explain. This might suggest specific economic or social activities of some social groups, possibly restricted in specific areas of a settlement. Of course, evidence is not sufficient yet and such hypotheses need to be corroborated by further finds and study.

From the inland waters to the sea

For the moment, evidence about Neolithic watercraft only comes from inland sites, in spite of the intensive navigation in the Aegean Sea. However, relatively few Neolithic coastal sites have been excavated till now, several of which did not give any other clay models either. Besides, as this material has been identified relatively recently, unrecognised specimens may still lay in Museum deposits together with other miscellaneous clay fragments.

Even in this inland corpus of material, some of the original boats could have been seaworthy, at least more than basic dugouts. A unique model from Tsangli in southeastern Thessaly (Giannopoulos 1910:63, fig. 3; Wace-Thompson 1912:124, fig. 74 c; Marangou 1991, pls. IV, VIIb–IX; 1996a, fig. 2–3) (Figure 17.7), dating possibly from the MN, shows such an advanced type of hydrodynamic shape. The identification of the original is however not easy:it could be an extended dugout, but its

Figure 17.7. Middle Neolithic boat model from Tsangli (length: 10.2 cm).

length:breadth ratio is only 1.5; it is too large. This could be explained by an assemblage of longitudinal elements of several stems (Höckmann 1996, fig. 4.2) (cf. above). If it were a hide boat (of *curragh* or *umiak* type?), then its "keel" would represent an element of a hide boat frame. Nevertheless, the morphology of the interior rather recalls hollowed wood.

In fact, the model is divided transversally in two compartments by what seems to be a bulkhead left in the solid, or a fitted transom. Basic log-boats may be partitioned in order to separate functional spaces on board, to secure the load, fish or fishing gear, or transported animals, or to provide seats. The inner division and large breadth of the Tsangli model may suggest that the boat was well adapted as a cargo.

Another advanced type of craft probably constitute some clay models from Final Neolithic sites, in a region of lakes and rivers around Pelagonia (Former Yugoslavia), Romania and Albania (Marangou 1991), near the Greek border (Map 17.2). Communication among sites located in the Pelagonian closed valley is easy (Simoska *et al.* 1975; *cf.* Hammond 1972:41–46), easier towards the south than towards the north, and close cultural contacts existed among several of these sites (group Bakarno Gummo-Suplevec-Grnobuki). A number of these models at Maliq, Vucedol and Bitola have been identified as representing double dugouts, much more stable in open water and more roomy for transport. Some of them have projections on one or both ends, which are occasionally perforated. Paired logs, among other places, were attested in the beginning of the 20th century in Albania for the crossing of rivers and transport of animals (Marangou 1991, pls. VIb, VIIa). Some evidence about prehistoric paired logs is available from Italy. In the 16th century A.D. monks of the Athos monasteries used them indeed in the Aegean sea by the Chalkidiki peninsula (Central Macedonia) for fishing (Marangou 1991:27).

As about the complex Tsangli model, Tsangli, a particularly large Neolithic settlement (the mound measures about 200×210 m:Decourt 1990:51, note 18), is located in the centre of a valley which runs along a small tributary of the Enipeus river (Map 17.1, T). Half an hour to the south, on the hills, there are the vestiges of the Greek city of Eretria (Wace *et al.* 1912:86). A group of seven Neolithic sites located closely to each other have been identified, at low altitude, between the valley and the slopes (Tsangli is at 204masl; Decourt 1990:55). They are situated near a much-frequented passageway, which leads across the low mountains from the Aegean (the Volos or Pagasean gulf), to the interior plain (Decourt 1990:50–51, 127–128). In fact, the low hills to the south and the north do not hinder relations with the Almyros plain and the Peneios basin (Wace *et al.* 1912:241–242). This was also a later communication axis from the coast to the Western Thessalian plain (Decourt 1990:67). This is one of the alternative passages of the Roman army under Flamininus in 197BC:he would have crossed through the hills, near the historical town of Eretria, close to Tsangli, coming from the east towards the Enipeus valley (Decourt 1990:109 and fig. 127). Eretria was located on the summit of a trapezoidal hill close to the ridge, which permits to descend precisely to the plain of Almyros (Decourt 1990:103).

As a mater of fact, the mountains separating the large inner Thessalian basins from the coast let only the small plains of Volos and Almyros in direct contact to the sea networks (Map 17.1). These smaller eastern coastal plains have climatic conditions resembling south-eastern Greece (Johnson 1996:271). Not only Tsangli was not really isolated from the seacoast, but it even occupied a privileged position between the sea and the hinterland communication axes.

Besides, sea was closer to Neolithic sites, which are now at some kilometers from the bay of Volos. The important in the Late and Final Neolithic site of Dimini lies on the western edge of the coastal plain of Volos, at 3km from the present coast. The site has been reconstructed recently as a coastal settlement (Zangger 1991). A major episode of alluviation in the 4th millennium BC has formed the plain, pushing the coast away from Neolithic Dimini (Andreou *et al.* 1996:543). The site seems to have been occupied as long as the coast was close, meaning that the location and may be the function of the site were closely related to the environmental setting (Zangger 1991). In the Bronze age, when the sea moved away, another site was selected (Petromagoula) on the coast, at a distance of a few kilometres (Zangger 1991).

A similar situation occurred in the eastern part of

Western Macedonia, in the Yannitsa plain and marshes and the Thermaic Gulf (Map 17.2). The riverine alluvium in the deltas of the important rivers Aliakmon, Axios and Gallikos had not yet moved the coast away, to its present position. The site of Nea Nikomedeia, inhabited since the EN, was located near the shore of the Thermaic Gulf around 7500 BP. From then on, competing lake/lagoon/marsh and marine influences succeeded one another (Faugères 1989:106–107; Psychoyios 1992:23, 25–27).

Towards the end of the Middle Neolithic, the sea level rose in various areas of the Aegean Sea, while in plains humidity increased and some parts of them were submerged by the sea. The sea level continued to rise in the first part of the Late Neolithic (Psychoyios 1992:27). The climate became the warmest and most humid after the Glacial period about 5900BC and remained like that till about 5600BC. The climatic optimum coincided with the first part of the Late Neolithic (around 5000BC), when the temperature was about 2 degrees Celsius warmer than today and rainfall increased (Psychoyios 1992:28).

The significance of the omnipresence of water in the regions considered and the relative proximity of the Aegean coast shed new light on the multiple clues about overseas relationships of the Thessalian and Macedonian hinterlands in the Neolithic period.

Incidentally, the naval expedition of the Argonauts for the Golden Fleece started, according to the myth, from the Volos bay. However, the precise location of the Late Bronze Age site, the Homeric Iolkos, from where Jason departed, can not be identified with certainty (Andreou *et al.* 1996:550–551 and note 91).

Conclusions:variety and multifunctionality of Neolithic watercraft?

A means of aquatic mobility and acquisition of alternative food resources in an insecure Neolithic environment is an important instrument for survival by the water. This significance can also be assumed from the fact that watercraft was even represented in clay.

At this stage of investigation, in the regions considered, a relatively limited number of material has been identified, mostly dated from the last part of the Greek Middle Neolithic and the Late Neolithic. Lack of Early Neolithic and early Middle Neolithic boat representations, if not fortuitous, might also be a repercussion of contemporaneous customs. Their occurrence later could be attributed to a pronounced interest in aquatic mobility in the end of the Middle Neolithic and in the early Late Neolithic. One could correlate this interest to changes in the aquatic environment, such as increase of humidity, floods of rivers, extension of lakes, or submersion of coastal plains by marine transgression, as well as to increased involvement in nautical matters. The latter trend could have been influenced by evolution in networks of communication and exchange across or along water, in the frame of more diversified economic and broader social interests. Improvement of technical capabilities and therefore of watercraft performances facilitating access to new territories could have a further bearing on this trend, particularly in areas offering more challenges, for example in sites located within view of the sea.

In spite of the fact that navigation is more intensified in the Final Neolithic, scarcity or absence of models of boats from Northern Greek sites, contrasting to the situation in other regions (e.g. Chalcolithic Bulgaria, Albania and Pelagonia), could again be due to excavation or identification hazards. The case of Dispilio according to present evidence is striking:real boat outlines are found precisely in the later strata, while boat models come from the older phases. Nevertheless, this absence or scarcity coincides with a shift in three-dimensional art concerning choice of represented subjects, morphology and probably function towards the end of the Neolithic period in Thessaly; among other mutations, not only models of boats, but also models of other structures are now extremely rare.

A variety of watercraft types, some of which at least were not simple dugouts, are assumed to have been used in the Neolithic, all the more so, if we bear in mind the probability of non-preserved evidence and of non-identified specimens. Different types of the original watercraft had been represented and may co-exist even in our restricted corpus of models, as they do among the limited number of preserved gunwale outlines.

The local environmental conditions must have been consequential for the choice not only of raw material, but also of boat types. Navigation in large lakes and rivers as well in the sea waters would necessitate compliance to more demanding requirements than fishing and water fowl hunting in marshes, or crossing shallow and short water expanses. In addition, different boat types had presumably been used for distinct functions in the same environment. Therefore, several alternative solutions for selecting raw material and shapes for the construction of Neolithic watercraft are conceivable. The choice may have depended primarily on local, environmental and topographic conditions, but also on economic requirements, specialised functions, social needs, and even symbolic concerns.

Acknowledgements

The author is grateful to Professor Barbara Purdy for supporting participation to the WARP 1999 in Florida. Special thanks are due to Professor George Hourmouziadis for entrusting me with the study and publication of a part of the material of his excavations at Dispilio, as well as for helpful discussions. Ioannis Kallinikos, last constructor of

the traditional boats of the Kastoria lake, *karavia* and *manoxyla*, provided invaluable information. Discussions with Maria Mangafa+ and Maria Dinou, who supplied information on the botanical and anthracological material, as well as with other colleagues from the Dispilio excavations proved very useful. Many thanks are due to Anne Dietrich for fruitful discussions on wood and bark and to Lucien Basch for helpful comments about primitive boats. Finally, warmest thanks are addressed to Ole Crumlin-Pedersen for precious advice and encouragement during a stay at the Centre for Maritime Archaeology in Roskilde in April 1997.

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