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The Thinker of Târpesti. Source: Cucuteni (Athena Publishing & Printing House Bucharest, 1997)

Introduction remarks

The *XXVIth* volume of journal *Documenta Praehistorica*, which is at the same time also the *6th Neolithic Studies* anthology, comprises papers originally presented at the sixth international *Neolithic Seminar*, which took place at the Department of Archaeology in the week of 18–22 May 1999. Papers were given by ten invited speakers and, almost all of which are included in revised form in this anthology.

At the *6th Neolithic Seminar* in Ljubljana, the speakers shared expertise and contemplated on the mesolithic and neolithic in China; on the transition to farming in China; on the neolithic funeral rites at Zagheh in Iran; on the cognitive significance of neolithic tokens; on the places that created time in mesolithic and neolithic in Danube Gorges and beyond; on the transition to farming in the East Baltic; on the built environment in the neolithic in southeastern Europe; on an indigenous respond to transition to farming in Mediterranean Europe; on the landscape dynamics on the Ljubljansko barje and, on the stable isotope evidence of the neolithic diet.

There are some more papers presenting current approaches and perspectives relating to the transitions from foraging to farming in western Anatolia, and western Mediterranean; the prehistoric mobility in eastern Thrace; the dog burials and human burials associated with dog remains in the Iron Gates Mesolithic; on the ecology of neolithic environmental impacts on the Ljubljansko barje and on the fringe of the Mátra hills.

Radiocarbon dates are given in this volume using the convention *bp* and *bc* for uncalibrated radiocarbon years. *BP* and *BC* are used to indicate calibrated radiocarbon dates unless otherwise noted by the authors.

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The Mesolithic and the Neolithic in China

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ABSTRACT - *The concept of a Mesolithic period was introduced in Chinese prehistoric archaeology from the West. Scholars argued in the 'seventies that the microlith cultures identified in open sites (northern China) and in cave sites (southern China) should be classified as Mesolithic. However, recent discoveries have revealed evidence of pottery production and agricultural activities in these contexts, thus challenging the notion of a Mesolithic period in the prehistory of China. The identification of Neolithic cultural development in China was based on the regional pattern of Yellow River Valley cultural sequences. It has been suggested recently that the Yangtze River Valley region was the second Neolithic centre. Cultural sequences in both regions consist of three phases. The end of the Neolithic period in China correlates with the decline of the Neolithic cultures in the Yangtze River Valley.*

IZVLEČEK - *Pojem mezolitsko obdobje je v kitajsko prazgodovinsko arheologijo prišel iz zahoda. Znanstveniki so v sedemdesetih letih dokazovali, da moramo mikrolitske kulture, ki so jih odkrili na planih najdiščih (severna Kitajska) in jamskih najdiščih (južna Kitajska), obravnavati kot mezolitske. Vendar nedavno odkriti dokazi o proizvodnji keramike in kmetovanju spreminjajo našo predstavo o mezolitskem obdobju na Kitajskem. Ugotavljanje neolitskega kulturnega razvoja na Kitajskem je temeljilo na regionalnih vzorcih kulturnih sekvenc v dolini Rumene reke. Pred kratkim so predlagali, da je bila dolina Modre reke drugi neolitski center. Kulturna zaporedja v obeh regijah sestavljajo tri faze. Konec neolitskega obdobja na Kitajskem sovpada z upadom neolitskih kultur v dolini Modre reke.*

KEY WORDS - *China; Mesolithic; Neolithic; pottery production; plant cultivation; agriculture*

I. THE MESOLITHIC IN CHINA

The concept of the Mesolithic in modern archaeology in China: an introduction

Modern archaeology was introduced to China from the West in the 1920's. Western scholars organised the first excavations of prehistoric sites in China, such as Zhoukoudian in Beijing, and Yangshao in Henan. From the beginnings of this discipline, concepts of the Palaeolithic and Neolithic were applied to interpret the remains of prehistoric cultures in China. The concept of the Mesolithic was introduced somewhat later. When Pei Wen-Chung conducted his survey in Guangxi in 1935, he located four cave sites in Wuming and Guilin, which were named Baqiao, Baxun, Tengxiang, and D cave, respectively (*Pei Wen-Chung 1935*). Pei collected pebble implements, perforated pebbles, grinding stones and stone knives. He dated these remains to slightly later than the Palaeolithic, implying that they belong to the Mesolithic. In 1947, Pei studied the microliths discovered at the Zhalaino'er site in Ha'erbin, Helongjiang province. He regarded these microliths as specimens representing the initial period of the microlith industry in China, thus they were Mesolithic remains as well (*Pei Wen-Chung 1947*). Since these sites were not scientifically excavated and no reliable dates could be assigned to them, Pei remained cautious about his own observations and surveyed these sites again in the 1950's. He discovered pottery in association with remains that were contemporaneous with the micro-

liths. On the basis of this new evidence, Pei corrected his previous interpretation. However, the notion that a Mesolithic period was present in prehistoric China and that it may be associated with lower Holocene cave dwelling sites in southern China, has profoundly affected the field.

The identification of Mesolithic cultures

Since the 1950's and 1960's, more cave dwelling sites occupied during the transitional period from the Upper Pleistocene to the Holocene were found in southern China. Sites dating to this period that were excavated or intensively surveyed up until the 1980's include Baoqiao A Cave in Wuming, Baxun B Cave, Tengxiang C Cave, Guilin D Cave, Dongyan Cave, Zengpiyan, Miaoyan, Gaitoudong in Laibin, Bailan Cave (Phase II assemblage) and Dalongtan in Liuzhou, Chenjiayan in Liujiang, Aidong in Chongzuo, Huangyandong and Luojiyan in Fengkai, Dushizai in Yangchun, and Diaozhuyan in Qingtang, all south of the Nanling Mountains, as well as Xianrendong in Wannian and Sanjiaoyan, Maguaiyan, Houlongdong, Dongweiyan and Yangjiayan in Daoxian, and Hunan north of the Nanling range. These cave dwelling sites are located primarily at the base of the southern or northern slopes of the Nanling Mountains in South China. Stratigraphically, the cultural deposits in these cave sites are later than the Pleistocene. They contain large amounts of snail, mollusc shell and vertebrate remains. Almost all faunal remains are from modern species. The artefact assemblage includes substantial amounts of lithic, bone, antler, and mollusc shell implements. The manufacture of chipped pebble implements, characterised by the use of a direct percussion method and unifacial retouch, is a primary feature of this lithic industry. Typologically, chopping implements predominate in the lithic assemblage. Some scrapers and points are also present. Flake implements are few in number. Perforated pebbles (so-called "weight stones") and cutting tools with polished blades are the most abundant polished implements. Some localities yielded small flint tools (Fig. 1). The major types of bone, antler, and shell artefacts include awls, needles, projectile points, spades and knives (Fig. 2). Radiocarbon dates were obtained from some of the snail shell and burned bone specimens. The dates of the snail shell cluster around 12 000 bp. The youngest sample is Huangyandong ZK677, which dates to 10 950 ± 300 bp. After calibration, the date of the remains should be older than 9000 bp (The dates obtained from snail shell samples are usually older than the radiocarbon date by 1000 to 2000 years in the limestone area). Burned bone samples obtained from the lower layer and the upper substratum of the middle layer at the Dashizai site yielded some early dates: 16680 ± 570 bp (BK83018),

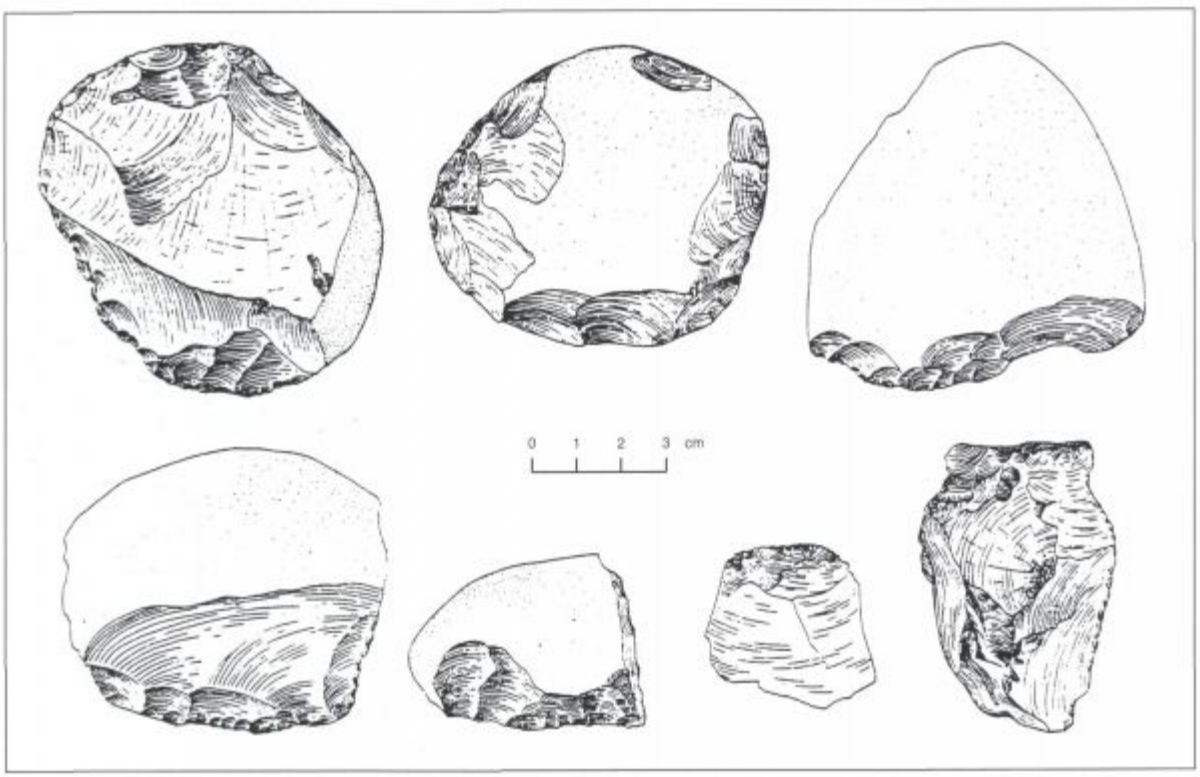

Fig. 1. Lithic tools from layer 3 of Xianrendong (1962 excavation).

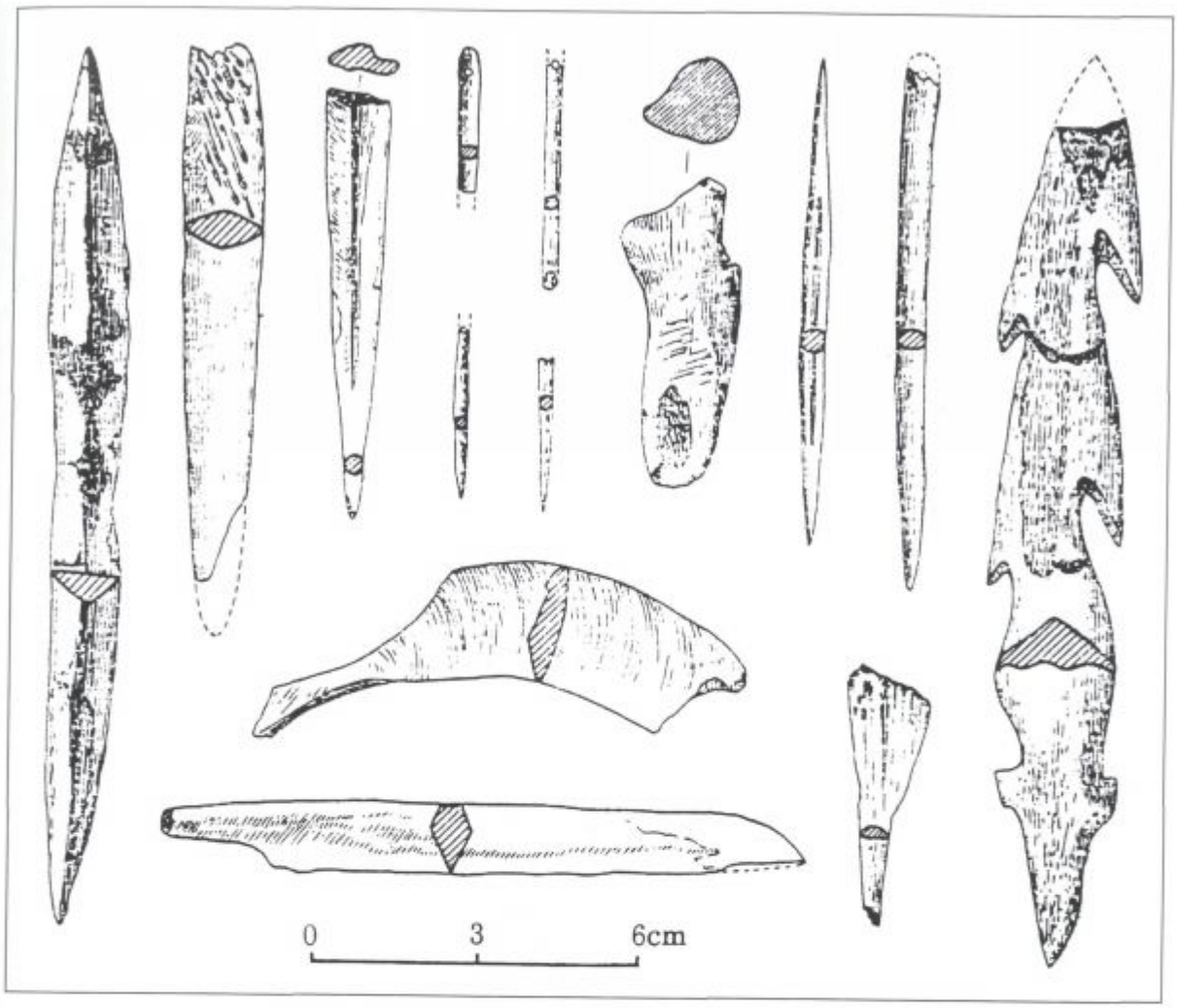

Fig. 2. Bone tools from layer 3 of Xianrendong (1962 excavation).

15350±250 bp (BK83017) and 14260±130 (BK 83016). Since these remains have distinct characteristics and similarities in both distribution and chronology, the majority of scholars are inclined to classify them as the remains of one cultural horizon (*Yuan Jiarong 1997*). Ceramics were found in association with this cultural assemblage at the "Lower Layer Assemblage" of the Xianrendong site (Fig. 3), the lower level of the third layer at the Zengpiyan site, the lower layer of the Liyuzui site in Dalongtan, Liuzhou and the Miaoyan site in Guilin. However, their association with pottery is still problematic and cannot be confirmed. Based on the similarity of the assemblage with that of the Hoabinhian culture, which was widespread in Southeast Asia in the same period, as well as the fact that the Hoabinhian culture is thought to be representative of a "Mesolithic" period, some scholars have proposed that the remains of these cave dwelling sites represent the Mesolithic cultures of South China (*Tong Enzheng et al. 1989*).

Contemporaneous with the southern finds, a microlithic assemblage dated to the transitional period from the Pleistocene to the Holocene was identified in northern China. This microlithic assemblage is widespread in North China and its adjacent areas. Over 100 sites that contain this assemblage have been located in Hebei, Shandong, Henan, Shanxi and Shaanxi. Among these localities, the Shayuan site in Dali, Shaanxi, the Lingjing site in Xuchang, Henan, the Hutouling site in Yangyuan, Hebei, and the Fenghuangling site in Linyi, Shandong have been either excavated or intensively surveyed. The cultural assemblages of these sites retained the microlithic tradition from the Upper Paleolithic in northern China. Flint and quartzite were the main types of raw material. The lithic assemblage includes microblades and cores of wedge shape, keel shape and conical shape. It also has microlithic implements made from retouched flakes, including projectile points, scrapers, engravers and knives (Fig. 4). This microlithic assemblage demonstrates minor regio-

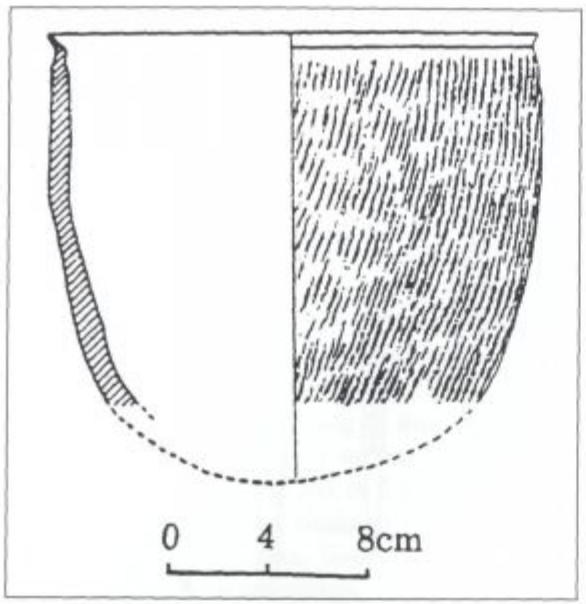

Fig. 3. Xian paddled pottery vessel from layer 3 of Xianrendong (1962 excavation).

nal variations and is thereby subdivided into the "Shayuan culture," the "Hutouliang culture" and the "Fenghuangling culture." Although most of these sites have been classified as lithic workshops and the overall characteristics of social organization are difficult to interpret, many scholars have regarded this microlithic assemblage as representative of Mesolithic cultures in northern China (*CASS 1984; Yan Wenming 1987*).

Discoveries of the Middle Neolithic

Before the 1970's, the Neolithic remains identified in the middle and lower Yellow River basin and the middle and lower Yangtze River basin, which together formed the heartland of cultural development in historic China, were considered representative of the highly complex Late Neolithic cultures. No association could be established between these Late Neolithic cultures and the so-called Mesolithic remains. In the 1970's and 1980's, some earlier Neolithic remains were identified in these regions: the Pengtoushan culture of the mid-Yangtze River basin in the south and the Cishan-Peiligang culture of the mid-Yellow River basin in the north.

The Pengtoushang culture is distributed in the flood plain of Dongting Lake in the middle Yangtze River basin. It is characterised by a highly advanced manufacture of pottery and bone, bamboo, wood and lithic tools. The Pengtoushang culture's lithic assemblage still contains abundant chipped pebble implements and small flint implements, and there are indications that hunting and gathering still play an important role in the subsistence economy. However, the remains of cultivated rice have been identified in many of the sites. In addition to the sheer quantity of the rice remains, observations made on the morphological attributes of the rice remains excavated at the Bashidang site in Lixian county suggest complex species characteristics of the rice cultivated here. It is classified as an archaic variety representing neither *Oryza sativa indica* nor *Oryza sativa japonica*. Since the Bashidang site is located in a waterfront environment, paddy agriculture might have been practised here. In addition, all the sites of this period have yielded the bones of domesticated stock and fowl, such as pig, goat and chicken, indicating that stock-raising activities were already diversified.

It is likely that Pengtoushan culture agriculture had developed beyond the initial stage of agricultural emergence. The Bashidang site, an example of a Pengtoushan culture settlement, covers an area of 30 000 square meters. The settlement was enclosed with an earthen wall and a ditch. Inside the enclosure was a well-planned residential area, cemetery, storage area, and waste disposal area. The settlement pattern shows little difference from that of the following Zaoshi culture. Therefore, the majority of scholars regard the Pengtoushan culture as Middle Neolithic (that is, the early phase of the Middle Neolithic) in prehistoric China. The Pengtoushan culture has been dated with a series of radiocarbon dates. Most dates are around 8000 bp. The earliest date, 9100 ± 120 bp (BK87022), is an AMS date of charcoal from a pottery sherd (*Pei Anping 1996*).

The Cishan-Peiligang culture is distributed in Henan and southern Hebei, in the middle Yellow River basin. This culture had highly developed agriculture as well. Millet and other dry-land crops predominated in agricultural production. Over 80 storage pits filled with millet were found at the Cishan site. The weight of grain stored in these pits might have exceeded 50 tonnes. Pigs, chicken and dogs were the principal domesticated animals. The Cishan-Peiligang lithic assemblage includes pecked stone mortars and pestles, as well as polished axes, adzes and chisels. Chipped stone implements are also present. Typologically, Cishan-Peiligang pottery is highly diverse. This culture also developed an advanced industry for manufacturing bone implements. Many settlement sites are generally tens of thousands of square meters in area, with large cemeteries. In areas adjacent to the Cishan-Peiligang culture there were several contemporaneous regional cultures

such as the Laoguantai culture, the Houli culture and the Xinglongwa culture. The level of their social complexity was comparable to that of the Cishan-Peiligang culture and is indicated by the presence of large, moat-enclosed settlements and the evidence of agriculture. Microlithic tools are also present in the artefact assemblages. The Cishan-Peiligang culture was the immediate predecessor of the Late Neolithic cultures in the Yellow River basin. It does not represent the initial phase of Neolithic development in northern China, but rather should be regarded as representative of the Middle Neolithic in northern China. Chronologically, the earliest date for the Cishan-Peiligang culture so far is 8000 bp.

The search for the origins of Middle Neolithic cultures such as the Pengtoushan culture and Cishan-Peiligang culture must therefore focus on the cultural remains from the Upper Pleistocene and the onset of the Holocene, certainly before 8000 bp. Coincidentally, the remains from this period are represented by cave dwelling sites in the south and the microlithic assemblage in the north, which have been attributed to the Mesolithic, as was discussed earlier. Recent discoveries in the 1990's have shed new light on this research.

Recent discoveries in the southern region

In the 1990's, excavations of cave dwelling sites such as the Xianrendong site and the Diaotonghuan site in Wannian, Jiangxi and the Yuchanyan site in Daoxian, Hunan have yielded new information on early cultural development in the south. The Xianrendong site and the Diaotonghuan site are both located in the Dayuan basin, which is part of the hilly karst landscape in north-eastern Jiangxi. Xiangrendong is a cave site situated at the base of a limestone hill in the northern part of the basin. Diaotonghuan is a rock shelter site lying atop a small hill about 60 meters high in the western part of the basin. The distance between the two sites is only 800 meters. On the basis of two previous domestic excavations in the 1960's (*Jiangxi Provincial Committee for Administration of Cultural Relics 1963; Jiangxi Provincial Museum 1976*) and a joint project by Peking University's Archaeology Department, the Jiangxi Provincial Institute of Archaeology and Cultural Relics, and the Andover Foundation (AFAR) of the United States, systematic sampling was done at the Xianrendong site, and a small-scale excavation – at the Diaotonghuan site, in the fall seasons of 1993 and 1995 (*Zhang Chi et al. 1996*). The cul-

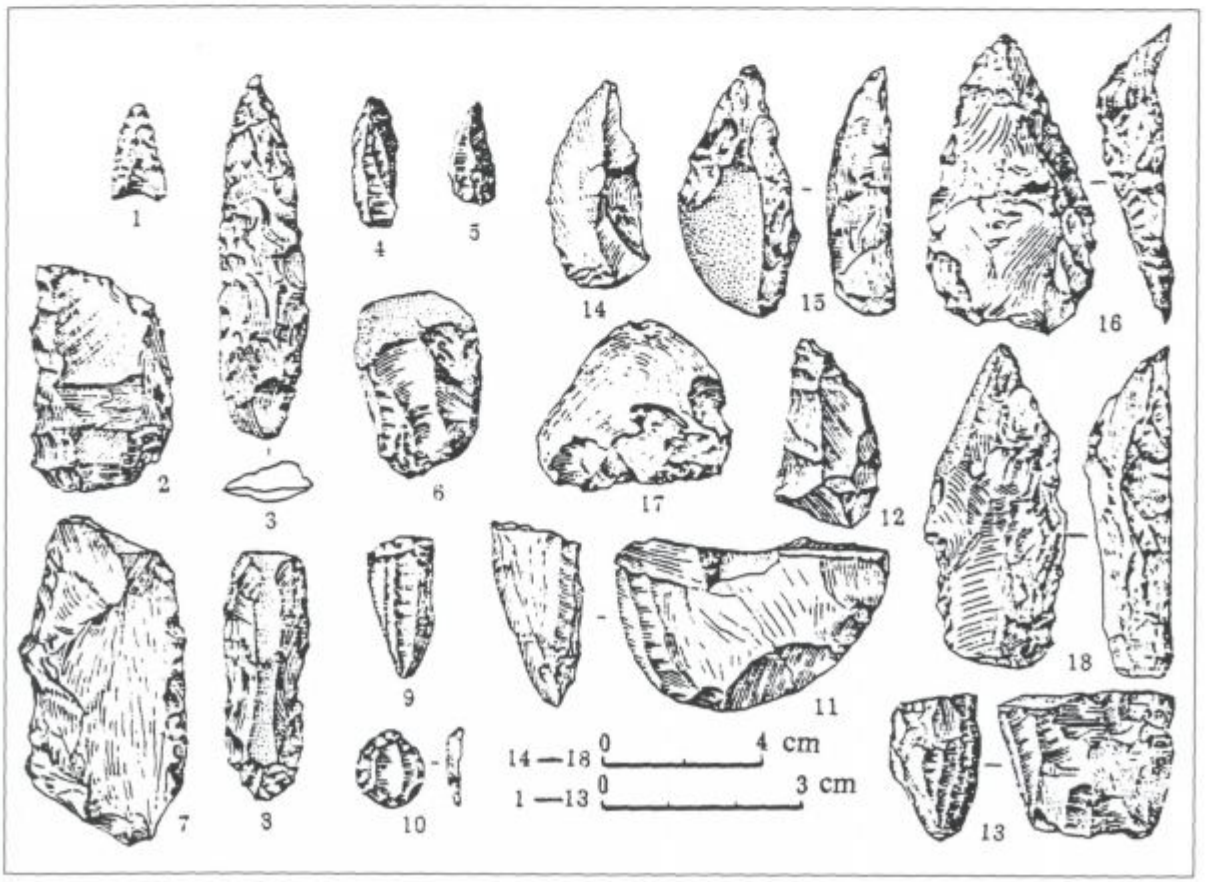

Fig. 4. Lithic tools from Shayuan.

tural deposits of both sites are generally comparable chronologically; the two sites appear to be contemporaneous.

Artefacts excavated from both sites include lithics, pottery and tools of bone, antler and mollusc shell. All lithic tools are of chipped stone. Typologically, pebble choppers scrapers and hammer stones are the most frequently encountered. There are also small lithic implements of quartz and flint. These types include scrapers, projectile points and blades. Substantial amounts of bone, antler and shell artefacts were found, including bone awls, bone needles, bone projectile points, bone harpoons, "antler adzes" and perforated shell implements (knives). These classes of artefacts have all been reported in previous excavations, as has the pottery type. The new finds, however, contribute to a better understanding of the existing data.

Over 100 pottery sherds of this period have been found in recent excavations. These are primarily body sherds, but include a small quantity of rim sherds as well. No vessels have yet been successfully reconstructed. All the pottery sherds were made of a similar clay admixture, tempered with coarse-grained quartzite. The diameter of the quartzite grit usually ranges from 1 to 3 mm, sometimes to over 5 mm. The poor sorting for the temper indicates that intensive selection was not made for it.

Since many quartzite tools have been excavated from Chinese sites of this period, it follows that the raw material for the temper might have come from an adjacent area and that the pottery might have been locally produced. Brown is the basic colour of the ceramics, with many variants that include dark brown, reddish brown and greyish brown. Some pottery sherds have a black core, indicating that the clay was not fully oxidised and that the ware might not have been fired in a kiln. Both modelling and coiling methods were used in pottery production. Pottery made with the former method is classified into two types. The first type has stroke marks on both the interior and the exterior of the vessel as a result of surface retouching. The second type has a plain surface, created by hand smoothing. The ornamentation of the stroke-marked pottery and the plain pottery is primarily the same and is characterised by V-shaped or U-shaped denticulations at 1 cm intervals along the vessels' rims. In the area underneath the rim, the exterior surface is decorated with a single row of puncture dots created by using a small stick to punch the interior of the vessel. The wall is thick in both types of vessel, generally measuring 0.7 cm. Some vessel walls are as thick as 1.2 cm. Although we have no intact pots, the vessel shape suggested by the fragments is a round-based jar with a straight rim. Vessels manufactured using the coiling method have been stamped with a potter's paddle to reinforce the walls. The paddle was wrapped with cord or fibre and the vessel surface is consequently marked with cord impressions, producing cord-marked pottery. This type of vessel should be a jar (or urn) with a round base and slightly flared, round rim and straight sides. Pottery vessels manufactured by the coiling method were tempered primarily with coarse-grained quartzite. A small number of vessels were tempered with crushed, cord-marked pottery sherds. The manufacturing process was the same for pottery tempered with either material. A few pottery sherds made by the modelling method have straw mat or cord-woven mat impressions stamped onto their exterior surface and could be referred to as woven-pattern pottery.

Excavations of the 1993 and 1995 seasons also systematically collected soil and other ecofact samples. Over 1600 phytoliths from many species of plant were detected in more than 40 samples obtained from every layer. Researchers applied multivariate analysis to compare the double-peaked rice phytoliths statistically. Using this method, a certain number of phytoliths morphologically indicative of both wild rice (*Oryza nivara*) and cultivated rice (*Oryza sativa*) have been identified. This suggests that cultivated rice had already become part of the people's diet during this period. Results from carbon isotope (^{12}C, ^{13}C) and nitrogen isotope (^{14}N, ^{15}N) analyses of human bones excavated at Xianrendong and Diaotonghuan tend to confirm this observation.

A substantial amount of faunal remains was found at Xianrendong and Diaotonghuan. Remains include deer, boar, rabbit, fox, turtle and a variety of bird bones. Various species of deer predominate, followed by the remains of boar and bird. This would seem to reflect the general pattern of hunting activity during this period.

Charcoal samples were taken from all layers in the 1993 and 1995 excavations of Xianrendong and Diaotonghuan. Chinese and American research teams submitted over 30 samples for AMS dating. However, the dates appear to be too early. Quite a few dates fall into the range between 19 780 ± 360 bp (BA 95136) and 15 050 ± 60 bp (UCR3555). The youngest date is 12 430 ± 80 bp (UCR3561), and comes from Layer

3B1 of the Xianrendong site. This should be close to the date of the same stratum's cultural deposit.

Two excavations were conducted at the Yuchanyan site (*Yuan Jiarong 1996*) at the same time as the excavations at Xianrendong and Diaotonghuan. Yuchanyan is a cave dwelling site in the limestone region of Hunan. The deposit in the cave is relatively well preserved and the cultural component is rather homogenous. The excavations revealed a wide range of lithic, bone, antler, teeth, shell and pottery artefacts. The lithic industry is all of chipped stone and includes choppers, scrapers, cutting tools and hoe-like implements, which are primarily unifacially flaked pebble implements. The small flint implements that are present at the Xianrendong site are absent here. Bone artefacts include awls and adzes. Two piles of pottery sherds situated near the bottom of the deposit are the only remains of ceramics encountered on the site. The thickness of the body sherds varies; some specimens are 2 cm thick. The ware is dark brown and its clay tempered with quartzite of various grain sizes, the majority of which fall into a range between 5 and 10 mm. A round-based urn with a slightly pointed bottom, flared rim and slanted body is the only vessel that could be reconstructed. Pottery from this site also has stamped cord marks, which were produced with a method similar to that of the cord-marked pottery from the Xianrendong site discussed earlier.

Rice phytoliths are widespread in the cultural deposit of Yuchanyan. More importantly, four rice husks were found at the site, two of which were found in layers close to the bottom of the deposit. Based on microscopic analysis of the morphological feature of the double peak on the surface of the husks, researchers believe that these rice samples retain characteristics of *Oryza Sativa indica*, *Oryza Sativa japonica*, as well as wild rice. They represent the archaic prototype of cultivated rice at the initial stage of evolution from wild to cultivated rice.

Over 40 species of plant were identified at the Yuchanyan site using the flotation method. Deer predominated among the large amount of faunal remains, which include water deer, red deer, and other species of deer, followed by boar, cattle and the Chinese bamboo rat. There are abundant bird bones as well, accounting for 30 per cent of the total faunal remains. A substantial amount of aquatic faunal remains was uncovered at the site, including fish, turtle, mollusc and snail. These remains resemble those found at Xianrendong.

Radiocarbon dates for Yuchanyan come from the AMS dating of organic carbon on a pottery sherd from Layer 3H. Among these samples, the carbon residue sample BA95057b yielded a date of 14 810 ± 230 bp, and the humic acid sample BA95057a yielded a date of 12 320 ± 120 bp. The date of the pottery's manufacture and utilisation should fall between these two dates (*Yuan Sixun et al. 1997*).

New discoveries in northern China

In the 1980's, work at the Nanzhuangtou site in Xushui, Hebei, in northern China uncovered ceramics and polished lithic implements in the same cultural context as Yuchanyan, but which date to approximately 10 000 bp. New discoveries of the 1990's come from the Nihewan basin in Yangyuan, Hebei. About ten sites containing microlithic assemblages have been excavated or intensively surveyed there, including Yujiagou, Ma'anshan, Qijiawan, Gongdiliang and Bashibutan. The dates of these sites fall into the range between 14 000 and 8000 bp. Fire hearths and ash pits were located at the Anshan site, along with lithic cores, flakes, microblades and blanks for lithic implements scattered throughout the site. The cultural deposit at the Yujiagou site consists of three layers. Its lithic assemblage includes microblades, scrapers, projectile points, burins and adzes. There are also decorative items made from mollusc shells, snail shells and ostrich eggs. The cultural deposit's faunal remains include frog, ostrich, mouse, wild horse, wild donkey, deer, bison and antelope, with the latter predominating. A small number of pottery sherds were uncovered in the middle and upper layers of the Yujiagou site. These pottery sherds were tempered with sand and are mostly reddish brown and yellowish brown, with incised, parallel arcs resembling fingernail marks on their exterior. The vessel type was probably that of a jar. One of the pottery sherds has been dated by thermoluminescence to 11 000 bp (*Xie Fei 1998*).

In addition, large numbers of pottery sherds have been found in the same cultural context with microliths at the Zhuannian site and the Zhejiangying site in Beijing. The pottery there was tempered with either coarse-grained quartz or mica, was brown in colour, and its vessel wall has a black core, indicating that its firing temperature was not high. Vessel types include jars and pots. Stone mortars and pestles are also present in this cultural assemblage. Both sites are radiocarbon dated to a range between 9000 and 10 000 bp (*Yu Jincheng 1998*).

Discussion

The recent discoveries of the southern cave dwelling sites and the northern microlithic assemblage which date to the transitional period from the Pleistocene to the Holocene have contributed much to our understanding of early cultures in China. This contribution is reflected in the following respects. First, the presence of early pottery is confirmed. Second, the emergence of rice agriculture in the southern region during this period is suggested by the analyses of rice phytolith remains. Third, a general pattern can be observed in the diversified foraging economy, especially noteworthy for fishing and hunting activities. Large mammals such as deer and boar were the principal game animals in the southern region, supplemented by bird and aquatic fauna.

The southern region has yielded the most complete data. The cave dwelling sites occupied during the transitional period from the Upper Pleistocene to the onset of the Holocene and during the Lower Holocene are distributed primarily along the base of limestone hills in the southern karst region. They are most frequently found along the southern and northern slopes of the Nanling Mountains and are the primary type of occupation site discovered in the south thus far. Open-air sites are also present, however, such as the Phase I remains recently excavated at the Dingshishan site in Yining (*Fu Xianguo et al. 1998*). It is likely that more open sites of this type will be identified in the future. Minor variations are present in artefact assemblages from these sites, although shared attributes include pebble implements with unifacial retouch, perforated "dibble discs," "cutting implements" with polished blades, artefacts of bone, antler and shell, cord-marked and plain pottery tempered with coarse-grained quartzite, and the remains of prototypical rice agriculture. The occupants of these sites shared the same ecosystem, as well as a similar subsistence economy, and developed a homogenous settlement pattern. So far, cave dwelling sites are known only in southern China. In contemporaneous sites in northern China, pottery is found in association with a widespread microlithic assemblage. The general characteristics of this cultural assemblage are not fully understood. However, the fact that the northern lithic industry is characterised by microliths is in itself a feature that distinguishes it from the contemporaneous southern tradition. The lithic industry of North China is associated with the lithic industry of Northeast Asia in this period. The lithic industry of the southern tradition had some similarities with the pebble lithic industry of adjacent continental Southeast Asia of the same period. Based on this similarity, some scholars of Southeast Asian cultures have concluded that the southern China assemblage is part of the Hoabinhian culture which was widespread in Southeast Asia during the same period. However, the Sumatra-type pebble implement, which is the typical artefact of the Hoabinhian culture, is clearly different from the pebble implement found in contemporaneous South China. Pottery was also absent in the Hoabinhian culture, nor have remains of rice cultivation been found there.

Based on radiocarbon dating and relative dating, human occupation at the southern cave dwelling sites ceased at approximately 10 000 to 9000 bp. This precedes the deposits of the Early Middle Neolithic cultures, such as that of the Pengtoushan culture in the southern region. The lithic industry of these Early Neolithic remains, characterised by the overwhelming presence of pebble implements and the additional occurrence of small flint and quartzite tools at some sites, is a continuation of the lithic manufacturing tradition of southern China following the Paleolithic. The highly sophisticated nature of the bone and antler artefacts is a characteristic shared with contemporaneous cultures on the Eurasian continent and its adjacent areas. Their stroke-marked and cord-marked pottery vessels are the oldest known anywhere in the world to date. The stamped cord-marked pottery, however, is a distinctive local tradition. This pottery making method became widespread in the Middle Neolithic in southern China. In the subsistence economy, game animals in the Mesolithic consisted primarily of deer, boar and various kinds of aquatic resources, which is also similar to the faunal subsistence pattern of the Neolithic, except for the high frequency of bird remains characteristic of the Mesolithic cultural assemblage. The role played by rice agriculture in the subsistence economy is not known, although we do have evidence for the origin of a rice agricultural system, which became dominant in South China only later, during this period. This culture had developed some basic elements of the Neolithic cultures of the southern region. It became a major source for the development of the southern Middle Neolithic complex represented by the Pengtoushan culture, which is characterised by large, chipped pebble implements, small flint implements, cord-marked pottery and early rice agriculture. Therefore, this culture should be regarded as the Early Neolithic culture in South China. Although agricultural remains have yet to be identified in the northern microlithic cultures that

are contemporaneous with the southern finds, pottery emerged early in the north. The later phase of this microlith culture, represented by the Zhuannian site and the Zhenjiangying site in Beijing, is chronologically close to the Cishan-Peiligang culture of the Middle Neolithic. The microlithic tradition was maintained up to the Late Neolithic in the northern region.

It can be argued that the cave sites in the southern region during the transitional period between the Pleistocene and the Holocene and the microlith culture in northern China represent the two principal sources for Neolithic cultures in prehistoric China. The Middle and Late Neolithic cultures centred in the Yangtze River and the Yellow River basins arose from these two bases. The cultural assemblages that were identified as Mesolithic before the 1980's actually display characteristics of Neolithic cultures. They are clearly distinct from Mesolithic cultures in other regions of the world.

II. AN OUTLINE OF CULTURAL DEVELOPMENT IN NEOLITHIC CHINA

The presence of a Neolithic period on the territory of present-day China was proposed after the emergence of modern Chinese archaeology in the 1920's. In the first decades of its development, Chinese archaeologists could not form a comprehensive framework of cultural developments in Neolithic China due to limitations of data and research. Only after the mid-1980's did scholars start to propose a specific chronology and to synthesise the general characteristics of each period (*Yan Wenming 1987; 1989*). From then on, the archaeology of Neolithic China has made significant progress, most notably in recent years. This is especially reflected in the amount of data and research regarding the Neolithic cultures of the lower and middle Yangtze River and in the identification of Early Neolithic cultures in this area. This progress has allowed a better understanding of cultural development in Neolithic China.

The middle and lower basins of the Yellow River and the Yangtze River were the heartland of cultural development in ancient China. Although this vast region is a relatively independent geographic unit, the region's environment is highly complex and diversified. The diversity is best reflected in the differences between the north and the south. The economic and cultural differences here were a result of different ecological contexts that were already present in the Palaeolithic. In the Neolithic, a wide range of regional cultures developed on the basis of these differences. Over time, various interactions between the regional cultures homogenised the pattern of regional development. According to current data, the development of Neolithic cultures in the heartland of ancient China went through three phases, termed the early, middle and late phases. The late phase can be further subdivided into early and late periods. After the late period, there was a transitional period to the Bronze Age or Three Dynasties civilisation, which we also call the Post-Neolithic period. In the following sections, the general features of these phases' cultural development are elaborated.

The Early Neolithic (c. 12 000–6500 BC)

The cultural differences between the north and south were already noticeable in the Palaeolithic. By the Early Neolithic, two distinctive cultural systems had clearly developed in southern and northern China.

The northern manifestation was a microlith culture distributed throughout the North China plain and its adjacent regions. Many sites or localities of this culture have been identified in Hebei, Henan, Shaanxi, Shanxi and Shandong. Over one hundred sites have been found in the hilly region in central Shandong alone. On the basis of minor differences in cultural attributes, the microlith assemblage was once further subdivided into the "Shayuan culture," "Hutouliang culture" and "Fenghuangling culture," even though these cultures' shared characteristics make them very similar. The microlithic assemblage consists of microlithic cores which conical, wedge-shaped and keel-shaped, as well as a long, narrow microblade. Both small lithic tools such as scrapers, projectile points and burins, and large lithic tools such as adze-shaped implements are present. Ceramic vessels represented by jars, stone implements represented by mortars and pestles, as well as bone and shell artefacts that include awls and pendants, have been found in the later manifestations of this microlithic assemblage. These later forms are found in the middle and upper layers of the Yujiagon site in Yangyuan, the Zhuannian site in Beijing and the Nanzhuangtou site in Xushui. Antelope was the principle game animal utilised at the Yujiagon site. Large mammals such as wild horse, cattle, wild donkey and deer were also present. Deer and boar were the primary game animals uncovered at the Nanzhuangtou site.

An early culture characterised by cave dwellings was discerned along the northern and southern bases of the Nanling Mountains in South China. To date, a dozen sites of this type have been identified. The majority of these sites are cave sites, but some are open-air sites. The use of pebble implements is a primary feature of this southern culture. Its lithic assemblage includes bifacially flaked chopping implements, perforated pebbles and cutting implements with polished blades. Small lithic tools of flint and quartz are also present at some sites. The manufacture of bone, antler and mollusc shell implements, which include awls, needles, projectile points, knives and harpoons, were highly developed in this culture. A type of round-based pottery jar which was tempered with coarse-grained quartzite was found at the Xianrendong site in Wannian, the Yuchanyan site in Daoxian, the Miaoyan site in Guilin and the Dalongtan site in Liuzhou. Reliable evidence of rice cultivation is also found at Xianrendong and Yuchanyan, although a higher proportion of hunting-fishing-gathering activities is observed in the subsistence economy. Deer and boar were the game animals that served as the main sources of protein for the foraging groups. The exploitation of aquatic fauna and birds was also significant.

These Early Neolithic sites are not extensive in area, which suggests that the organisation of these early settlements was not complex. Six hearths were identified on a single living floor excavated at the Xianrendong site, which suggests that different consumption areas might have been present within a single settlement at the same time.

The Middle Neolithic (6500–5000 BC)

Remains of agriculture have not yet been identified in Early Neolithic sites of the northern region. However, it is likely that the agricultural systems in both the north and the south during the Middle Neolithic period emerged from their preceding cultural assemblages of the Early Neolithic. In the middle and lower Yellow River basin, many northern sites of the Middle Neolithic period yield remains of foxtail millet and broomcorn millet, which are both dry-land crops. Over 80 storage pits filled with millet were found at the Cishan site. The total weight of grain is estimated at 50 tonnes when fresh. Domesticated stock and fowl include pig, dog and chicken. A large quantity of cultivated rice remains was found in the mid-Yangtze River basin, which indicates the presence of a system of paddy agriculture. Pig, buffalo, and chicken were the principal domesticated fauna in the southern region.

Several hundred sites dating to this period have been found. The northern cluster includes sites of the Laoguantai culture in Shaanxi, the Cishan-Peiligang culture in Hebei and Henan, the Houli culture in Shandong and the Xinglongwa culture in Southeast Inner Mongolia. Although microlithics are still present among the remains of this period, polished stone tools comprise the bulk of the lithic assemblage. Typologically, the assemblage includes stone mortars, pestles, spades, sickles, knives, axes, adzes and chisels. The ceramic vessel types are also diverse and include jars, urns, pots and alms bowls. The northern cluster features an advanced industry of bone tools as well. The Pengtoushan-Zaoshi culture is the only group with agricultural remains known from this period in the mid-Yangtze River basin of South China. Chipped pebble implements and small flake tools were the principle types of lithics. Polished stone implements such as axes and adzes were also present. In addition, a variety of bamboo and wood implements are known from the southern assemblage. Ceramic vessel types include pots, urns, and plates, which were tempered with charcoal and impressed with cord marks. A hunting-fishing-gathering culture known as the Baozitou culture was identified in the Yijiang River basin in the Lingnan region further in the south, which also had pottery and polished stone implements.

Large settlement sites over tens of thousands of square meters in area are known from this period. Some settlements were enclosed by moats. For instance, the settlement at the Xinglongwa site in Aohan Banner, Inner Mongolia was enclosed by a moat two meters wide. The enclosed area was about 20 000 square meters and had multiple rows of house structures. The moat-enclosed settlement at the Bashidang site in Lixian, Hunan was almost 30 000 square meters in area and was comprised of a residential area, storage area, a cemetery and waste disposal area. The houses of this period were relatively large, often ranging between 30 and 40 square meters each. Social stratification in houses and in burial practices is not significant, which has been interpreted as showing the insignificant institutionalisation of social inequality at these settlements.

The Early Phase of the Late Neolithic (5000–3500 BC)

The Late Neolithic is a time of full-blown development in prehistoric China. Over ten thousand sites of this period have been found. Regional differen-

tiation in cultural attributes increased dramatically. The remains of the early phase of the Late Neolithic include the sites of the Yangshao and Beixin-Dawenkou cultures in the Yellow River basin, the Zhaobaogou-Hongshan and Xiaozhushan cultures north of the Yellow River basin, the Daxi culture in the mid-Yangtze River basin, the Hemudu, Majiabang and Songze cultures in the lower Yangtze River basin, and the Xiantouling culture in the Pearl River basin.

The societies of this period experienced rapid development in agriculture. This is manifested in the diffusion of agricultural practice to regions north of the Yellow River basin and south of the Yangtze River basin. Moreover, rice and other crops of paddy agriculture were introduced to North China, while millet and other dry land crops were brought to the Yangtze River basin.

Goats were raised in both the south and north. Also common to both regions was a variety of crops such as cabbage, melon and hemp. Regional development gave rise to craft specialisation and specialised production zones during this period. A broad variety of pottery, including highly developed painted pottery, as well as refined stone, jade and lacquer ware are all examples of specialised production. Regional pottery-making traditions became extremely complex, as did exchange networks. Several specialised lithic manufacture centres have been identified. The largest is located in the Ningzhen region in Jiangsu. Its products reached not only the entire lower Yangtze River basin, but also the mid-Yangtze River basin and the lower Yellow River basin. The lithic production centre in the Three Gorges area was also quite large; its products are found in most areas of the mid-Yangtze River basin. The Western Liaoning and Ningzhen regions were two major jade manufacture centres. Products from the latter were distributed broadly, extending through the entire Yangtze River basin and the middle and lower Yellow River basin. The expansion of trade networks formed the basis of cultural interaction.

The area of the settlement sites during this period is generally in the range of tens of thousands of square meters, and the settlements were usually centrally organised. For instance, the moat-enclosed settlement of Phase I at the Jiangzhai site in Lintong, Shaanxi consisted of five groups of houses. The houses in each group were of three different sizes. The entrances of all these buildings faced a central plaza. The settlements' associated cemeteries were usually large, some having over one thousand individuals. The burials were usually grouped into hierarchically differentiated groups within each cemetery. This has been interpreted as varying levels of social organisation within the communities. Large settlement centres of over one hundred thousand square meters in area emerged in the latter part of this phase. Towns with earthen wall enclosures have been identified at the Xishan site in Zhengzhou, Henan and at the Chengtoushan site in Lixian, Hunan. Large burials furnished with conspicuous items started to appear, such as in the Lingjiatan site in Hanshan, Anhui. These have also been taken as indicators of intensive social stratification.

The Late Phase of the Late Neolithic (3500–2500 BC)

The archaeological cultures of the late phase of the Late Neolithic retain the general patterns of their earlier phase predecessors. In the northern region, the Yangshao culture, the Dawenkou culture and the Hongshan culture were in the later stages of their course of development. In the middle and lower Yangtze River basin, the southern region witnessed the continuous development of the Qujialing-Shijiahe and Liangzhu cultures, which had already flourished in the previous period. The dramatic development of social complexity on a regional scale was characteristic of this period.

Social stratification is the most striking feature of this period, and is reflected in the variety of settlement sizes. The size of most settlement sites falls into a range between thousands of square meters and tens of thousand of square meters. However, some sites are as large as hundreds of thousands of square meters, and a few extraordinarily large settlements such as the Taosi site in Xiangfen, Shanxi, the Dawenkou site in Ningyang, Shandong, the Liangzhu site in Yuhang, Zhejiang, and the Shijiahe site in Tianmen, Hubei reach up to several million square meters. In addition, large ceremonial centres, such as the Niuheliang site in Lingyuan of Liaoning, which was over ten square kilometres in area, date to this period. The settlement pattern often consists of clusters of a dozen or even several dozen sites. Walled enclosures constructed of stone or earth were present in several regions. The walls surrounding the central settlement at the Shijiahe site were over 4000 meters in length. The moat was 60 meters wide. It would have taken an estimated 1000 people a period of ten years to construct the wall. Such a labour force would require a community with an estimated population of 20 000 to 40 000 individuals

(*Nakamura Shinichi 1997*). This matches the population of an early city-state.

Houses in the smaller settlements were generally not large during this period. However, large structures such as palatial architecture and altars were present in the large settlements. In mortuary practice, the majority of burials in cemeteries had few grave goods. Large burials were few in number; they were generally arranged in clusters, and were furnished with substantial amounts of delicate pottery, jade carvings, lacquer ware, ivory carvings and silk garments. This suggests that elite status was already well established at this time and that it might have been hereditary.

The stone and jade production centres in the Three Gorges region and the Ningzhen region declined in this period. The elite had monopolised access to raw materials as well as the manufacture and distribution of finished goods for the production of conspicuous items such as ritual pottery ware, jade carvings, lacquer ware and ivory carvings, in order to reinforce their power of social control. The pattern of production and exchange of daily items was different from that of the previous period. Incised pictographic symbols began to appear on both ceremonial pottery vessels and ritual jade items in this phase.

The Post-Neolithic (2500–2000 BC)

The concept of a Post-Neolithic is proposed here in order to describe the period previously known as the Longshan Horizon/Period. In the Yellow River basin, the Qijia, Kexingzhuang, Wangwan and Longshan cultures comprised the Post-Neolithic. In the middle and lower Yangtze River basin, the Shijiahe and Liangzhu cultures, which had flourished in the preceding period, declined in the Post-Neolithic. Few settlement sites of this period have been found in the Yangtze River basin region, although remains from these sites clearly demonstrate cultural traits of the Yellow River basin in the north.

Contemporaneous settlements in the Yellow River basin retained local cultural features from the preceding period. The use of the potter's wheel became highly developed. Bronze items are frequently encountered. A pottery sherd incised with eleven characters was found at the Dinggong site in Shandong.

The Post-Neolithic was the transitional period from the Neolithic to the Bronze Age or Three Dynasties civilisation of China. According to the conventional scheme, the late phase of this period noticeably overlapped with the period of the legendary Xia dynasty. The Three Dynasties civilisation emerged in the general region of the Central Plain, which is also known as the middle and lower Yellow River basin; it was a continuation of Post-Neolithic cultures in this region.

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REFERENCES

INSTITUTE OF ARCHAEOLOGY, CASS 1984. *Xinzhongguo de Kaogu Faxian he Yanjiu: 33–35.*

JIANGXI PROVINCIAL COMMITTEE FOR THE ADMINISTRATION OF CULTURAL RELICS 1963. Jiangxi Wannian Dayuan Xianrendong dongxue yizhi shijue (Test excavation at the Xianrendong cave site in Dayuan, Wannian, Jiangxi). *Kaogu Xuebao 1:1–16.*

JIANGXI PROVINCIAL MUSEUM 1976. Jiangxi Wannian Dayuan Xianrendong dongxue yizhi di'erci fajue baogao (Report of the second excavation at the Xianrendong cave site in Dayuan, Wannian, Jiangxi). *Wenwu 12: 12–23.*

NAKAMURA SHINICHI 1997. Several questions on the Shijiahe site. *Journal of Japan Society for the Archaeology of China 7: 24–40.*

PEI ANPING 1996. Pengtoushan wenhua chulun (On Pengtoushan Culture). *Changjiang Zhongyou Shiqian Wenhua Ji Di'erjie Yazhou Wenming Xieshu Taolunhui Lunwenji: 81–104.*

PEI WEN-CHUNG 1935. On a Mesolithic (?) industry in the caves of Kwangsi. *Bulletin of the Geological Society of China 14(3): 413–425.*

1947. Zhongguo Xishiqi Wenhua Lueshuo (On the microlithic cultures of China), *Yanjing Xuebao: 33.*

TONG ENZHENG et al. 1989. Lun Nanzhongguo yu Dongnanya de zhongshiqi shidai (On the Mesolithic in South China and Southeast Asia). *Nanfang Minzu Kaogu (vol. 2): 1–25.*

XIE FEI et al. 1998. Nihewan pendi kaogu fajue huo zhongda chengguo (Major discoveries in the archaeology of the Nihewan basin). *Zhongguo Wenwu Biao, Nov. 15:1.*

YAN WENMING 1987. Zhongguo shiqian wenhua de tongyixing he duoyangxing (The pattern of prehistoric cultures in China: homogeneity and diversity). *Wenwu: 3: 36–52.*

1989. Zhongguo xinshiqi shidai juluo xingtai de kaocha (The settlement pattern of Neolithic China: an investigation). In *Qingzhu Subingqi kaogu wushiwu nian lunwenji (Collection of papers in honour of Su Bingqi's 55 years of academic service in archaeology): 72–90.*

YUAN JIARONG 1991. Hunan Daoxian Quanxinshi zaoqi dongxue yizhi jiqi xianguan wenti (Lower Holocene cave dwelling sites in Daoxian, Hunan and their related questions). *Jinain Huangyandong Yihi Faxian Sanshi Zhonian Lunwenji: 100–108.*

1996. Yuchanyan huo shuidao qiyaun xin wuzheng (New evidence for the origin of rice cultivation). *Zhongguo Wenwu Bao, 8: 1.*

YUAN SIXUN et al. 1997. Applications of AMS Radiocarbon Dating in Chinese Archaeological Studies, *AIP CP392: 803–806.*

YU JINCHENG 1991. Beijing shi xinshiqi shidai kaogu faxian yu yanjiu (The discovery and research of Neolithic sites in Beijing). *Bashe Ji: 39–44.*

ZHANG CHI et al. 1996. Jingxi Wannian Xianrendong yu Diaotonghuan yizhi (Xianrendong site and Diaotonghuan site in Wannian, Jiangxi). *Lishi Yuekan (Taipei), 6: 47–49.*

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Documenta Praehistorica XXVI

Funeral rites at Zagheh: a Neolithic site in the Qazvin plain, Iran

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ABSTRACT – *Recent discoveries of the Neolithic temple at Zagheh on the Iranian plateau have been presented. Funeral rites and the interrelation between temple functions and graves have also been discussed. It is pointed out that the nearest similar painted temple is located in Çatal Hüyük in Central Anatolia.*

IZVLEČEK – *V članku je predstavljeno neolitsko svetišče v Zaghehu na Iranskem platoju. Predstavljeni so pogrebni običaji in povezave med obredi v svetišču in grobovi, odkritimi v neposredni bližini. Velja poudariti, da je najbližje podobno svetišče locirano v Çatal Hüyüku v osrednji Anatoliji.*

KEY WORDS – *Iran; Neolithic temple; funeral rite; female graves*

The region between the northern Zargos (N. W. Iran), the eastern Iranian plateau, and the Alburz system is centered on the central plateau of Iran, and includes the Qazvin plain in the west (Fig. 1). The plain is an alluvial basin covering an area of 443000 acres. The area is approximately 1/130 m above sea level. In the plain there are areas whose natural resources offer fruitful prospects for the investigation of early sedentary life in the Neolithic period. In addition, the plain is well situated to encourage cultural connections. Therefore, it can be seen as a major highway linking northern Zagros with the eastern Iranian plateau. Qazvin plain is a region given prominence when it was thought that 'Archaic ware' – best known from the first phase in the Qazvin plain (Zagheh) – represented the earliest stage of settled life. But the problems of cultural sequencing in this region and its relation to other cultural zones in Iran have yet not been analysed (*Talai 1983*). This is important, since it can eventually contribute to our understanding of cultural development and relations between the central plateau and contemporaneous development in the eastern Iranian plateau and central Asia during the whole Neolithic period. The Neolithic site of Zagheh is located in the southern part of the Qazvin plain, about 60 km south of the provincial city of Qazvin. It is a small mound covering an area 300 m long and 200 m wide, with a height of one metre, and more than six metres of archaeological debris. There are some ^{14}C dates from seventh and early fifth millennium available. The site had been deserted in the fifth millennium

The first excavations on the site were by the Institute of Archaeology, University of Tehran in 1970, under the directorship of professor E. O. Neghahban

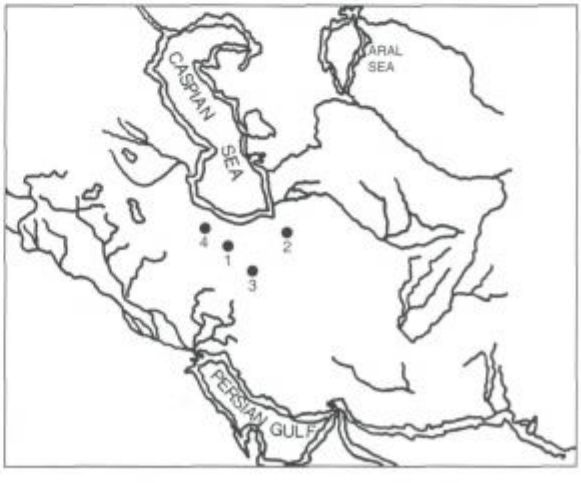

Fig. 1. Location map: 1. Ismaïlabad; 2. Tepe Hissar; 3. Sialk; 4. Zagheh (Qazvin Plain).

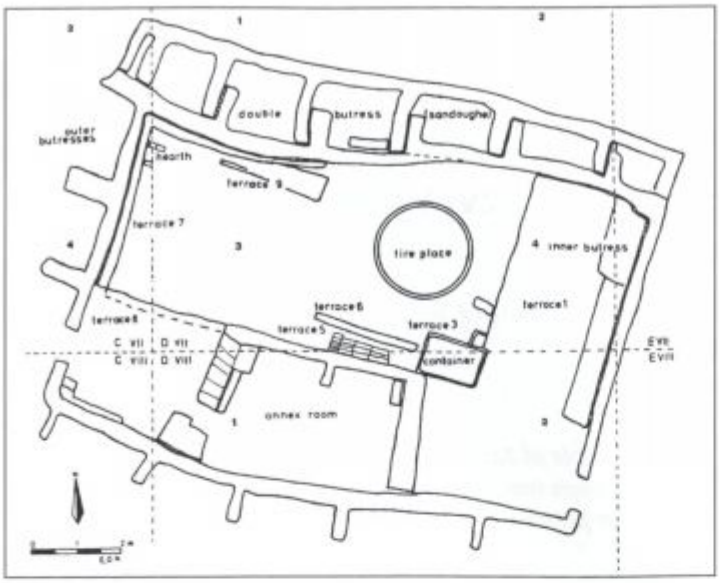

Fig. 2. Floor plain of Zagheh painted temple (*after Neghahban 1984*).

(*Neghahban 1973; 1984*). The excavation of materials then revealed that the site is basically Neolithic. It also indicated that the materials are potential sources of much new information concerning not only the relationship between the early and late Neolithic in the central plateau of Iran, but also the development of an early Neolithic painted pottery assemblage in the region. To develop this potential, an attempt was made to conduct long-term systematic annual excavations to obtain as much evidence as possible, particularly architectural remains.

Therefore, as a result of several seasons of excavations, a considerable portion of the ancient village of Zagheh has been revealed (*Malek Shahmirzadi 1977*). The objects excavated from the site are so numerous that one can accurately depict the life style and the economy of the earliest dwellers on the Qazvin plain. Here it should be noted that the problems of cultural sequence and other archaeological aspects of the Zagheh excavations have already been described in both published and unpublished forms and need not be repeated here, except to give some description of Zagheh's painted temple in connection with the subject. It is a large, rectangular and fairly complex structure, which holds the central position in the ancient village of Zagheh (Fig. 2). Mud brick is the main, the most abundant and accessible material used in the construction. Inside the main room (117 m^2) of the temple, nine platforms (benches) were built as seating. There is also a fireplace for heating in winter (*Neghahban 1979*). The walls were painted with a simple meander and dentation design (Fig. 3). The benches and the walls were mounted with mountain goat skulls and horns. The relatively considerable size of the temple and its internal features indicate that the temple was used for social gatherings. In the excavating season of 1975 a large number of clay figures were found inside the temple, which further indicates that the building was a religious centre (*Neghbahn 1984*). Structural details indicate that there must have been a long tradition in local architecture. However, the temple in Zagheh Neolithic village provides a first-hand opportunity to examine the inhabitants' religious practices.

It is worth noting that there have not yet been found similar painted temples on the Iranian plateau. The nearest counterpart is located in Çatal Hüyük in Central Anatolia (*Mellaart 1967*).

The following is a brief description of 8 graves found at Zagheh during the 1992 excavation season. We believe, on the basis of previous finds at the site (1971–1974), '...that the inhabitants of Zagheh buried their dead inside the Neolithic village. In most cases the children and the young were buried under the floor of the roofed areas of houses. All of the skeletal remains showed traces of diluted ochre. Various grave goods and presents were found with some burials.' (*Malek Shahmirzadi 1990*).

Graves were located about 9 meters from main boundary of the temple (trenches A8–E8) in the centre of the village. They are buried in a semicircular row positioned beneath the occupation floor of the buildings that must had been related to the temple.

All the remains are of young females (aged 25–30). Although they were buried in simple pits (Fig. 4), their faces were clearly oriented towards the temple

Fig. 3. Showing the inside of Zagheh painted temple, and also the pattern of design.

building (Fig. 5). They all showed the intensive use of red ochre, even inside their mouths (Figs. 6-7). I should point out that, at present, in some parts of Iran, villagers use ochre as a wall plaster for preventing insect penetration. Apparently, the use of ochre in funeral rites has been reported from many contemporaneous Neolithic sites in Iran. However, the pattern of orientation in Zagheh, as in the 8 graves illustrated, has not been seen at any other related sites in Iran. Clearly, this provide an opportunity to study the interrelation between temple functions and graves, but also the importance of the temple at funeral sites in the village communities of Zagheh. In Iran, burying the dead in and around holy places is a continuing practice. On the other hand, it seems that the 8 females were somehow privileged people that were buried around the temple; if this is accepted, this will give pause for thought concerning the social structure of the Zagheh community. Among the more interesting finds from the 8 graves, such as grave goods, were tiny drilled beads in some numbers made of agate, turquoise, lime-stone hematite and unidentified stone. These beads, which have no clear pattern, were arranged to create strings (Fig. 8). They are unevenly distributed in each grave. Almost all the beads are finished products that indicate some degree of specialisation in bead production. The presence of such items in the graves in large numbers strongly suggests the bead production industry flourished in Zagheh; at the same time, a bead production workshop has not yet been found in Zagheh. On the other hand, since the only known deposit of turquoise reported from the extreme east of the Iranian plateau, one can further suggest the existence of long distance trade. The kinds and number of beads recovered from the graves is unique, and have rarely been found in other Neolithic sites in Iran.

In sum, as stated earlier, this is preliminary report on the data recovered from the cleaning of 8 graves at Zagheh. It is preliminary at almost every level of data collection, description, and analysis. I think it only reasonable that readers be given a sense of what kind of information is, or is not, presently available.

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REFERENCES

MALEK SHAHMIRZADI S. 1977. *Tepe Zagheh: A sixth millennium BC village in the Qazvin plain of the central Iranian plateaue.* Ph.D. Dissertation, University of Pennsylvania.

1990. Private Houses at Zagheh: A Sixth Millennium BC village in Iran. *Bulletin of the Ancient Orient Museum, vol. XI. 1990: 1-25.*

MELLAART J. 1967. *Catal Huyuh. A Neolithic Town in Anatolia*. New York.

NEGHAHBAN E. O. 1973. Preliminary Result of the Excavation of Sagzabad, Marlik. *Vol.1, Journal of the Institute of Archaeology of Tehran University: 8.*

1979. A brief report on the painted building of Zagheh. *Paleorient, vol. 5: 239-250.*

1984. Clay Human Figurines of Zagheh. *Iranica Antiqua, Vol. XIX: 1-20.*

TALAI H. 1983. Statigraphical Sequence and Architectural Remains at Ismalabad - The central plateau of Iran. *Archaeologische Mitteilungen Aus Iran, Vol. 16, 1983: 57-68.*

Fig. 4. Zagheh. Grave beneath the house floor.

Fig. 5. Zagheh. Skeleton oriented towards the painted temple.

Fig. 6. Zagheh. Burial with ochre concentration.

Fig. 7. Zagheh. Burial with ochre deposited in the mouth.

Fig. 8. Zagheh. Stone beads found in grave.

Fig. 9. Zagheh. Skull after restoration.

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Tokens: the cognitive significance

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ABSTRACT - *Media shape the mind of those who use them. I analyze how tokens used for counting and accounting in prehistory brought people to thinking in greater abstraction.*

IZVLEČEK - *Mediji oblikujejo mišljenje tistih, ki jih uporabljajo. V članku razčlenjujemo, kako so žetoni, ki so jih v prazgodovini uporabljali za štetje in računanje, spodbudili ljudi k bolj abstraktnemu razmišljanju.*

KEY WORDS - *Neolithic tokens; Neolithic media; ideograms; counters*

INTRODUCTION

In the fifties, Marshall McLuhan of the University of Toronto alerted the world that media are not passive conduits of information, but deeply affect the human mind. He made a compelling case that "the medium is the message" by demonstrating that writing and oral communication required, and therefore instigated, the creation of different cognitive skills (*McLuhan 1962.27-39; 1964.81-90; Moos 1997*). Following in McLuhan's footsteps, I argue that the token system, a Neolithic medium of communication, provoked profound cognitive changes (*Schmandt-Besserat 1992.1996*).

I. THE TOKEN SYSTEM: A NEOLITHIC MEDIUM OF COMMUNICATION

Tokens are recovered in Middle Eastern archaeological sites dating 8000-3000 bc, from Syria to Persia and from Anatolia to Palestine as well as in parts of Eurasia ca. 5000-4000 BC (*Budja 1998*). These clay artefacts, about 1-2 cm across, are modeled in multiple shapes. Some have geometric forms such as cones, spheres, disks, cylinders, tetrahedrons, ovoids, triangles and quadrangles (Fig.1). Others take naturalistic shapes such as miniature animal heads, vessels, tools and furniture (Fig. 2). Many bear markings in the form of incised lines (*Schmandt-Besserat 1996.15-20*) (Fig.3).

Tokens were counters used to keep track of goods, with each token form standing for one specific unit of a commodity. A cone and a sphere, for example, represented a small and a large measure of grain, respectively (Fig. 1), and a disk with an incised cross, a sheep (Fig. 3). The number of units of merchandise was shown in one-to-one correspondence. In other words, two small units of grain were shown with two cones, three cones stood for three small units of grain, and so on. It is now well established that in the fourth millennium bc the tokens were an accounting device used by the Mesopotamian temple administration to record entries or expenditures of goods offered by worshippers during monthly religious festivals. Presumably their function was similar in prehistory, when they served to collect and administer communal goods and, as such, were the backbone of a redistribution economy (*Schmandt-Besserat 1992.170-183*).

The token system was a medium of communication (*Schmandt-Besserat 1992.161-165*). Each counter can be termed an "ideogram" or sign standing for a concept: a unit of merchandise. Moreover, there was not only one type of token carrying a discrete meaning, but rather an entire repertory of interrelated types of tokens, each with a corresponding discrete meaning. The tokens therefore represent the earliest non-verbal code or sign system for transmitting eco-

Fig. 1. Plain tokens. Mesopotamia, present day Iraq, ca. 4000 bc. The cone, spheres and disk represented various grain measures; the tetrahedron stood for a unit of labor. Courtesy of Denise Schmandt-Besserat, The University of Texas at Austin.

nomic information. The token system is furthermore the immediate forerunner of the first writing system, the Mesopotamian cuneiform script. The transition from counters to script occurred about 3300 bc, when tokens, probably representing a debt, were stored in an envelope until payment. The envelope was in the shape of a hollow clay ball that hid the tokens held inside. The accountants therefore impressed the tokens on the surface of the envelopes before enclosing them, so that the shape and number of counters could be checked at all times without breaking the envelopes (Fig. 4). The cones and spheres, representing measures of grain, for example, appeared as wedge-shaped and circular impressed markings, respectively. About 3200 bc, once the system of impressed signs was understood, clay tablets – solid cushion-shaped clay artifacts bearing the impressions of tokens – replaced the token-filled envelopes (Fig. 5). At that point the three-dimensional tokens had been replaced by two-dimensional impressed signs that conveyed the same meaning.

For the first three to five hundred years, writing continued in the wake of tokens. It is only at about 2700 bc that the cuneiform script finally broke away from its forerunner to emulate spoken language. Writing borrowed the syntax of speech and as a result texts were no longer restricted to itemizing goods, but were opened to various fields of human experience. Writing became progressively phonetic (*Roch Lecours 1995.219*). Logograms, referring to the sound of monosyllabic words, gave way to syllabograms representing fragments of words. Finally, after the invention of the alphabet at about 1500 bc, letters reached the ultimate segmentation of sound (*Tzeng, Hung 1981.237*).

The tokens were not a marginal or esoteric medium. On the contrary, the considerable number of counters and their widespread distribution within settlements prove that during no less than five millennia, the clay tokens were household items for keeping track of everyday mundane commodities, and in

Fig. 2. Naturalistic tokens representing animal heads (above: dogs; in the center, from right to left: ox and goats or ewes; below: a double spouted vessel). Susa, Iran, ca. 3300 bc. Courtesy of the Musée du Louvre, Département des Antiquités Orientales, Paris.

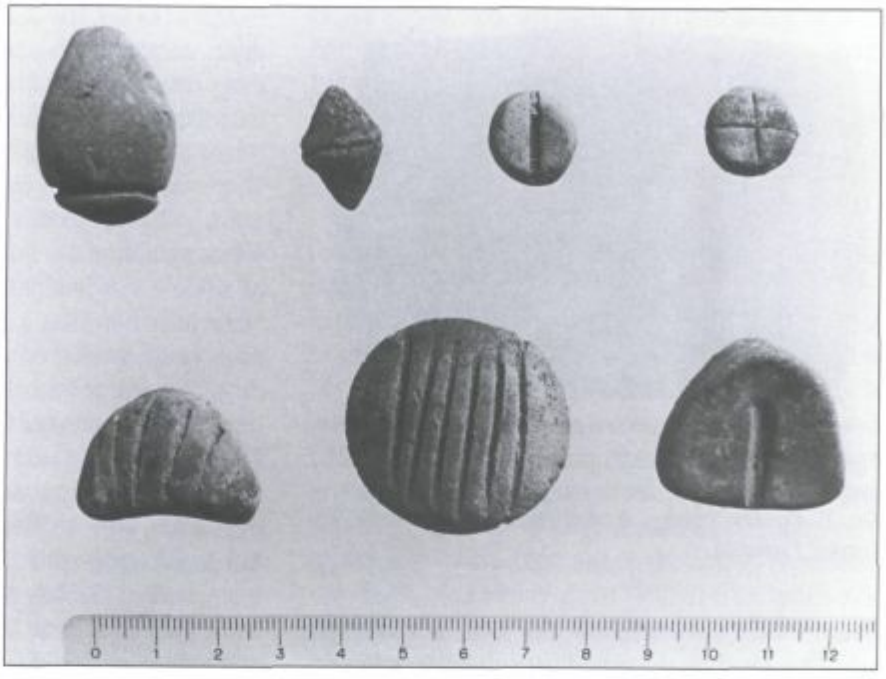

Fig. 3. Complex tokens representing (above, from right to left:) one sheep, one unit of a particular textile, one measure of honey and one jar of oil, (below, from right to left: one fleece of wool, one ingot of metal. Susa, Iran, ca. 3300 bc. Courtesy of the Musée du Louvre, Département des Antiquités Orientales, Paris.

particular, of dues to the collectivity. Their pervasiveness in all parts of the Middle East and their spread into Eurasia is good evidence of their importance in pre- and proto-history. Finally, they played a crucial role in the evolution of communication (*Vygotsky 1978.46*). The fact that the token system was the first code to supplement speech and that it is the immediate precursor of western writing makes it an important medium to be reckoned with.

II. TOKENS AND NEOLITHIC MEDIA

The token system originated in the Neolithic period, about 5000 years before civilization, and in particular, before the invention of writing. The tokens were therefore the creation of an oral world, when information was exchanged face to face, by word of mouth. In this part of the paper, I compare and contrast the tokens to the spoken word.

Both tokens and words were symbols. Tokens were artefacts, and words were strings of sounds that stood for something else. That is to say, the words and tokens were "signifiers" standing for the "signified" (*Baron 1981.168–169*). As symbols, spoken words have semantic values. A word such as "sheep" refers to a single, discrete, unequivocal entity, here a ruminant mammal of the genus *Ovis*. Likewise, each token shape was endowed with a single, discrete, unequivocal meaning. A disk incised with a cross, for instance, meant "sheep". Whenever repeated, the disk with a cross always referred to the same item – "sheep" – and only to that item.

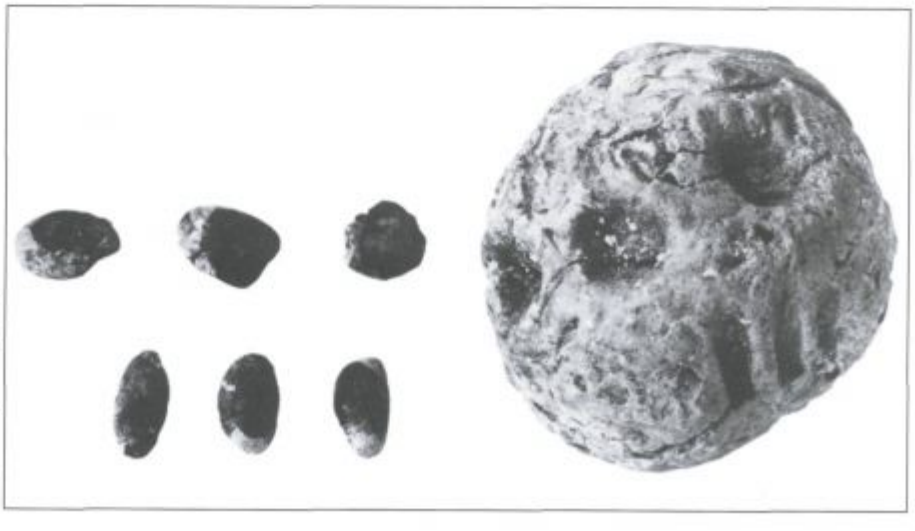

Fig. 4. Envelope and its content of tokens with their corresponding markings. Susa, Iran, ca. 3300 bc. Courtesy of the Musée du Louvre, Département des Antiquités Orientales, Paris.

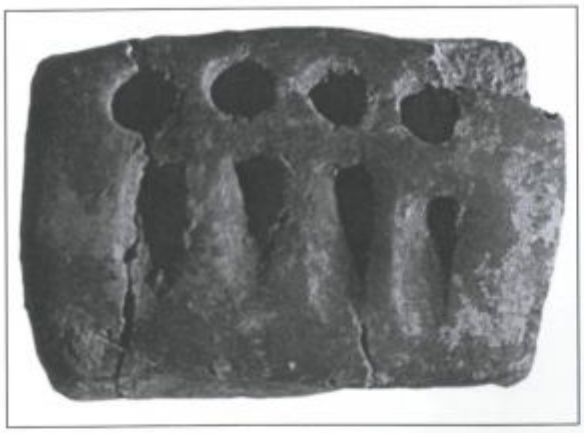

Fig. 5. Impressed tablet featuring an account of grain. Godin Tepe, Iran, ca. 3100 bc. Courtesy of Dr. T. Cuyler Young, Royal Ontario Museum, Toronto, Canada.

Because they were symbols, the form of a token is arbitrary, much as the sounds of words are arbitrary (*White 1949.25–30*). There was no fundamental reason why the disk bearing a cross meant "sheep." Similarly, there is no fundamental reason why the assembled sounds "sh-ee-p" refer to a ruminant mammal of the genus *Ovis*. In fact, any other shape or sound would do, as long as it was adopted by a society. The naturalistic tokens were similarly arbitrary. For instance "dog", signified by a dog's head (Fig. 2), was an arbitrary choice, since the animal "dog" could just as well be represented by a dog's tail or a representation of the entire animal.

Tokens, like words, were part of comprehensive, integrated systems. In other words, just as each society has enough words to communicate all useful items – the Inuit have words to describe all possible snow conditions and Arabic has a vocabulary to denote all varieties of camel hair – so there were as many token forms as there were goods to administer. The assemblage of tokens from Tepe Asiab, an early agricultural community ca. 7500 bc in western Iran, yielded multiple subtypes of tokens (sixteen) standing for farm products. But the token repertory grew in time because, like spoken language, the system was open. That is to say, when the inventory of merchandize expanded, so did the number of token types. In the fourth millennium bc, for instance, in the Sumerian city of Uruk, the token repertory reached 250 shapes to represent products manufactured in the urban workshops, including textiles, garments, jewelry, perfume, vessels, furniture and tools.

The token system and spoken language, however, shared only the fundamental features of symbolism. Needless to say, the tokens were a rudimentary medium compared to spoken words. Unlike speech, they were restricted to one type of information only, namely, real goods. Furthermore, the counters were "ideograms" standing exclusively for noun concepts. The system had no symbols for verbs, pronouns, articles or prepositions. Unlike spoken language, the token system made no use of syntax. The meaning of a token was independent of its placement order. "Jane likes Bob" has a meaning different from "Bob likes Jane", but three cones and three spheres arranged in any possible way, were always to be translated "three small and three large baskets of grain." Furthermore, the token system had no way to express number other than by one-to-one correspondence, i.e., by matching the number of counters to the number of units counted (*Justus 1996*). Most importantly, the fact that the same token shapes were used in a large area of the Near East, where many dialects would have been spoken, shows that the same type of counter always referred to the same goods even though the words for these goods differed. In other words, the tokens were truly ideograms, not logograms, corresponding to language specific words. Unlike spoken language, the counters were not based on phonetics.

It may be added here that the token system also differed from the rare manifestations of Neolithic symbolic art. The overriding function of art is to stimulate or express emotions rather than to communicate concrete information (*Scheffler 1997.112*). Therefore, although the tokens and art were two visual media, they greatly differed in content. Whereas the counters conveyed specific economic data, statues, figurines, amulets, wall paintings or plastered skulls dealt with intangibles (*Cauvin 1997*). Whereas the images probably evoked nebulous supernatural religious or magical powers, the tokens referred to precise units of a specific daily life commodity. Finally, whereas the meaning of some of the counters can be traced through the cuneiform signs that replaced them, the significance of Neolithic images will always remain enigmatic and, therefore, art is beyond the scope of this paper.

The tokens constituted an original medium of communication to collect, process, store, and retrieve information. The system of counters differed fundamentally from other Neolithic symbolic media such as art and spoken language. Namely, they differed from art in content and from the spoken word in form.

III. TOKENS: THE NEW COGNITIVE SKILLS

The tokens were a radical departure from oral communication because they relied on a different sensory mode: words were aural and tokens were visual. In the following part of this paper I discuss how, as McLuhan would have predicted it, shifting communication from the ear to the eye had irrevocable cognitive consequences.

The first notable outcome of a visual communication system was abstracting knowledge from the knower. Aural information was stored in individuals' brains, requiring willingness and certain physiological conditions in order to be retrieved. But tokens were extra-somatic. As a result, information stored by tokens could be decoded at any time by anyone initiated into the system (*Olson 1980.3*).

The tokens transmitted reveal data. For example, three cones stated "3 small measures of grain" in the most concise, explicit and unambiguous manner. This differed from oral information which, in order to facilitate memorization, was often couched in a flowery style in narratives, allegories or metaphors, and used rhythmic devices such as repetition and alliteration (*Ong 1982.37–41*). Tokens abstracted data from verbal contexts (*Goody 1977.88*).

There are more than 50 ways to say "tonight," because, as McLuhan observed (*1964.82*), oral communication is "hot," involving gestures, facial expressions, intonation and inflexion. But the tokens were "cold" because they abstracted data from body language. A cone was a cone and its significance, namely, a small measure of grain, never varied.

Moreover, oral communication, also in McLuhan's word, was "vibrant" because it was meant for and tuned to an audience, constantly adjusting to its reactions. In contrast, the tokens were "static." Whatever the circumstances, the value of the cone or any other token remained unchanged. Tokens abstracted data from subjectivity.

The shift from ear to eye was of great importance because it made it possible for individuals to touch and visualize information. In other words, tokens prompted new cognitive skills to manipulate, scan, evaluate, scrutinize and analyze an account. This, in turn, allowed new ways of abstracting data.

Whereas words consist of immaterial sounds, the tokens were concrete, solid, tangible artefacts which could be handled, arranged and rearranged at will. For instance, the tokens could be ordered in special columns according to types of merchandise, entries and expenditures, donors or recipients. The token system thus encouraged the manipulation of data by abstracting all possible variables (*Harth 1983.19*).

Patterning, the presentation of data in a particular configuration, was undoubtedly developed to highlight special items (*Luria 1976.20*). Organizing units of the same kind in lines, for example, became possible with tokens. Furthermore, these lines, as is illustrated by the signs impressed on envelopes and tablets, were organized hierarchically – the units of greater value being placed above the lesser ones. Spheres, standing for large measures of grain, were systematically lined up above the cones, representing small measures of grain (Fig. 5). The token system provided strategies to abstract the relative value of the merchandise.

Tokens facilitated counting. They made it easy to add, subtract, multiply and divide by manually moving and removing counters. The geometric layout of operations such as adding two tokens to two tokens, and three tokens to three tokens, and so on, helped the conceptualization of abstract numbers (*Justus 1999.56, 64; Hoyrup 1994.70*).

Whereas words can only be uttered one at a time, groups of any number of tokens could be handled at the same time. This made it possible to deal simultaneously with the multiple components of a comprehensive budget. The system stretched human cognition to cope with new levels of complexity.

Compared to the spoken word, which fades instantly, the single most important advantage of solid tokens was permanence. The artefacts could be stored for any length of time. For example, the record of a debt could be kept until it was repaid. The tokens were mnemonic: they liberated memory.

Finally, because the tokens provided physical proof of an agreement and because they were small, light and sturdy, the counters could be transported to conduct transactions in the absence of a party involved. Communication over distance expanded the sphere and scope of human interaction.

In sum, the substitution of tokens for real goods introduced multiple new ways of handling data in abstraction (*van Gigch 1991.234*). A word like "sheep" and the corresponding token, a disk bearing

a cross, abstracted data from their context in a similar way: the sheep could be accounted for orally in a conversation, or visually on the accountant's table, independently of the status or location of the animals. But tokens further abstracted information from any human source and from verbal and body language. As a result, the Neolithic accountant was no longer the passive recipient of someone else's knowledge, but took an active part in decoding the visual information encoded in the counters. This necessitated the acquisition of new cognitive skills that capitalized upon the visualization and physical manipulation of data. In turn, these new techniques fostered further abstraction of the data according to such variables as type of goods, value and number. As a result, Neolithic society was able to handle larger amounts of more complex information with greater efficiency and objectivity. Finally, tokens removed data from the contingency of place and time and, by so doing, they expanded the sphere of human interaction and liberated human memory from tedious lists of data difficult to memorize.

CONCLUSION

The Paleolithic medium of communication was speech. Spoken language is the natural, universal form of human communication that mankind has the inborn ability to acquire. As McLuhan eloquently argued (*1964.83*), the directness, freshness and subtleness of a face to face transaction, which combines voice intonations with facial expressions and body-language, has never been surpassed.

The Neolithic farmers of the Middle East invented a system of clay tokens to count and account for units of goods. As McLuhan would have predicted it, the switch to a radically different medium based on visual and tangible artefacts, spurred significant cognitive changes. The major outcome was to increase the human capacity for dealing with actual things in abstraction.

The token system set media on a visual course that incessantly challenged the human mind to deal with the real world in greater abstraction. In short, tokens paved the way for writing by translating aural communication into a visual form. Two-dimensional written signs were further removed from the goods they represented than were the previous three-dimensional tokens. Then phonetic signs no longer represented commodities, but the sounds of the corresponding words. Ultimately, the alphabet with semantically meaningless letters standing for semantically meaningless sounds created yet another double level of abstraction (*McLuhan 1964.86*). Writing in electronic form today further removes humans from the real world. McLuhan referred to the effect of media on the human mind as a powerful vortex. This metaphor certainly suits the token effect.

∴

REFERENCES

BARON N. S. 1981. *Speech, Writing and Sign, A Functional View of Linguistic Representation*. Bloomington.

BUDJA M. 1998. Clay tokens - accounting before writing in Eurasia. *Documenta Praehistorica XXV: 219-235*.

CAUVIN J. 1997. *Naissance des Divinités, Naissance de l'Agriculture*. Paris.

GIGCH van J. P. 1991. *System Design Modeling and Metamodeling*. New York.

GOODY J. 1977. *The Domestication of the Savage Mind*. Cambridge.

HARTH E. 1983. *Windows on the Mind. Reflections on the Physical Basis of Consciousness*. New York.

HOYRUP J. 1994. *In Measure, Number, and Weight*. New York.

JUSTUS C. 1999. Pre-decimal Structures in Counting and Metrology. In Gvozdanovic J. (ed), *Numeral Types and Changes Worldwide: 55-79*.

1996. Numeracy and the Germanic Upper Decades. *Journal of Indo-European Studies 23: 45-80*.

LURIA A. R. 1976. *Cognitive Development. Its Cultural and Social Foundations*. Cambridge, Mass.

McLUHAN M. 1962. *The Gutenberg Galaxy*. Toronto.

1964. *Understanding Media*. New York.

MOOS M. A. 1997. (ed.) *Marshall McLuhan essays. Media Research*, Amsterdam.

OLSON D. R. 1980. Introduction. In Olson D. R. (ed.), *The Social Foundations of Language and Thought: 1–6.*

ONG W. J. 1982. *Orality and Literacy*. New York.

ROCH LECOURS A. 1995. The origins and evolution of writing. In Changeux J-P., Chavaillon J. (eds.), *Origins of the Human Brain: 213–235.*

SCHEFFLER I. 1997. *Symbolic Worlds, art, science, language, ritual*. Cambridge.

SCHMANDT-BESSERAT D. 1992. *Before Writing*. 2 vols. Austin.

1996. *How Writing Came About*. Austin.

TZENG O. J. L. , HUNG D. L. 1981. Linguistic Determinism: A Written Language Perspective. In Tzeng O. J. L., Singer H. (eds.), *Perception of Print, Reading Research in Experimental Psycholocy: 237–255.*

VYGOTSKY L. S. 1978. *Mind in Society, The Development of Higher Psychological Processes*. Cambridge, Mass.

WHITE L. A. 1949. *The Science of Culture, A Study of Man and Civilization*. New York.

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Trajectories towards the neolithisation of NW Turkey

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ABSTRACT – This paper considers diverse trajectories concerning the origin of some early farming villages in Northwestern Turkey during the beginnings of food producing economies in this part of the country. The roots for the process are sought in the Konya area on the Central Anatolian Plateau. The ceramic assemblages of the first farming sites of the Northwest are believed to be a reproduction of the pottery tradition best known from Çatalhöyük East, both technologically, morphologically and as regards manipulation and use. In individual sites, the present state of research allows contemplation both of migration and mesolithic adaptation to explain for the transition to neolithic subsistence modes.

IZVLEČEK – *V članku pretresemo različne poti, ki so vodile k nastanku nekaterih zgodnjih kmetovalskih vasi na severozahodu Turčije v času začetkov pridelovalnega gospodarstva v tem delu države. Korenine tega procesa iščemo na območju Konya na osrednji Anatolski planoti. Menimo, da je keramika s prvih kmetovalskih najdišč na severozahodu posnetek keramične tradicije, ki jo najbolje poznamo iz najdišča Çatalhöyük East, tako v tehnološkem kot oblikovnem smislu in načinu uporabe. Na posameznih najdiščih omogoča stanje raziskanosti razmišljanje tako o migraciji kot mezolitski prilagoditvi, s katerima lahko razložimo prehod v neolitski gospodarski sistem.*

KEY WORDS – *Anatolia; neolithisation; migration; autochthonous transition to farming; pottery production*

INTRODUCTION

Northwest Turkey is here conceived as the region defined by the drainage basin of the Sea of Marmara combined with the northwestern part of the Anatolian Plateau drained by the Sakarya River (Fig. 1). The geographical crossroads position of NW Turkey – both intermediate of Central Anatolia and Southeast Europe, and of the Aegean and the Black Sea –, as well as its archaeological potential were soon recognised by prehistorians (*Bittel and Otto 1939.1-8*). Bittel, and later Mellaart (*1955.55*), pointed out that the area straddles one of the main thoroughfares connecting the Anatolian Plateau to the Aegean. It was David French who, surveying the region in the early sixties, tried to find archaeological corroboration of this crucial position by observing that the region "must be considered as a possible source or intermediary for ideas or developments that may have passed between [Anatolia and the Aegean]" (*French 1967.49*). French was the first who attempted to find traces of evidence for the route along which Near Eastern methods and techniques might have spread into Southeastern Europe (*l.c.*). Initiating a long-term survey program (1979–1990), Mehmet Özdoğan enlarged French's aims, simultaneously extending the survey area through full coverage of what was thought a critical contact zone area in Balkan–Anatolian relations, *viz.* Turkish Thrace, the European part of Turkey (*cf. Özdoğan 1982.38; 1985.517ff.*). However, for the neolithic period, Özdoğan soon had to admit that the Marmara area proved more a barrier than a bridge between east and west, being unable to find sites of that stage in Thrace. In addition, he recognised that the neolithic, "Fikirtepe," sites on the coast were soon abandoned after an initial phase of settlement involving some form of farming (*Özdoğan 1983.411; 1985.523*).[1] As

1 Here, consideration of the possible "Fikirtepe" site of Bulgar Kaynağı, deep in Turkish Thrace, is postponed until final presentation of the survey data (*cf. Özdoğan 1991.367 map; Özdoğan, Miyake and Özbaşaran Dede 1991.62; Özdoğan 1997*).

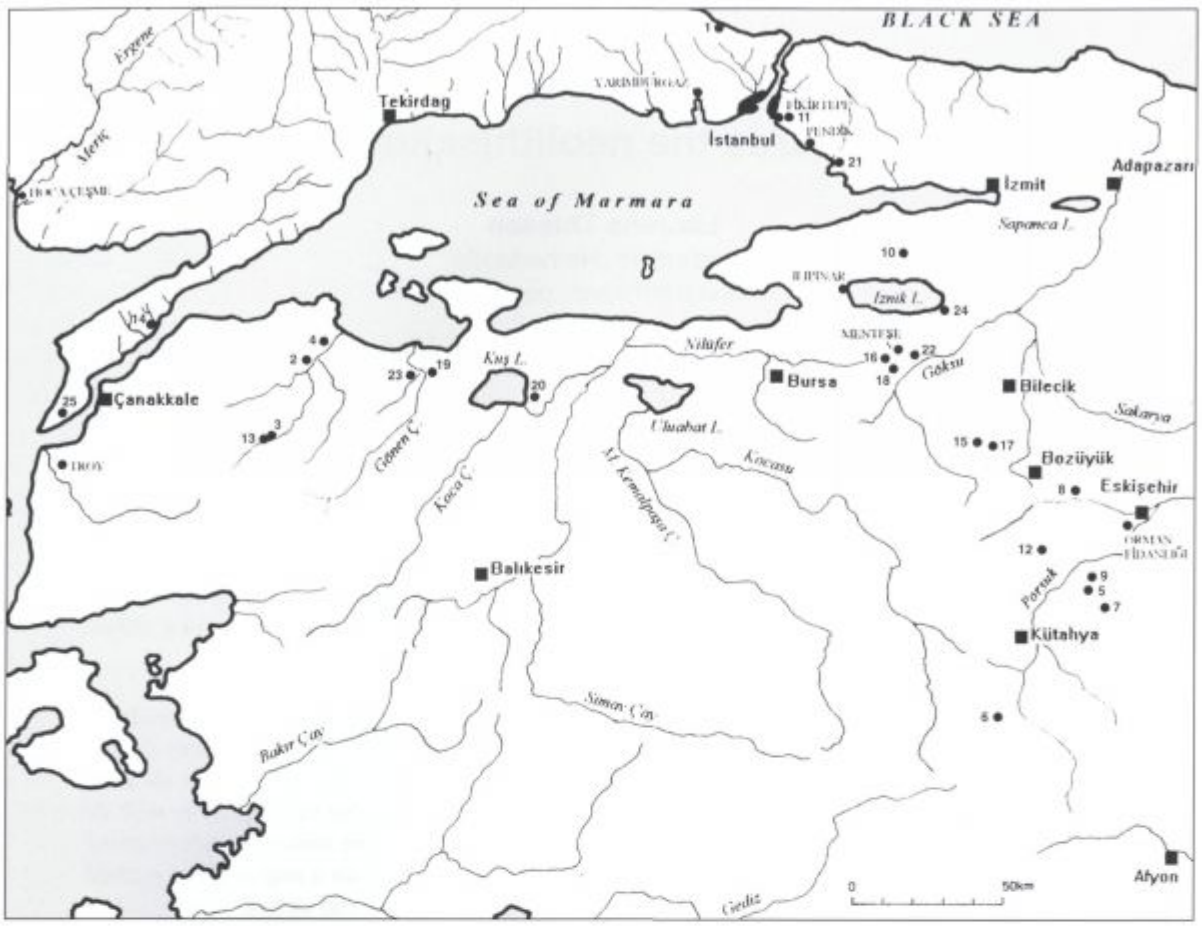

Fig. 1. Late neolithic–early chalcolithic sites in Northwest Turkey (including some aceramic sites, nos. 1–4). Squares: modern cities. Excavated settlements on map; unexcavated sites numbered as follows: 1. Ağaçlı. 2. Anzavurtepe. 3. Çalca Mevkii. 4. Gavurtarla. 5. Asarkaya. 6. Aslanapa. 7. Asmainler. 8. Demircihüyük. 9. Fındık Kayabaşı. 10. Hanımköprü. 11. İçerenköy. 12. Kanlıtaş. 13. Karlıdere–Çalca Mevkii. 14. Kaynarca Mevkii. 15. Kınık. 16. Marmaracık. 17. Pazaryeri II. 18. Sırt Yol. 19. Taraççı Mevkii. 20. Tepetarla Manyas. 21. Tuzla. 22. Yenişehir II. 23. Yılanlık Mevkii. 24. Yüğücek. 25. Karaağactepe.

argued elsewhere, the cultural and chronological discrepancy of the Thracian sites with the southern Marmara locations – the former ones culturally dependent on the Bulgarian early neolithic –, confirmed that NW Turkey did not play a direct role in the neolithisation of SE Europe (*Thissen 1999*).

I.

The excavations at the site of Ilıpınar, due west of the İznik Lake in the Asiatic part of Turkey settled the absolute date of "Fikirtepe." Additionally, they showed that the occupation of the first neolithic villages in this part of the country continued beyond the trial events on the East Marmara coast (*Roodenberg [ed.] 1995*) (see Tab. 1).

If I recapitulate Ilıpınar's 500 year sequence, several points may be highlighted. There is no evidence of an occupation of the site prior to phase X. Life was already fully agricultural, sheep and goat dominating. An intense fire, possibly obliterating the whole settlement, destroyed the last building level of phase X. The subsequent phases IX–VII constitute a continuous cycle of building and rebuilding, with a strong adherence to previously used building plots. Existing patterns in ceramic production and use, in the bone and antler tools and in the chipped stone industry are being maintained, suggesting a stable and coherent society. Pigs become gradually more numerous. In phase VI the first structural use of mud brick is attested, although previous earth wall construction is not unknown in the form of *pisé*, cobs and daub. The pattern of single house units is discarded and replaced by linked single-room units forming specific architectural layouts. In the phase VI pottery, basically, the old canon is adhered to, but several elements point forward to the subsequent phase VA. An extremely

strong fire destroys level VI, vitrifying walls, mud bricks and pottery. Phase VA deviates from the earlier sequence in choice of building plot, in house plan, in pottery and in the first occurrence of steatopygous female figurines of baked clay showing clear parallels with Southeastern Europe of the mid-sixth millennium cal BC (cf. *Roodenberg 1993.266 Fig. 5*). Lasting perhaps a century, Ilıpınar VA ultimately falls victim to a severe fire, after which phase VB marks the beginning of a stage which represents an 'internationalisation' of contacts spreading over the Balkans and Asia Minor linking the Aegean and the Black Sea, and which may be attributed to the Middle Chalcolithic period. After the burning of phase VB, the site is abandoned for over two millennia.

The foundation of Ilıpınar can, with a fair degree of certainty, be set at about 6000 cal BC (cf. *Roodenberg, Thissen and Buitenhuis 1989/1990.75; Roodenberg 1995.171ff.*). This date would make Ilıpınar X roughly contemporaneous with the second major occupation phase at Hacılar (the cluster of levels V–III), with the beginning of the Thessalian Middle Neolithic (or "Sesklo") period, and with the establishment of the first farming sites in Eastern Makedonija, *viz.* Anza and Vršnik. By 6000 cal BC, Thessaly had already at least two centuries of peaceful and successful village life behind it, the Giannitsa Plain in Greek Macedonia had known farming sites for several generations and seen their subsequent abandonment, while the fertile plains of Western Turkey most probably had been occupied by aceramic farming communities by the later part of the seventh millennium cal BC.[2] The neolithisation of NW Turkey, therefore, was comparatively late.

phase	*number of building levels*	*building method*	*cal BC range*
burnt			
VB	1	mud brick	5500–5450
burnt			
VA	3	mud brick	5600–5525
burnt			
VI	2	mud brick/*pisé*	5675–5625
VII	2	cob-on-post/ wattle-and-daub	5725–5675
VIII	4	cob-on-post/*pisé*	5800–5725
IX	3	cob-on-post/*pisé*	5875–5800
burnt			
X	3	cob-on-post/*pisé*	6000–5875
virgin soil			

Tab. 1. The Ilıpınar sequence.

Prior to the Ilıpınar excavations, suggestions as to the existence of an early pottery horizon in the Northwest were first ventured by James Mellaart, underlining conceptual parallels in the Fikirtepe pottery and early Hacılar (levels IX–VI), simultaneously stressing the differences (*Mellaart 1967*). The Ilıpınar excavations proved his dual thesis concerning the date and the southern origin as roughly correct. Earlier, Mellaart had rightly perceived the similarities of pottery surveyed from the site of Menteşe in the Yenişehir Plain with the Fikirtepe assemblage (*Mellaart 1955.56, 73*)[3]. Later, French could add two more sites in the Yenişehir Basin to this emerging early pottery culture. He also connected Ilıpınar with the Marmara settlements (*French 1967. 56f.*). French further noticed the Fikirtepe connections in some of the pottery excavated by Bittel in 1937 at Demircihüyük in the Eskişehir Plain (*Bittel and Otto 1939, Pl. 10:1–6*). All these relations were corroborated by the surveys carried out later by Özdoğan in these areas and found full confirmation by the excavations at Demircihüyük and Ilıpınar. The term "Fikirtepe culture" was coined both for the sites in the Eastern Marmara area and for those located more to the south on the Anatolian mainland – first tentatively by Bittel (*1969/70.18*), but since then explicitly by Özdoğan (*1983*, cf. also *Seeher 1987.44; Efe 1990.92*). Here, I wish to restrict the label for the coastal Marmara settlements only.

The work done on Ilıpınar, in particular, allows to elaborate some hypotheses about the origin of its culture and about its relation to the Fikirtepe sites to the north and to the alleged Fikirtepe sites due south. More generally, certain differences with, notably, the Eastern Marmara coast settlements give rise to contemplate different trajectories toward sedentary village life to have been at play, confirming the superficiality in the coherence of the "Fikirtepe culture" (likewise, *Özdoğan 1997*).

2 A full treatment of these areas may be found in my PhD dissertation, recently submitted to the Faculty of Archaeology of Leiden State University, titled "Early village communities in Anatolia and the Balkans, 6500–5500 cal. BC. Studies in chronology and culture contact" (*1999*).

3 "These sherds [from Menteşe] show the probable presence of sites of the Fikirtepe type and period also in the region south of the gulf of İzmit (...)" (*Mellaart 1955.56*).

II.

Solid material culture parallels exist between Ilıpınar X and the presently known cluster of sites on the East Marmara coast, collectively labelled as "Fikirtepe," after the most thoroughly investigated type site (*Bittel 1969/1970; Özdoğan 1979; 1983*). In the pottery, for instance, the two quantitatively dominant vessel categories in Ilıpınar, *viz.* restricted pots with four vertically-pierced knob handles and pots with two horizontal lugs (Fig. 2.2-3 and 1, 4 resp.) occur widely at Fikirtepe as well. After Özdoğan's analysis of the Fikirtepe pottery, however, open forms make up a far larger proportion in the assemblage than is the case at Ilıpınar (27.7% *vs.* <5% resp.). This difference in the proportion of the main vessel categories may be related to differences in the subsistence base of both sites, rather than indicating chronological variety. Simultaneously, however, the occurrence at Fikirtepe of both pot categories, which at Ilıpınar have been linked to mutually exclusive, but related functions in cooking, implies a similar discrete use at the Marmara site. Elsewhere[4] I have argued that the pots with vertically-pierced knob handles were used in the cooking of pulses such as lentils and bitter vetch, which both appear to have been major food stuffs at early Ilıpınar (cf. *Van Zeist and Waterbolk-Van Rooijen 1995.161*). Pulses, after an initial cooking-stage, require only a limited supply of heat during cooking, just enough to keep things boiling. Particularly in the case of bitter vetch there is a need to boil it for minimally one hour in order to remove the poisonous substance (*Van Zeist and Waterbolk-van Rooijen 1995. l.c.*). The possibility of regulating the distance between fire and pot by means of the strings, so as to control the degree of heat intensity, makes pots with pierced knob handles well adjusted in this respect. The two-handled pots, by contrast, were possibly placed directly *over* the fire, the large handles providing easy grip when lifting them from it. The wider orifices noted for the two-lug pots during Ili-

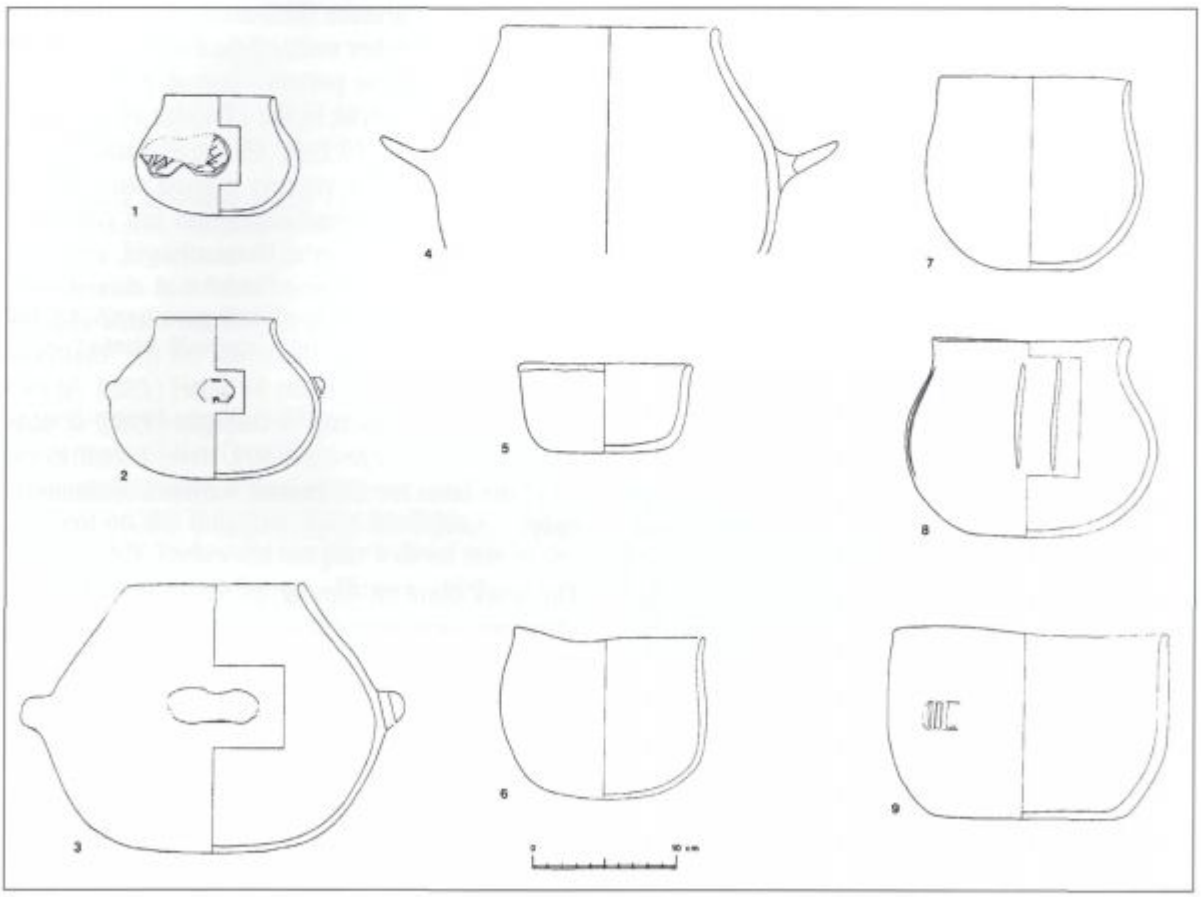

Fig. 2. Ilıpınar phase X. Major vessel categories. Provenance: 1. S9/112 (showing scored attachment place for lug, two horizontal lugs originally). 2. S9/042. 3.S9/119. 4. Section/050. 5. Section/050. 6. S9/112 (oval). 7. S9/085. 8. S9/112 (oval, grooved decoration repeated on the four cardinal points). 9. S9/113 (oval; four vertically-pierced knob handles originally).

4 Cf. note 2 supra.

pınar phases IX–VI would allow recurrent stirring of the contents (in order to avoid burning the food) and/or adding of ingredients. Therefore, if one assumes that *different* subordinate categories of cooking pot have been used for the preparation of *different* foodstuffs, then the two-lugged pots may have been used for the preparation of food involving miscellaneous ingredients (e.g., specific soups, meat or vegetable dishes). The preparation of such 'composite' dishes, involving the adding of different ingredients and needing frequent stirring, may be thought to profit from a vessel that is easily manipulable and the orifice of which is easily accessible.

This inferred structural relationship in a dominant domestic utensil between the İznik area and the Eastern Marmara coast is present also in at least two sites situated south and southeast of the İznik Basin, *viz.* Menteşe and Demircihüyük. At the recently excavated site of Menteşe in the Yenişehir Basin, the basal deposit yields a similar pottery assemblage as known from Ilıpınar X (cf. *Roodenberg 1999. Fig. 13*). Three ^{14}C dates from the top level of this deposit confirm contemporaneity with the north, where it must be stressed that some 3 meters of accumulation still remain untouched[5]. In the Yenişehir Basin, two other sites (Marmaracık and Yenişehir II – cf. *French 1967.53, 55 resp.*), unexcavated thus far, yield similar pottery on the surface, indicating that they might have formed a tight cultural unit together with Menteşe as late as 6000 cal BC. Given the 3 m of remaining deposit at Menteşe, it is not inconceivable that the Yenişehir site cluster was established a few centuries earlier than basal Ilıpınar. All three Yenişehir sites are located on the northern edge of the plain, where a shallow lake existed in its lower part until recently (*Roodenberg 1999*). Both material culture and environmental position connect the Yenişehir site cluster with the İznik Lake, where next to Ilıpınar, a possibly contemporaneous settlement is attested on its eastern shore (Yüğücek, cf. *French 1967.55*).

Apparently, the small alluvial fans on Lake İznik's western and eastern shores suggested attractive locations for establishing permanent villages to a large degree dependent on farming. A separate pass connects each shore over the Kurban Mountains with the Yenişehir Plain. Given the possible ancestry of Menteşe over Ilıpınar, simultaneously acknowledging the close material culture correspondences between both areas, it is not inconceivable that the İznik area was settled from the Yenişehir Plain. Two points speak against a scenario where basal Ilıpınar would represent a mesolithic/epi-palaeolithic adaptation by local hunter-gatherers turning to agriculture. There is, first, the heavy reliance on *ovicapridae* in Ilıpınar X, with hunting evidently having played a minor role (Tab. 2).

phase	*domestic (n)*	*wild (n)*	*wild (%)*
VB	151	9	5.6%
VII–VA	1190	47	3.8%
VIII	4080	70	1.7%
IX	1117	176	13.6%
X	781	79	9.2%

Tab. 2. Preliminary data on the proportion of wild and domestic in the major food animals in Ilıpınar phases X–VB (*after Buitenhuis 1989/1990.112, Tab. 4*).

Had the first settlers at Ilıpınar been hunter-gatherers, then one would suspect a higher proportion of hunted species. The fact that, as Buitenhuis perceived, the reliance on sheep and goat is in contrast to what would be expected, as both species did not occur naturally in the region (*Buitenhuis 1995.153*), does not, however, automatically lead to a southeastern origin of the settlers (*l.c.*). Even local hunter-gatherers could be misinformed concerning the maladjustment to the local circumstances of species unknown to them before. A second factor against mesolithic adaptation is the rather limited use of marine resources during Ilıpınar X (cf. *Buitenhuis 1995.154, Tab. 2*).

The thorough knowledge of the local surroundings to be assumed for hunter-gatherers in general would have reflected both in a more diversified marine fauna[6] and in a quantitatively higher representation in basal Ilıpınar, were we to consider the site's establishment as a local decision. The fact that not a single fish bone has been collected from phase X (*Buitenhuis 1989/1990.114*), neither from the lake nor from the sea (only 15 km away), is again hard to reconcile with a hunter-gatherer background for the first villagers at Ilıpınar. Indeed, only the faunal re-

5 The three Menteşe dates are as follows: GrN-24463, 7200±60 BP, GrN-24461, 7170±60 BP and GrN-24462, 7050±35 BP (*J. Roodenberg, pers. comm.*).

6 For Ilıpınar X, Buitenhuis did count only three marine species, all of the *Mollusca phylum*, to note Ostrea edulis, Mytilus galloprovincalis and Cerastoderma edule (*Buitenhuis 1995.156*).

mains from the subsequent levels at the site testify to a strongly increased exploitation of the environment, both in terms of use of the sea, increased hunting (phase IX) and an increased dependency on pig breeding at the cost of sheep and goat breeding (*Buitenhuis 1989/1990.115*). We tend to interpret this evidence as exemplifying a progressive knowledge of the surrounding land (from phase IX onwards) after an initial exploration stage (phase X).

Recapitulating, the evaluated evidence strongly suggests that the earliest farming village at Ilıpınar was settled by non-local people and not by local hunter-gatherers. Given the very close material culture ties with the site cluster in the Yenişehir Basin to the south, it is most likely that the origin of these settlers must be sought in that area. Because of the presence of a small lake there, it is tempting to consider that the settlers of Ilıpınar sought and found a similar environment to the one they knew from their root country. In fact, it is extremely likely that they had information beforehand on an analogous situation existing beyond the mountains (*cf. Anthony 1990.900*)[7].

III.

Short-distance migration is more difficult to apply in hypotheses concerning the origin of the villages at the East coast of the Marmara, *i.e.* the Fikirtepe sites, notwithstanding the fact that several material culture variables, such as pottery (see above), bone and antler tools and, possibly, lithics, conform both to Ilıpınar X and Menteşe. All the Fikirtepe sites, four of which are presently known, were very close to the sea, while fresh water was provided by small streams and perennial springs. Bittel well describes the excellent choice of location of the type site itself, which was protected from the north winds by low hills behind the site, also pointing out that the small bay of Kalamış (now some 1.3 km away from the site) may originally have reached further inland (*Bittel 1969/1970.3f.*). Evidently, the choice of location was made on the basis of detailed knowledge of local circumstances, more bent on the full exploitation of marine and freshwater food sources than on maximised yields from tilled fields. The location of Pendik is almost exactly similar and is clearly chosen on the basis of similar considerations (cf. *Özdoğan 1983.401*)[8]. Again, as was done above, one might surmise that such comprehensive knowledge of the local surroundings is more readily found with hunter-gatherers indigenous to the area than with a migrating farming population. The local background of the inhabitants of the Fikirtepe sites was claimed nearly two decades ago by Özdoğan, observing that the chipped stone industries of both Fikirtepe and Pendik represent "a direct offspring of the Epi-Palaeolithic industries of the region" (*Özdoğan 1983.409*). In addition, from the scarcity of grinding stones, mortars and sickle blades retrieved at Pendik and Fikirtepe he concluded that agriculture was not of primary importance (*l.c.*). The marine orientation of Fikirtepe, already perceived by Bittel (*1969/1970.4 and note 7*) is confirmed for Pendik by more recent soundings at the site, as attested by stone weights and bone hooks possibly used in fishing (cf. *Harmankaya 1983.29; Pasinli et al. 1994.151, Figs. 9–11, 16*).

The strong contrast in settlement location and subsistence with Ilıpınar phase X pertains to house building as well. The Ilıpınar and Menteşe dwellings were relatively solid features with deeply set posts, lattices and daub, and otherwise built of *pisé* with wooden reinforcements (cf. *Roodenberg 1993.253f., 264 Fig. 3*; *Roodenberg 1999*). Fikirtepe and Pendik houses, however, were of much lighter construction, involving wattle-and-daub walls without deeply set posts to fix them to the ground (cf. *Bittel 1969/1970.6ff., Pl. 1; Özdoğan 1983.405*). It is tempting to associate these light habitations with a population not tightly bound to a fixed spot; they certainly suggest an ability to cope with local circumstances in diverse ways not centred primarily on the need to formalise the domestic by constructing long-lasting dwelling places.

In view of what has been said above, the local mesolithic background of the Fikirtepe fishing villages on the Marmara east coast is certain, as has recently been restated by Özdoğan in an important paper (*1997*). Simultaneously, the ceramic assemblages of these sites correlating fully with Ilıpınar, Menteşe and Demircihüyük, combined with the experiments at farming relying fully on the five major domestic species (sheep, goat, cattle, pig and dog) as exemplified by the animal remains (cf. *Buitenhuis 1995.152, 155, Table 1*), suggest that a southern impulse for both must be acknowledged (*Özdoğan 1989.203; Gatsov and Özdoğan 1994.98*). Given the simulta-

7 "Migrants are not likely to move to areas about which they have no information."

8 The same seems to apply to the remaining two Fikirtepe sites, viz. İçerenköy and Tuzla, although data on these are rather sparse.

neous occurrence of both the farming techniques and the pottery on the northern sites, it is not improbable that these innovations were also introduced together, possibly from a single source and by a single means. The direct source area might well have been the İznik Lake region, where Ilıpınar on its west- and Yüğücek on its eastern shore might have provided the immediate interface for the mesolithic-neolithic culture contact.

IV.

The two sites presently known through survey in the small Pazaryeri Plain attest that strong cultural traditions existed between the Yenişehir Basin and similar basins further south. Here, Kınık and possibly Pazaryeri II yield material strongly reminiscent of the top deposits of Menteşe and of phase VA at Ilıpınar (cf. *Efe 1992.565f., 1993.21f.*). Earlier material has not yet been detected. Southeast of the Pazaryeri area, the Eskişehir Basin is the first area, when coming from the western lowlands by way of the Bursa-Bozüyük road, that is located on the Anatolian Plateau (*Bittel and Otto 1939.1f.*). Here, the site of Demircihüyük yields definite connections in ceramics with the top deposit of Menteşe and with Ilıpınar VA, as is evident from pots with strap handles at the rim (*Seeher 1987. Pl. 12:6-18*), some *impresso* ware (*ibid., Pl. 21:1-8*) and painted sherds (*ibid., Pl. 8*) (cf. *Roodenberg 1999. Figs. 12: 1-6, 13:2*). However, the presence at Demircihüyük of discrete, but chronologically valuable variables such as 'slanted' handles (*Seeher 1987. Pls. 4:6-7, 20:23-25*), pottery lids and horizontal, pierced lugs (*ibid., Pls. 7:6, 19:39, 20:3, 5, 8*), definitely link the pottery of this site to the basal deposits of Ilıpınar and Menteşe. As is well-known, all the early material from Demircihüyük was found in tertiary contexts, the neolithic site most likely hidden close to the later mound underneath thick alluvial deposits (*Korfmann 1983.25*)[9]. No ^{14}C dates being available for the early pottery, Seeher's claims that some of the material is contemporary to Çatalhöyük East levels XII-IX, or else to Çatal VIII and later (*Seeher 1987.46ff.*), while attractive, is not verifiable. However, the neolithic Demircihüyük pottery does suggest the presence of similar subordinate categories as known from Ilıpınar, Menteşe and the Fikirtepe sites, *viz.* pots with four vertically pierced knob handles and pots with two horizontal lugs, and it does imply the presence of similar discrete concepts regarding cooking and food manipulation. While the strong "Fikirtepe" affinities of some Demircihüyük pottery have been recognised as early, the basal deposit of the neolithic site may well antedate both Fikirtepe and Ilıpınar, similar to what has been proposed for Menteşe (*vide supra*). Unfortunately, the crucial question tackled for Menteşe *vs.* Ilıpınar concerning the pathway towards neolithisation cannot be taken up here. While for Menteşe the faunal data are in the process of analysis, no such data exist for neolithic Demircihüyük.

V.

Now that we have contemplated the diverse trajectories leading towards the establishment of several neolithic sites in the Anatolian northwest, it is tempting to stretch the evidence a little further. A decade ago, Özdoğan perceived the roots of the Fikirtepe pottery to be in the Hacılar and Çatalhöyük assemblages, stating that it "came fully developed from the south as an intrusive new element" (*Özdoğan 1989.203*). By extension, this observation would apply equally to the ceramics of Ilıpınar, Menteşe and Demircihüyük. While I believe the hint at Hacılar to be less valid, the ceramic assemblage of Çatalhöyük East does provide a remote blueprint for pottery categorization and manipulation in the Northwest.

In the Çatalhöyük ceramics, a technological development involves the shift from straw- or chaff-tempered, cream-burnished and low-fired wares as used during levels XII-IX/VIII to dark-burnished, grit-tempered pottery, occurring from level VIII/VII onwards (*Mellaart 1966.170; Last 1996.120*). The recent publication on the new Çatal-project, including a helpful reanalysis of the old excavation's pottery (*Last 1996.115-120*), strengthens the basic division of the Çatal pottery sequence in at least two stages. The shift in the use of temper is accompanied by a drastic decrease in wall thickness separating levels XII-IX, via VIII-VII, from VIB-II (no material being preserved from levels I-0) (*Last 1996.117, Table 9. 1a*). The repertoire of shapes, roughly composed of bowls and holemouth pots (Fig. 3)[10], varies in relative proportion over the sequence. Holemouths in-

9 The actual mound of Demircihüyük has a thick Early Bronze Age deposit. The 5 m of settlement debris lying untouched below the groundwater table (*Korfmann 1983.25*) most probably dates to the Late Chalcolithic period.

10 The latter of which, according to Mellaart, were used for cooking, as evidenced by "thick layers of soot in which they are covered" (*Mellaart 1962.54*).

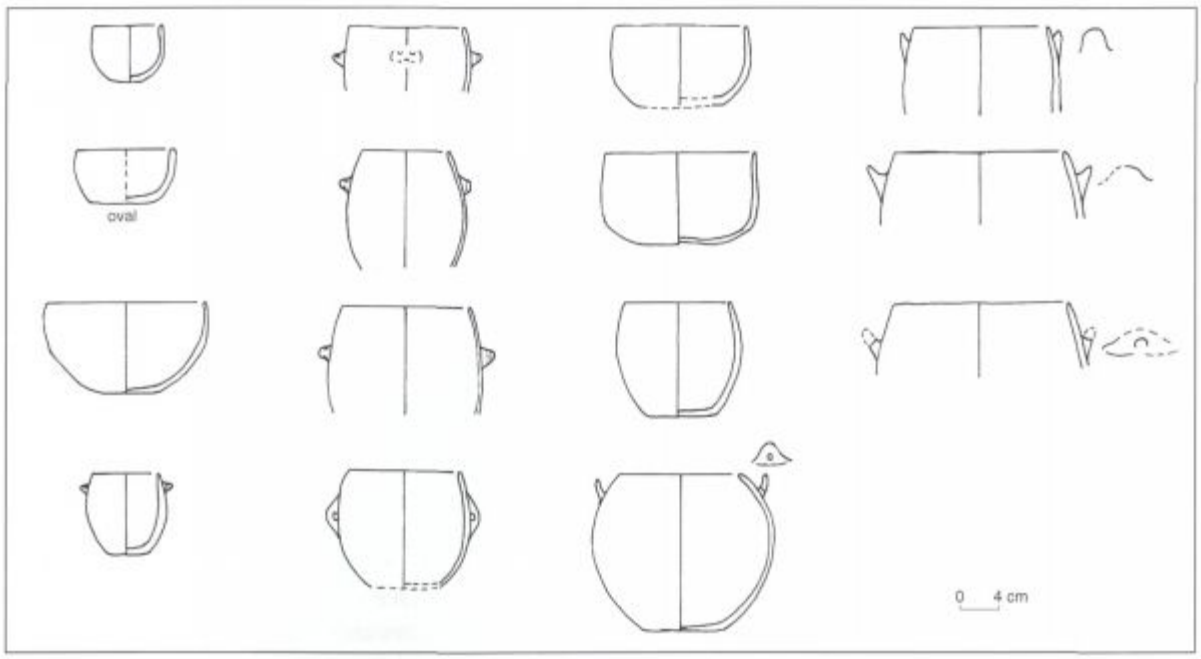

Fig. 3. Çatalhöyük East, levels VIA–II. Plain-burnished bowls and cooking pots (*after Mellaart 1961.162 Fig. 2:14–15, 20–21; 1962.53 Fig. 9:11, 14–18, 20, 22–25*).

crease in quantity from level VIB onward, to decrease dramatically again during levels III–II (*Last 1996.117, Table 9.1a*). The trend toward the final Çatal levels seems to be that both necked pots and open (bowl) forms begin to dominate the assemblage in favour of holemouth pots. Concomitantly, there is a larger amount of small vessels including miniatures in the later levels (*Last 1996.116*). The bowls in the later levels preserve the deep aspect of the earlier ones, but profiles become S-shaped or carinated (*Last 1996.125, Fig. 9.4:3–5*). Handles, not generally attested before level VIB, occur mostly on holemouths. Here, three main types may be distinguished, *viz.* the "rare," vertically-set strap handles (*Last 1996.118, 121, Fig. 9.2:4–5*), horizontal lugs (*Last 1996.127, Fig. 9.5:5*, labelled 'flaring lugs') and vertically-pierced knob handles (*Last 1996.127, Fig. 9.5:2–3*, termed 'straight lugs'). The horizontal lugs abruptly increase in quantity from level VIA over V, in favour of the vertically-pierced knob handles which are not attested later than level IV (*Last 1996.118, Table 9.3*; cf. *Mellaart 1962.54*). The latter type was replaced by a variant (what Last calls 'pointed lugs'), which in level III shares the distribution with the 'flaring lugs.'

If one may trust these figures, based as they are on the random preservation state of the pottery excavated by Mellaart, some facts can be established: a) holemouth pots dominate the sequence during levels VIB–IV; b) handles occur from level VIB onwards and are associated with holemouth vessels; c) horizontal lugs and vertically-pierced knob handles co-occur only during levels VIB–IV; d) vertically-pierced knob handles do not occur after level IV, but have been replaced by 'pointed lugs'.

My conclusion is that the horizontal (or 'flaring') lugs were very characteristic of the later levels at Çatal – from level V–III (no counts available for levels II–0), and further that the vertically-pierced knob handles (or 'straight lugs') and the 'pointed lugs' are both variants belonging to a single class. Conceived thus, the relation vertically-pierced knob handles *vs.* horizontal lugs is on a roughly equal footing from level V onwards (Tab. 3). On this basis, it can be further inferred that – necked pots taking over from holemouths from level III – necked pots also were provided with vertically-pierced knob handles or horizontal lugs.

level	n	*vertically-pierced knob*	*horizontal lugs*
III	(5)	50.0%	50.0%
IV	(22)	40.0%	60.0%
V	(54)	60.0%	40.0%
VIA	(27)	94.7%	5.3%
VIB	(4)	?	?

Tab. 3. Çatalhöyük East, levels VIB–III. Relative frequencies of major handle types (*after Last 1996*).

The pottery assemblages from basal Ilıpınar (and by extension those from the Fikirtepe sites, Menteşe and Demircihüyük) connect in one structural sense with Çatalhöyük East VIB and later. The simultaneous occurrence in the northwestern sites of two major pot categories, morphologically identical and only differentiated through their handle types, and both associated with discrete uses in the cooking process, continues a practice involving cooking and vessel manipulation first established in the Konya Plain during the Çatalhöyük East VIB–0 time frame. Also the shape of the individual handle sets, as well as their location and mutual exclusive occurrence in twos and fours is fully compatible with the Konya region.

While the southeastern origin of basal Ilıpınar's pottery use and technology could be established, other northwestern culture variables do not automatically fit the picture. The early houses at Ilıpınar and Menteşe, if not in the cob-on-post method later to be widely applied in the Balkans, were built with *pisé* walls occasionally reinforced with horizontal wooden balks. While the cob-on-post method seems to have been dictated by climate and available material (cf. *Roodenberg 1993.254; 1995.169*), the pure 'earth' walls with wooden anchors could be distant echoes from the Central Plateau. They certainly contradict the purely environmental determinism apparent from the other construction method. However, the free-standing, single room houses of Ilıpınar strongly contrast with the planned, tightly nucleated settlement plans known from Aşıklı Höyük, Çatalhöyük East or Erbaba.

Simultaneously, neither Fikirtepe's, nor Ilıpınar's lithic industry bear any resemblance to that of the Konya area, with its sophisticated bifacial pressure flaking techniques and highly diversified repertoire (*e.g.*, Çatal East, Çukurkent, Ilıcapınar). Ilıpınar, in this respect, represents a continuation of a local epipalaeolithic tradition analogous to Pendik and Fikirtepe (*J. Roodenberg, pers. comm.*). But, as Roodenberg has stressed, "ties with the Anatolian highlands were preserved through the provision of obsidian, which was imported from the Hasan Dağ area in Central Anatolia" (*Roodenberg 1995.169*; cf. *Bigazzi et al. 1995*).

If a connection between the Konya area and the northwest (Demirci, Menteşe, Ilıpınar, Fikirtepe) on the level of ceramic knowledge involving the transmission of specific concepts (of technological and morphological nature and those concerning use) is accepted, I may put forward the hypothesis that the link between both areas was established somewhere during Çatalhöyük East levels VIA–III. It was during that time slice that holemouth pots dominated the repertoire of Çatal, and both the horizontal lugs and the vertically-pierced knob handles co-occurred in equal proportions, thus providing the category basis on which the earliest pottery of the northwestern sites was established. I do not wish to suggest contemporaneity of Çatal VIA–III and early Ilıpınar. While the establishment of Ilıpınar is rather confidently set at about 6000 cal BC, the ^{14}C dates from Çatalhöyük East levels VIA–II fall within the second half of the seventh millennium cal BC. To be more precise, not one of the dates from this cluster is later than 6200 cal BC at 1σ. Consequently, the possible time range for the spread of concepts on pottery just mentioned from Çatal to the Northwest may be set anywhere between 6500/6400–6300/6200 cal BC.

Recapitulating the evidence, I propose that, despite the wide divergences between the Konya area and the Marmara Basin in settlement pattern, building methods and stone industry, the underlying concepts as apparent in the manufacture, appearance and use of the pottery of both areas relate the Anatolian Northwest to the Central Plateau. This selective parallelism in material culture is then either a function of the observed discrepancy in time between both regions, or else is directly related to the specific material culture variable itself, *viz.* pottery, to its producers and to patterns of tradition and know-how involved. The same selection would, in my view, preclude migration from the Plateau to the Northwest, but it might reflect exogamous marriage practices. Simultaneously, the transmission out of the Plateau of knowledge concerning farming, was possibly another parallel feature of culture contact between Çatal and the mesolithic population further north.

VI.

Evidently, the research base for testing these assumptions is still on a humble level. However, the links between the Konya area and the Anatolian Northwest do not disclaim the observations made by Bittel and Mellaart that the Konya Plain connects directly to the Northwest by way of the Eskişehir Basin, via the İnegöl and Yenişehir Basins to the İznik Lake, and from there to the Marmara (cf. *Bittel and Otto 1939.7; Mellaart 1955.55, 75, Pl. XI*).

The neolithisation of NW Turkey had its roots in the knowledge of methods and techniques concerning farming accumulated in the Konya area for nearly a millennium, and in their subsequent application. At present, there are no immediate reasons to consider the establishment of early farming sites in the Northwest as due to migration - the Konya area was not particularly densely settled in the seventh mill. cal BC. Nor was the eventual abandonment of Çatalhöyük East by the end of the millennium due to deteriorating circumstances, occupation simply being transferred to Çatalhöyük West.

To conclude, it is proposed that the first farming villages in the Eskişehir Basin (Demircihüyük and Fındık Kayabaşı (*Efe 1995*)) were the result of mesolithic culture contact with the Konya area or, more probably, given the large intervening area, were themselves settled from villages lying between the Konya and Eskişehir Basins. The establishment of the three early farming sites in the Yenişehir Basin was linked to the Eskişehir Plain, although presently available data preclude any further assessment. I have further argued that the settlement of Ilıpınar (and possibly a contemporaneous site on the east shore of the İznik Lake) was a deliberate move by farmers from the Yenişehir area, the peculiar commitment to the land as evidenced by the faunal remains from Ilıpınar discrediting a local hunter-gatherer adaptation. Finally, the inverted evidence from the Fikirtepe sites is strongly in favour of a local mesolithic population adopting simultaneously an adapted form of farming and the full use of ceramics. The immediate know-how for both innovations has most probably to be sought in the İznik Lake villages.

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REFERENCES

ANTHONY D. 1990. Migration in archaeology: the baby and the bathwater. *American Anthropologist 92: 895-914.*

BIGAZZI G., ODDONE M. and YEGINGIL Z. 1995. A provenance study of obsidian artifacts from Ilıpınar. In Roodenberg J. (ed.), *The Ilıpınar excavations I. Five seasons of fieldwork in NW Anatolia, 1987-91: 143-150.*

BITTEL K. 1969/1970. Bemerkungen über die prähistorische Ansiedlung auf dem Fikirtepe bei Kadıköy (İstanbul). *Istanbuler Mitteilungen 19-20: 1-19.*

BITTEL K. and OTTO H. 1939. *Demirci Hüyük. Eine vorgeschichtliche Siedlung an der phrygisch-bithynischen Grenze. Bericht über die Ergebnisse der Grabung von 1937.* Istanbul.

BUITENHUIS H. 1989/1990. [Investigations at Ilıpınar] The faunal remains. *Anatolica 16: 111-119.*

1995. The faunal remains. In Roodenberg J. (ed.), *The Ilıpınar excavations I. Five seasons of fieldwork in NW Anatolia, 1987-91: 151-156.*

EFE T. 1990. An inland Anatolian site with pre-Vinča elements: Orman Fidanlığı, Eskişehir. A re-examination of Balkan-Anatolian connections in the fifth millennium BC. *Germania 68: 67-113.*

1992. 1990 yılında Kütahya, Bilecik ve Eskişehir illerinde yapılan yüzey araştırmaları. *Araştırma Sonuçları Toplantısı 9: 561-583.*

1993. Chalcolithic pottery from the mounds Aslanapa (Kütahya) and Kınık (Bilecik). *Anatolica 19: 19-31.*

1995. İç Batı Anadolu'da iki neolitik yerleşme: Fındık Kayabaşı ve Akmakça. In Erkanal, A. *et al.* (eds.), *In memoriam: İ. Metin Akyurt Bahattin devam anı kıtabı. Eski Yakın Doğu kültürleri üzerine incelemeler: 105-114.*

FRENCH D. 1967. Prehistoric sites in Northwest Anatolia I. The İznik area. *Anatolian Studies 17: 49-100.*

GATSOV I. and ÖZDOĞAN M. 1994. Some epi-palaeolithic sites from NW Turkey. *Anatolica 20: 97-120.*

HARMANKAYA S. 1983. Pendik kazısı 1981. *Kazı Sonuçları Toplantısı 4: 25-30.*

KORFMANN M. 1983. *Demircihüyük. Die Ergebnisse der Ausgrabungen 1975-1978. Band I. Architektur, Stratigraphie und Befunde.* Mainz.

LAST J. 1996. Surface pottery at Çatalhöyük. In Hodder I. (ed.), *On the surface: Çatalhöyük 1993-95: 115-171.*

MELLAART J. 1955. Some prehistoric sites in North-Western Anatolia. *Istanbuler Mitteilungen 6: 53-88.*

1961. Early cultures of the South Anatolian plateau. *Anatolian Studies 11: 159-184.*

1962. Excavations at Çatal Hüyük. First preliminary report, 1961. *Anatolian Studies 12: 41-65.*

1966. Excavations at Çatal Hüyük, 1965. *Anatolian Studies 16: 165-191.*

1967. Anatolia before *c.* 4000 BC and *c.* 2300-1750 BC. In *Cambridge Ancient History. Vol. I, part 1: 304-326.*

ÖZDOĞAN M. 1979. *Fikirtepe.* [İstanbul University, unpublished PhD thesis]. İstanbul.

1982. Doğu Marmara ve Trakya bölgesi araştırmaları. *Türk Arkeoloji Dergisi 26 (1): 37-61.*

1983. Pendik: a neolithic site of Fikirtepe culture in the Marmara region. In Boehmer R., Hauptmann H. (eds.), *Beiträge zur Altertumskunde Kleinasiens. Festschrift für Kurt Bittel: 401-411.*

1985. A surface survey for prehistoric and early historic sites in Northwestern Turkey. *National Geographic Research Reports - 1979 Projects: 517-541.*

1989. Neolithic cultures of Northwestern Turkey. A general appraisal of the evidence and some considerations. In Bökönyi S., Raczky P. (eds.), *Neolithic of Southeastern Europe and its Near Eastern connections. International conference 1987, Szolnok-Szeged: 201-215.*

1991. 1989 yılı Marmara bölgesi araştırmaları ve Toptepe kazısı. *Kazı Sonuçları Toplantısı 12 (I): 345-376.*

1997. The beginning of neolithic economies in Southeastern Europe. An Anatolian perspective. *Journal of European Archaeology 5 (2): 1-33.*

ÖZDOĞAN M., MIYAKE Y. and ÖZBAŞARAN DEDE N. 1991. An interim report on excavations at Yarımburgaz and Toptepe, Eastern Thrace. *Anatolica 17: 59-121.*

PASİNLİ A., UZUNOĞLU E., ATAKAN N., GİRGİN Ç. and SOYSAL M. 1994. Pendik kurtarma kazısı. *Müze Kurtarma Kazıları Semineri 4: 147-163.*

ROODENBERG J. 1993. Ilıpınar X to VI: links and chronology. *Anatolica 19: 251-267.*

1995. Chronologies and conclusions. In Roodenberg J. (ed.), *The Ilıpınar excavations I. Five seasons of fieldwork in NW Anatolia, 1987-91: 167-174.*

(ed.) 1995. *The Ilıpınar excavations I. Five seasons of fieldwork in NW Anatolia, 1987-91.* Leiden.

1999. Investigations at Menteşe Höyük in the Yenişehir Basin (1996-97). *Anatolica 25: 21-36.*

ROODENBERG J., THISSEN L. and BUITENHUIS H. 1989/1990. Preliminary report on the archaeological investigations at Ilıpınar in NW Anatolia. *Anatolica 16: 61-144.*

SEEHER J. 1987. *Demircihüyük III. Die Keramik I.* Mainz.

THISSEN L. 1999. A chronological framework for the neolithisation of the Southern Balkans. In Hiller S., Nikolov V. (eds.), *Tell Karanovo 1947-1997, internationales Symposium. Das Neolithikum in Südost-Europa. Karanovo 1997.*

ZEIST W. Van and WATERBOLK-Van ROOIJEN W. 1995. Floral remains from late-neolithic Ilıpınar. In Roodenberg J. (ed.), *The Ilıpınar excavations I. Five seasons of fieldwork in NW Anatolia, 1987-91: 159-166.*

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Documenta Praehistorica XXVI

Places that created time in the Danube Gorges and beyond, c. 9000–5500 BC

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ABSTRACT – *The history of the region of the central Balkans and south east Pannonia is reviewed over the period of c. 9000–5500 cal BC. The rich and exciting evidence of the Danube Gorges region (the Djerdap) is presented in relation to the ecological setting and Early/Middle Neolithic settlement evidence of the wider region. It is suggested that the nature of these first Neolithic societies itself provides answers to the question of their origins, despite the recurrent invisibility of extensive Mesolithic occupation in Southeast Europe as a whole.*

IZVLEČEK – *V članku pregledamo zgodovino osrednjega Balkana in jugovzhodne Panonije v obdobju med približno 9000 in 5500 kalibrirano BC. Predstavimo bogate in vznemirljive najdbe Djerdapa, jih umestimo v okolje in jih povežemo z zgodnje/srednje-neolitskimi naselbinami v širši regiji. Menimo, da narava teh prvih neolitskih družb že sama po sebi odgovarja na vprašanje o njihovem izvoru, kljub temu da ekstenzivna mezolitska poselitev v jugovzhodni Evropi kot celoti ni vidna.*

KEY WORDS – *Danube Gorges; Mesolithic; Neolithic; settlement; pottery; conceptualisation of death*

Mankind feeds on itself more and more, and if it does not vanish or return to the Stone Age it will eat itself in ever-greater portions. This means that anywhere, in time and space, where people expresses their creativity, this thing that they did would explore more steadily and even emotionally overwhelm as their own all who belong to the human species. This kind of universalisation blurs the difference between cultural centres... and instead of the notion of imitation, introduces the notion of mutual exchange and interdependence.

Czeslaw Milosz, *Kontynenty* (*1986.85*)
(translated by the author)

INTRODUCTION

A step towards writing the local histories of whole regions and particular histories of archaeological sites together with all the 'folklore' accompanying any excavation, subsequent analyses and publication might offer a means for a proper understanding of what motivated the interpretations that have been offered. Without providing here a complete and detailed history, as the title might misleadingly suggest, I would like to offer the possibility of a comprehensive guide to the multidimensional nature of accumulated data and ideas for the case study considered. Thus, deposited layers of thoughts and disputes, long conversations between immediate participants and their listeners, and imaginative loops, along with the striking materiality of dusty boxes and excavated objects, and the specific metaphorical reality of photographs and plans (*Tilley 1999.11*) need a full involvement and a phenomenological exercise (*cf. Tilley 1994.74*).

There are two major issues that I want to raise here. The first is intended to set straight the record of Mesolithic and Neolithic sequences in the Danube Gorges region of Southeast Europe, at least in several aspects. Some of the questions thus posed are eventually directed to answering the question of the nature and reasons for changes in material culture and the introduction of a 'Neolithic package'. A necessary reminder is that all these changes most probably echoed moves in the wider world, with various kinds of communicative route and mechanism. Local his-

tories are inscribed only with the background of these grand narrative moves. In this sense, the variety of expressiveness of the same phenomenon and specificity of any particular case play equal roles in reaching an understanding. Although in what follows I use labelling such as 'Mesolithic' and 'Neolithic' extensively, this practice finds its justification only as a kind of heuristic device necessary to explain how currently formulated conceptual frameworks operate. However, I hope to show that close-up, contextual windows in the presentation of the case study that follows make it impossible to sustain these categories as such, and that at least an awareness of a need for their reconstruction should be anticipated.

Secondly, it seems necessary to integrate the Early Holocene archaeological record in the area of the Danube Gorges and the central Balkans into wider thinking on the specific historical period, on origins and reasons for the creation of features and artefacts, diachronic changes and the creation of landscapes; all these, along with issues of perceptions of time and its 'creation', as a part of fundamental ontological processes of being-in-the-world and dwelling-in-the-world, in Heidegger's words (*Heidegger 1962.78*).

The intertwining of these themes is seen as necessary if a fresh understanding is to be reached, and if the question of the places that created time, as yet another among the 'grand realities' (*Geertz 1973 [1993].21*), is to be approached in a proper way, I feel close to Clifford Geertz when he says, "I grow uncomfortable when I get too far away from the immediacies of social life" (*ibid. vi*). It seems that the immediacies of the archaeological record are often too easily neglected and left to their antiquarian melancholy. Thus, the created tokens of theoretical debates have been models of change that shrink material evidence as necessary; long theoretical exposures with nice, neat presentations of grand realities, or long critical accounts with archaeological case studies merely appended, often complaining and awaiting a better quality of and the resolution of empirical data to support theoretically laid foundations. It remains to be seen how this kind of habit is also reflected in the particular case study discussed here, which shows that this particular kind of politics of intellectual manufacture to a great extent neglects the very raw material of materialised and patterned human action, whose primacy should be vital in our accounts.

THE DANUBE GORGES, C. 8500–5500 BC

We move to the Danube Gorges (Figs. 1, 2) as the point of departure for this account, an areas of Southeast Europe where continuities in the mater-

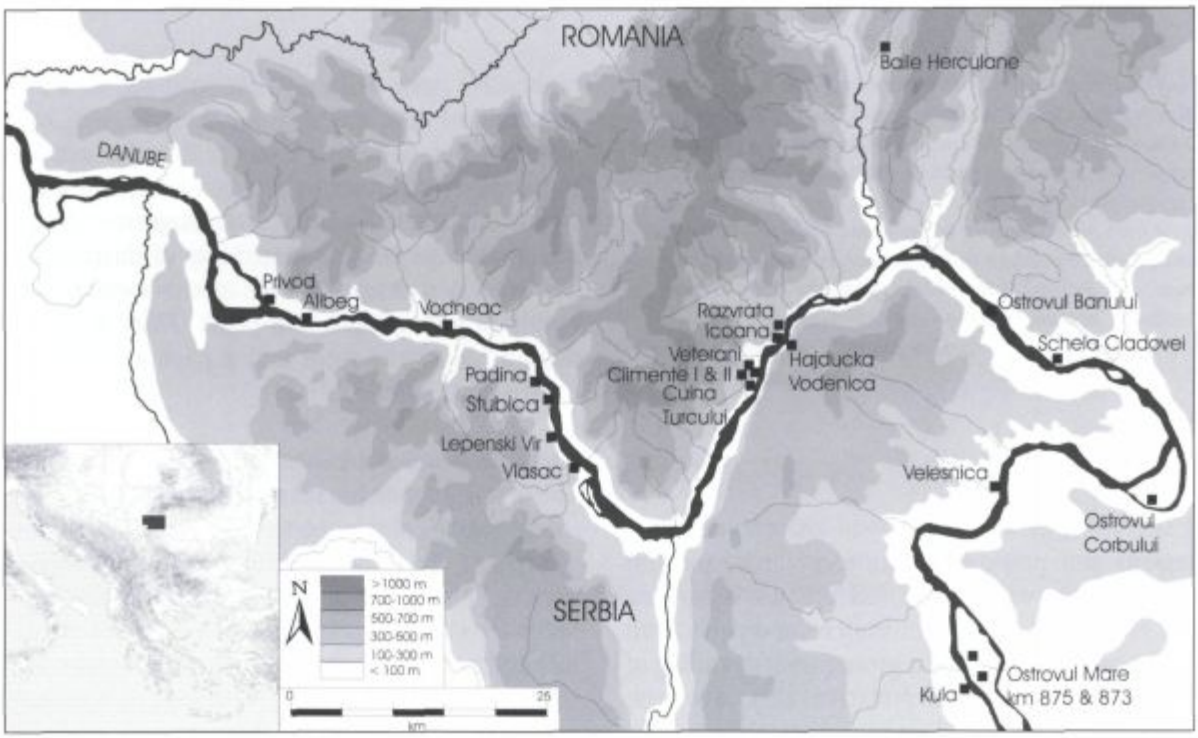


Fig. 1. Map of the Danube Gorges region showing sites with Early Holocene sequences (drawn by D. Borić and V. Novaković).

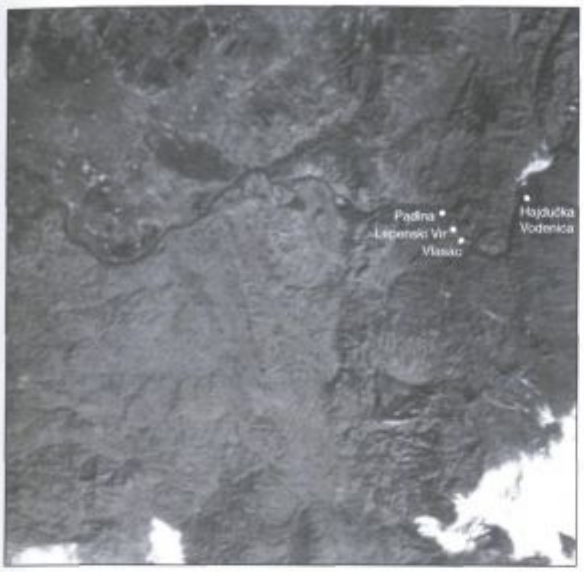


Fig. 2. Satellite image of the Danube Gorges region and eastern Serbia (courtesy of P. Popović).

ial record of Early Holocene sequences are abundant and complex. Specific geological development (*Marković-Marjanović 1978.11 sq.*) created the landscape: the Danube runs through narrow gorges, with steep sides that in many places rise vertically from the river, sometimes reaching a height of 500 m (Fig. 3). The drama of the cliffs and the water, and the mystery of coves and cliffs above, attract the attention. Sites with traces of human occupation were discovered in several gorges where the Danube had cut a narrow and winding route through the southern fringes of the Carpathian Mountains. After its gentle and slow run through the Pannonian Plain, the river speeds up, passing through narrow passages; in the narrowest, there are quartz-porphyry cliffs, and also deposits of greenish slate, Jurassic sandstones and limestones, gabbro, crystalline rocks and other deposits, rising sheer from the waters. In the gorge known as Gospodjin Vir (The Lady's Whirlpool) the river flows between rocks that rise from the riverbed to the surface; the power of the waters has eroded the rocks into the shape of whirlpool cauldrons, sometimes almost 30 m deep. Similar features are observed in the Lower Gorges, especially in one called Kazan (The Cauldron) (Fig. 3). The constant erosion of the banks and constant accumulation, has created several types of fluvial terrace, frequently narrow and rocky, in different periods, from the Pliocene to the Holocene. In the course of the Quaternary, some of the coves sedimented two types of loess-sandy covers of different age, blown by the south-easterly wind. In some places these eolian sediments are deposited in natural pockets protected by rocky ridges, on fluvial terraces or, as in the case of the archaeological site of Padina, in a giant fossil whirlpool at Sector III of this site, making an especially interesting feature (*ibid. 15, Fig. 5*). The older eolian sediments cover scree that eroded in the Pleistocene, and were found on a higher terrace (39/95 m above sea level), being from the Late Pleistocene. The younger sediments (from 1 to 10 m thick), consisting of light yellow sandy loess, cover the lowermost terraces (which in particular demonstrates the low water level of the Danube at the time of their deposition), and their formation falls into the Younger Dryas (*ibid. 14*). Material eroded from the upper mountain slopes – scree of more recent origin and its accumulation (of several metres) in some places – actually protected the archaeological deposits found on this kind of surface from slow, down-slope erosion. At sites without considerable vegetation cover, down-slope movement of scree can be observed even today (*ibid. 13*). On the other hand, concerning the extent of erosion by the river (with fluctuating rates)[1], many of the sites were discovered directly as a consequence profiles being exposed by the river's undercutting, which eroded their lowermost parts.

Some of the features of the landscape have often been cited as pointing to the isolation and refugial character of the region. However, it is here that we immediately we encounter the first unclear and sometimes misleadingly presented point. To what

Fig. 3. Passage through the Lower Gorge today – the narrowest route in the region (photo: D. Borić).

1 It seems that the regime of the Danube's water levels was drastically changing especially during the last two centuries, i.e. since the beginning of melioration works in the Pannonian plains that drained out massive annual accumulation of underground waters all over the Carpathian Basin (see Fig. 25) directing these into the Danube and its tributaries. This probably caused sufficient rise of the water level of the Danube, and as a consequence increased further erosion of its banks.

extent is it possible to speak of the isolation of settlements uncovered in these gorges? Many smaller or larger river valleys and streams of the Danube's tributaries intersect cliffs along around 130 km of the Danube's passage through the gorges (Fig. 4). The region of the 'hinterlands' is thus accessible, and this fact needs to be appreciated. Moreover, a much wider region is represented in the settlement record of the Gorges' sites, as will be more clearly shown below.

Fig. 4. View from Vlasac (photo: Centre for Archaeological Research, Belgrade).

Previous views and ideas – a selected guide

A number of settlements, linearly aligned along the Danube Gorges' banks and sited in small coves, with Late Palaeolithic, Mesolithic (also referred to as Epi-Palaeolithic) and Early Neolithic layers and features, was excavated in the late 1960's and early 1970's (*for a review of the history of research, see Radovanović 1996a.3–8*). All these were rescue excavations conducted to save sites along the banks of the river from an inevitable rise in water levels (up to 30 m) caused by the building of a hydroelectric dam.

Evidence of houses, burials, and sculptured art was interpreted as representing 'complex' hunter-gatherer groups on the basis of frequent analogies, in terms of settlement pattern, supposed reduced mobility, and one of the subsistence staples being an anadromous species of Acipenseridae fish, found in the ethnographic example of hunter-gatherer groups of the North-West American coast.

There has been a continuous attempt to define a classic version of the phenomenon specific to the sites in the Danube Gorges (primarily known by houses, burials and sculpted boulders) as mainly 'Mesolithic' (*e.g., Srejović 1966; 1967; 1968a; 1968b; 1969a; 1969b; 1969c; 1969d; 1972; 1989; Radovanović 1992; 1996a; 1997; Radovanović and Voytek 1997*) or primarily 'Neolithic' (*Jovanović 1968a; 1968b; 1969a; 1969b; 1971; 1974a; 1974b; 1975; 1987; see also Milisauskas 1978.96*). For over thirty years this argument has divided researchers in the area (*cf. Radovanović 1996a. 8–12*). The two main reasons for this situation are the low level of publishing, not allowing all the evidence to be taken into account and, presumably, a very personal struggle between excavators for the primacies of their own respective interpretations of the evidence encountered. This kind of situation encourages continuing controversy in attempts to explain how trapezoidal floor plans, with elaborate rectangular hearth constructions and the corresponding absolute dating of the two major sites – Lepenski Vir and Padina – have been presented as in the first case (Lepenski Vir) lacking Early Neolithic pottery and other Early Neolithic material culture (such as yellow-spotted 'Balkan' flint and polished stone axes, to mention only two), while at the other site (Padina), associations of this kind of material culture with 'classic' buildings have been unquestionably confirmed.

There also has been little doubt among researchers, with few exceptions (*Chapman 1989; 1992; Nandris 1968; 1971; Whittle 1996; 1998*), that well-known features at these sites clearly represent cases of sedentary settlements of "increasingly complex" hunter-gatherers (*e.g., Srejović 1969; 1972; Srejović and Letica 1979; Whittle 1985; Radovanović 1992; 1996a; Radovanovič and Voytek 1997*), or rather belong to an amalgam of incoming farmers and surviving local fisher folk (*the 'Neolithic' perspective of Jovanović [1975; 1987]*). For some of the authors, these groups, in the later stages of their development, reacted to emergent Early Neolithic food-producing groups, reluctantly accepting some of the Neolithic paraphernalia (*e.g. Radovanović 1992; 1996a; 1996b; Radovanović and Voytek 1997; Voytek and Tringham 1989*). Especially considering the issue of supposedly appearing/increasing sedentism, continuing studies of animal bones associated with a number of different contexts from these sites, involving cementum increment analyses on red deer teeth, will, it is to be hoped, make these issues clear (*Borić in preparation; Dimitrijević and Borić in preparation*).

In a recent synthesis of previous research and analyses in the Danube Gorges by Ivana Radovanović, the emphasis is on the 'Mesolithic' (economic) aspects of these settlements (*e.g., Radovanović 1992; 1996a; 1997*). Radovanović rightly points out the long continuities in the creation of most of the sites. How-

ever, the state of publishing, even in this synthetic account, obscures a final conclusion, and it remains unclear to what extent Early Neolithic material culture should be associated with certain stratigraphic contexts, and especially what role it should play in connection with some of the best-known features, such as sculpted boulders and elaborate houses/shrines. Also, this author sometimes uses an over-functional argument in an interpretation of a large number of uncovered burials, connecting them with a concept of formal disposal areas and assigning to them primarily the function of territorial markers connected with the control of resources in a certain territory, and with the ideological integration of communities in the Danube Gorges, and also in other European Mesolithic contexts (*Radovanović 1992; 1996a.14–15, 295; 1994*). This argument was strongly formulated to underline the conceptual dichotomy between what should be defined as Mesolithic in contrast to Neolithic.

Subsequently, it has been suggested that these 'increasingly complex' societies of hunter-gatherers, with incipient stages of sedentism and storage facilities, faced a new challenge in the appearance of Neolithic material culture through contacts with surrounding (incoming?) Early Neolithic populations, thus engaging in the process of exchange, acquiring/importing new forms of material culture, and also new subsistence staples, such as domesticates (*Voytek and Tringham 1989; Radovanović 1996b; Radovanović and Voytek 1997*). Terms often used in this kind of model are 'dominance', 'resistance', 'control', 'power' and 'prestige', all implying the notion of an ideology which serves to manipulate, restricting human actions by control over knowledge, reproduction, or a landscape (*Radovanović and Voytek 1997.28; also Tilley 1994. 26, 208*). Thus this view sees the existence of organised systems with the domination of experience and knowledge of landscapes (*Tilley 1994.26*) as "harnessed to legitimise patterns of social control and relating to restricting access to knowledge" (*ibid. 208*). Along this line, Radovanović and Voytek suggest (*but see also Srejović 1969*) that in the Danube Gorges "...an ideology which promotes power over a landscape masks control over people by placing it in realms that are further removed from the human actors" (*1997.28*). Thus, power over a landscape is seen only as serving to control people, as mystification by a 'small number of cynical men' (*Althusser 1971.37; cf. Treherne 1995.115*). However, a different conception of ideology should be anticipated here (*see below; also Treherne 1995.113–117*).

Some notions similar to those just mentioned concerning the introduction of Early Neolithic material culture to the Danube Gorges have been expressed by John Chapman (*1989; 1992.111–113*). He introduced the term 'arenas of social power' in order to explain the meaning and reasons for the creation of specific sites and the material record in Southeast Europe (*Chapman 1992.72–75*). In doing this he uses the ideas of Mann (*1986*), suggesting that certain places were chosen on the bases of their 'biographical suitability' for certain activities, where human actors use and manipulate power that originates from these places. However, again through the concept of power over ancestors, landscapes, imagery etc. (*Chapman 1992.116*), it is presented as an abstract force that lies behind human motives and actions. In this sense, the concept suggested by this author also lacks multidimensionality when confronted with the archaeological record. Instead of the possibility of a dense and detailed account of the infinite variations of human behaviour, this is a route towards reducing human reality to a few 'crucial' components. In another account on the beginnings of farming in Southeast Europe he employs the argument of the creation of 'arenas of social power', maintaining that "...the theme of social power in the Iron Gates gorge is central to these reconstruction of forager–farmer interactions" (*Chapman 1992.115; 1994.140*). The theme of interaction and resistance to farming is exploited for the region (*also Chapman 1992 passim*). Also, in his more recent account, Chapman lists the possible reasons for the introduction of farming, such as the accumulation of possessions, increased economic intensification, resource competition, increased family size and place-based world-views (*Chapman 1994.136*). Again the intention is to reduce things to a few 'basic' components, so the whole explanatory process eventually leads only further away from interpretative possibilities, subsuming data under already-knowns. On the other hand, in challenging ideas about established sedentism, especially in connection with the (changing) perception of time (*Chapman 1992.76 sq.*), this author has opened up some interesting interpretative possibilities.

In *The Domestication of Europe*, Ian Hodder (*1990*) claims the existence of common underlying structures in the narrative and 'real' world of the Eastern Mediterranean before and through the adoption of Neolithic material culture, as well as the subsequent configurations that these underlying structures took in different local contexts throughout Europe. He defined the competing structure through the dialec-

tic interplay of *domus* and *agrios* stories (*Hodder 1993.269*), which specify sets of rules and practices with shifting emphases. This scheme was then contrasted with the material evidence of the Eastern Mediterranean and European Neolithic. For Hodder, the case of the Danube Gorges and, in particular, the site of Lepenski Vir (*Hodder 1990.21–31*) stands among points of departure where the stories were most elaborately expressed. His remark that, on the basis of the publications about this site, one has the impression that the excavated houses form a scene for some drama (*ibid. 29*), where material objects and houses, together with graves and carved boulders, deliberately take particular relations, appears strikingly true. He confronts the position of hearths and graves with the house shapes and spatial relations of portable objects inside them, and the use of human bones as active tools in expressing meanings of domestication and control of the wild and death (agrios) by placing the dead beneath house floors, with a strong emphasis on the nurturing aspect (domus) of houses/shrines and hearths. This exciting and inspiring account, however, falls short on important problems concerning the stratigraphic sequencing of houses and graves, lacking the wider contextual picture of Lepenski Vir formed in the context of its local regional history. Also, although very useful for a comprehensive view from the standpoint of large-scale movements, on the theme of the creation/formulation/spread of these two competing narratives across Eurasia, there is almost no mention of the possibilities, mechanisms and ways in which ideas and values spread, in the construction of a new grand narrative or worldview at this time. One of the important assumptions put forward in this account is that "...the agricultural revolution may have been an epiphenomenon of deeper changes" (*ibid. 31*).

Recently, two main models of the neolithisation process in Southeast Europe and Europe have emerged which strongly dominate current debate. The first is motivated by research into the genetic mapping of present-day Europe which, in the opinion of its followers, finds enough evidence in the archaeological record to support the idea of the spread of the 'Neolithic package' as a quick and smooth process in the form of demic diffusion and population infiltration/replacement (*Ammerman and Cavalli-Sforza 1973*). A view of the spread of the Indo-European language at this time is one of the most important elements in this model (*Renfrew 1987; for the most up-dated views, with a strong emphasis on the necessity for a consensus on this issue, see the proceedings of the round table The Neolithic Transition in Europe: Looking Back – Looking Forward held in Venice, 29–31 October 1998*). A second model, partially standing in opposition to the first, and mainly promoted by Marek Zvelebil, has become known as the "availability model" (*Zvelebil 1986*). This model allows a certain degree of colonisation for Southeast Europe and the necessity for the adoption of farming, with a high level of materials and information available among foragers and farmers, together with the establishing of new breeding networks (*Zvelebil 1994[1995].116–120*). However, one of the most important points is that local populations, i.e. foragers, took an active part in this process, in contrast to the view of demic diffusionists that the change was largely introduced/diffused by the spread of farming communities. The availability model transposes the idea of existing frontiers between foragers and farmers in other parts of Europe and their coexistence for certain periods of time, and suggests that it is possible to see the same kind of process in the Danube Gorges (*ibid.119–120*). This is also close to the idea suggested by Radovanović (*1996b*). Although this kind of model might work in some other parts of Europe, it is not necessarily applicable to Southeast European contexts. It seems that the scale of the whole process is lost again. Created entities have become foragers and farmers, with clear-cut boundaries between the two. It does not appear so easy to qualify the first Neolithic communities across the Balkans with such a loose designation as 'farmers', as I shall try to show later. On the other hand, it is not clear why we would assume that the foragers of the Danube Gorges, or any other region for that matter, might have viewed themselves or been viewed as "culturally and economically inferior to farmers" (*Zvelebil 1994[1995].116*).

It seems that both predominant models attempt some sort of uniform and often straightforward explanation of changes, probably spending too much time on the grand scale. Hence the recurrent problem of running into the 'senseless side of history' (*Ricoeur 1984.131, following Whitehead*), where large-scale historical phenomena and social processes exist on an abstract scale too distant from the acts of individuals and single events. At the same time, these models clearly show our main metanarrative fascinations here: talk of origins, continuities and identities, with a slightly different emphasis.

Yet another recent view of the beginnings of the Neolithic in Southeast Europe, which also concerns the Danube Gorges region to some extent, is pre-

sented by Alasdair Whittle (*1996; 1998*). In this account there is an important shift from some well-rooted conceptual frameworks towards a deconstruction of the most common assumptions of the Neolithic metanarrative, such as the beginnings of sedentary life and farming, and towards understanding what the whole change was about. Also, Whittle allows a much greater role in the neolithisation process to local forager groups. For the Danube Gorges region he places an important emphasis on the correct sequencing of phases represented in the settlement record of the region (*Whittle 1996. 24–29, 44–46*). Writing of the Mesolithic-Neolithic dichotomy in other European contexts he interestingly advances the assumption that "the difference may be more apparent than real" (*ibid. 196*).

These are only some of the previous perspectives on the Gorges sites that receive some response in the following discussion. My intention now is to go beyond them, inevitably challenging their validity along the way.

There are four points that deserve particular attention here. Firstly, as the problem of architectural phasing and pottery association at Lepenski Vir remains unsolved, it is still unclear how this site should be designated: belonging to 'pure' hunter-gatherers, with no pottery, as suggested by some, or in contrast, there is the possibility that the abundant material culture with Early Neolithic attributes is associated with most of the 'classic' trapezoidal houses. Secondly, the quantities of pottery found at the Padina site are enormous, clearly associated with dugouts, creating the same trapezoidal house floors and hearth constructions as can be seen at Lepenski Vir. This situation greatly obscures the previously mentioned interpretation of the pottery at these sites as originating through an exchange process (*Voytek and Tringham 1989*), or the idea that the first pottery could have been a prestige item (*Radovanović 1996a.43*). Thirdly, these architectural features are often instantly equated and used as proof of the presence of sedentary hunter-gather-fishers, thus completely neglecting the necessity for a clear evaluation of the many phases represented in the long term build-up of these settlements and their features. In fact, older features such as stone and some rectangular hearth constructions and graves were probably used and 'recognised' in various activities during later phases. Lastly, a lack of radiocarbon dates greatly obscures any diachronic resolution of our scale in connection to phasing particular features at these sites.

SETTLEMENT RECORD: STORIES OF LEPENSKI VIR AND PADINA

In several accounts the excavator of Lepenski Vir reported the appearance of pottery in association with Lepenski Vir I and II phase buildings (Fig. 5), interpreting pottery here as intrusions from the upper Early Neolithic layer. Thus, fragments of monochrome pottery were reported between some house floors of superimposed buildings (e.g. buildings 35 and 36 or 23 and 18) (*Srejović 1968c.86; 1969.153*). These floors at Lepenski Vir were made of a special kind of hard limestone plaster, with a thin burnished surface coat, varying from red to white, which exhibited a high degree of hardness and calcification with organic residues such as bones (*cf. Ney 1971*). Although it is may be said that in a few instances some kinds of intrusion might have appeared, it is interesting to note Srejović's opinion that "only" 15 houses of Lepenski Vir phases Ic, Id, Ie and II, representing Mesolithic levels in his division, "contained some sherds of monochrome ware" (*Srejović 1968a.*

Fig. 5. Lepenski Vir I–II, excavated houses (photo: Centre for Archaeological Research, Belgrade).

24); these are houses 1, 4, 15, 16, 19, 20, 24, 26, 28, 32, 35, 37, 46, 47 and 54 (*Srejović 1969a.153*). Also, larger fragments of the bases and walls of semi-globular bowls were found in the front of houses of Lepenski Vir, namely in buildings 19, 24 and 47 (*ibid. 154*). The same kind of pattern of spatial distribution of whole pots appears as found in some of the houses at the Padina site (houses 7, 15 or 18, Sector III) (*Jovanović 1969b.30; 1987*). In Srejović's opinion these whole pots at the rear of houses at Lepenski Vir belong to layer IIIa–b, i.e. Early Neolithic settlement, and are not connected to the trapezoidal houses as at Padina.

To try to clarify this possibly confusing account I shall primarily refer to finds from the site of Padina, which in this context appear strikingly important. Also, at Padina it is possible to better understand how building activity was organised in the first place, i.e. in what way the loess slope of the cove in Sector III was approached in building classic houses. This important site contains four different sectors (i.e. coves created by the Danube's activity) divided only by bedrock ridges. It seems that excavated deposits from these coves, for general orientation, contain very early and also the latest deposits of the Danube Gorges sequence. But I shall return later to a more detailed stratigraphic sequence of different coves at this site. For the moment I shall concentrate on Sector III of Padina (Fig. 6), where the same kind of architecture and similarly organised settlement deposits as at Lepenski Vir were excavated. For the moment, the most importance difference is that the smaller number of houses and floors at Padina are made of a less durable hard coating of burnt earth.

However, a number of features, such as the placement of floors in trapezoidal houses on the same kind of geologically formed loess sandy surface (*Brünnacker 1971; Marković-Marjanović 1979.14, see above*), their proximity (2 hours walking distance along the Danube), the basic shape of the houses, the position of hearths, and elements of hearth constructions, are all overwhelmingly similar to Lepenski Vir. Also, the series of absolute dates from these two sites (*see Radovanović 1996a.359–360; Gob 1990.196–198; Gröningen Database; Bonsall et al. 1996; 1997*) which gave consistently corresponding results in dating the charcoal from hearth constructions and timber found on the floors of the houses (see Fig. 7) confirms the contemporary coexistence of these two sites. It is reasonable to expect that a full publication of stratigraphic contexts and all finds from the site of Lepenski Vir, reportedly including over 200 000 Early Neolithic potsherds (*Srejović 1969a.166*) with their exact location, would surely make the whole issue clearer. However, growing arguments concerning the nature of this important site and the whole phenomenon speak of a need to clarify the problem *now*.

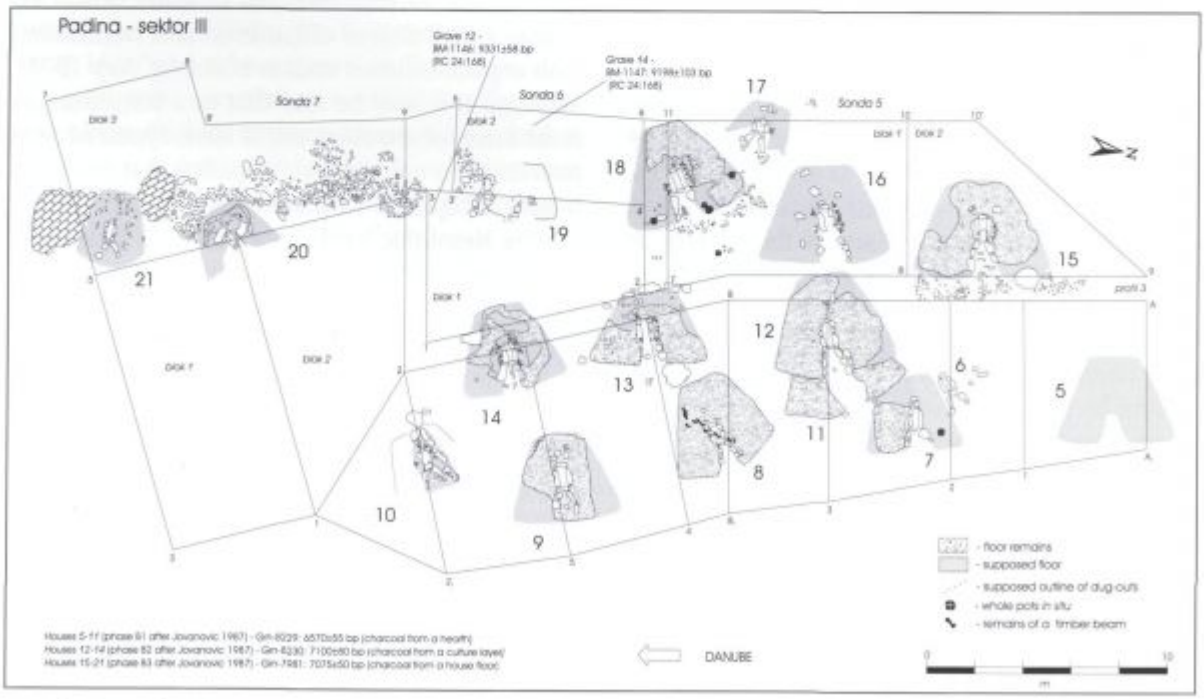


Fig. 6. Plan of settlement at Sector III of Padina – location of the stone construction of the necropolis and trapezoidal houses (redrawn by. D. Borić and V. Novaković according to an original plan courtesy of B. Jovanović).

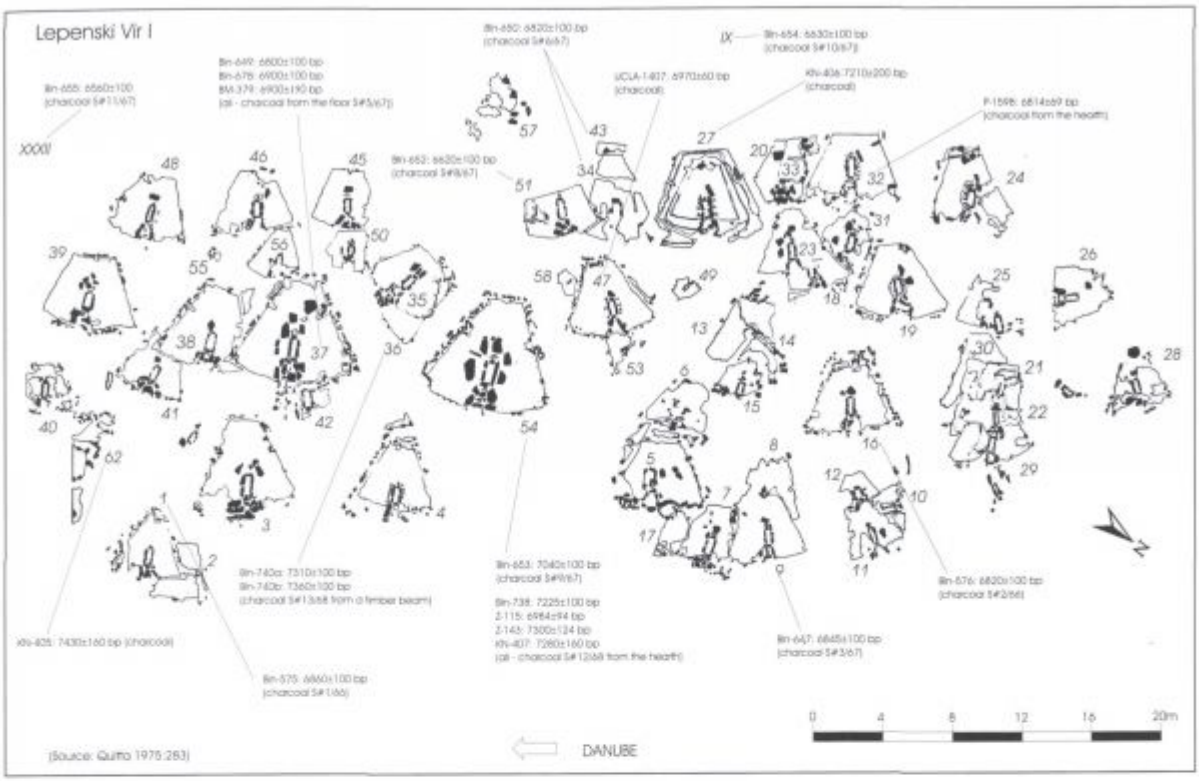


Fig. 7. Lepenski Vir – plan of settlement with locations and provenience of radiocarbon dates from and beneath house floors (adopted after Srejović 1969c.plan).

As I will try to show below, the whole issue can be contextualized through a comparison between similar features at Padina and Lepenski Vir, as well as other sites in the Gorges, that might yield some convincing clues for our reasoning[2]. Despite certain (important) differences created by their respective life stories, these two sites share all the main characteristics of this specific development in the Gorges.

Pottery and architecture

To begin with pottery, most often the key artefactual issue in debates over Mesolithic-Neolithic labeling, I have already indicated that at Padina the excavator reported a stratigraphic connection between classic houses with trapezoidal plans and Early Neolithic pottery. It seems crucial to attend to some of the features reported by the excavator and to attempt an explanation of some of the ambiguities that also appear here in interpreting the stratigraphic sequence.

The phase represented by trapezoidal buildings and elaborate hearth constructions is represented at sectors I and III, which is reported by the excavator to have a clear association of pottery with hearths and house floors (*Jovanović 1968a; 1968b.T. III, Fig. 4; 1969a; 1969b.T. X, Figs. 1–2, XII, Fig. 3; 1971; 1974a; 1974b; 1987.Fig. 6–8*). Complete pots found *in situ* on the floor and inside the hearth construction on the plan and photographs of House 18 (Figs. 8, 9), together with numerous potsherds, are hard to explain as intrusions from an upper "unrecognised"

2 Behind the official scene, preparations for publishing the site of Padina are under way and the current author is also involved in this project. At the same time my insight into some of the finds from Lepenski Vir enable me to talk about it from a perspective that goes closer to very details of things. It is still dynamic issue in deciding how the publication of Padina would look like (even concerning the choice of authors) and in what way and especially who would take over the full publishing of Lepenski Vir. These dynamics and decisions are in the core of arguments of two main factual and inseparably interpretative presentations already mentioned above that have been offered in Serbian archaeology concerning this topic. The core of this long lasting debate are arguments of diffuison i.e. autochthonous developments. But the whole debate is far from straightforward and for the full discussion see Borić in preparation. There is a great interest among archaeologists in Serbia and in the wider context of European archaeological audience for presentation of the data. In this way, publishing of this paper is another intentional programmatic step in trying to overcome the confusing points of the debate to a certain extent. By doing this it is possible that many new rifts in relations of participants in the debate would appear. And it might be one of the reasons that this kind of remark still finds its place only in the footnote of this text.

Fig. 8. House 18, in situ pottery at Padina, sector III (*after Jovanović 1969b.T. X, Fig. 1–2*).

layer (contra *Telenbach 1983*). Also, in the course of a recent analysis of pottery from the Padina site it has become clear that the large number of complete Early Neolithic pots and potsherd fragments is clearly associated with architectural features, and represented in quantities equal to those as at any other Early Neolithic site in the Balkans[3].

To properly understand these associations it is necessary to refer to the stratigraphic relation of houses on this slope of Sector III, as well as to move from a misleading two-dimensional representation of house plans. Thus, from Padina's published sections (*Jovanović 1969.T.VIII, Figs. 1–2*), in contrast to those from Lepenski Vir (*cf. Srejović 1969a; 1972. Fig. 6*), it is possible to see clearly the level from which the houses were dug up to 1.5 m into the slope (*Jovanović 1969b.28*) of a loess sandy deposit which was formed on the bedrock that slopes towards the Danube. In photographs of a cross section of Houses 11/12 (superimposed building floors), 13 and 14 shown here (Fig. 10), as well as in the section drawing of House 12 (Fig. 11) (*ibid. T.VII, Fig. 2; T. VIII, Figs. 1–2*), one can easily follow the line of a cut made into the slope, and distinguish between the culture layer infill of cuts and the sterile soil on

Fig. 9. House 18, in situ pottery inside the hearth construction at Padina, sector III (courtesy of B. Jovanović).

3 During June 1998, pottery from Padina was analysed and drawn and has been currently prepared for publishing by Dr. Borislav Jovanović. My participation in this analysis enables me to get a close insight into the variety of quantities, shapes and ornamentation represented at the site.

Fig. 10. Middle row of Houses at Sector III, Padina with a section running across Houses 11/12, 13 and 14 showing the level from which the houses were dug into the slope **(after Jovanović 1969b. T. VII, Fig. 2).**

each side of the cut. Also, the house floors that were furnished at the bottoms of these cuts with a central hearth construction correspond to the location of the cut visible on the section. Also, the difference in height between the floors of houses, here placed in three different rows, was created as a consequence of digging into the slope at different heights (*ibid. 29*). It is obvious that this kind of digging of levelled areas into the slope could have been one of the main reasons for the formation of trapezoidal shaped house plans in the first place, as has been already indicated (*ibid. 27*). It is possible, however, that this is not the only reason, but there will be more suggestions concerning this later.

Bearing in mind all the similarities between Padina and Lepenski Vir, it is possible to suggest that, although at the moment without adequately published section drawings, and in a way misleadingly presented terraces with house floors of the settlement (Fig. 5) (which was done by stripping off the cuts' sides; the same happened to the lowermost row of houses at the beginning of the Padina excavations, fortunately with well-documented sections), the same kind of building procedure was practised here. This is of crucial importance, since the infillings of houses representing occupational activity debris from the house itself and (probably after the abandonment phase) neighboring contemporary houses appear differently excavated at the two sites and not differently deposited. Also, this might explain the excavator's remark that very few finds were unearthed between the houses at Lepenski Vir (*Srejović 1969a*). On the other hand, the architectural features of the

Fig. 11. House 12, section, Padina, sector III **(after Jovanović 1969b. T. VIII, Fig. 1–2).**

Lepenski Vir III layer have been reported as being very scant, and no plan of this layer, showing the reported pits, has been published to enable an evaluation of the position of Early Neolithic pits in connection with the limestone house floors. So it seems that there are a few indications that the layer termed Lepenski Vir III, with subphases a and b, was at least in part misleadingly created by the excavator from the occupational infillings of the houses in Lepenski Vir I and II. Rather than looking for another explanation and the possibility that the floors of the building were created at this site in a way totally different from at Padina, I would suggest that the same practice of horizontally levelling spaces for floors by digging into the slope, created pit-dwellings at Lepenski Vir, as at Padina, that were subsequently elaborated with subsequently famous limestone plastered floors and hearth constructions.

Suggesting this different understanding of major stratigraphic features at Lepenski Vir, it is necessary to understand in what way the two sites correspond in portable material culture and, more importantly, what the stratigraphic and architectural associations of different classes of artifacts at these two sites are.

The pottery found at Padina has already been described as being associated with the houses, and I have also described the ambiguities concerning Early Neolithic pottery associations at Lepenski Vir. One almost metaphorical piece of evidence appeared in association with the animal bone assemblage at Lepenski Vir[4]. In the context of the floor level of House 28 (*Lepenski Vir Ib–c phase according to Srejović 1969a*), from the floor of this house, a large piece of sediment lying on the floor contained the calcified upper jaw of a red deer whose antlers were also lying on the floor of the house. At the time of the excavation this piece was removed and packed in a bag, ending up in the boxes with sorted animal bones. Between the teeth and the chopped piece of floor was a very firmly embedded fragment of Early Neolithic (Starčevo culture) monochrome pottery. Also, among animal bones from other contextual units (some of them representing "closed" contexts of deposits between superimposed house floors) (Fig. 12), isolated fragments of Early Neolithic monochrome pottery also appear as a product of occasional mistakes in sorting finds from these units, reinforcing the argument about the presence of pottery in these units too.

This find, although presented here as an isolated instance, is significant for proving that the Early Neolithic pottery was directly associated with the floors, i.e. with the buildings of Lepenski Vir I–II and any activities there. For the time being, it is impossible to suggest to what extent and in what variety this pottery was associated with the respective buildings and phases, at least not before the full publication of the pottery assemblage. However, it is almost certain that it resembles the pattern seen at Padina. As to the Padina pottery assemblage (*Jovanović 1968b.T. IV/1–4; 1969b.33, T.XVI/Figs.1–4; 1974a.*

Fig. 12. House 18 – this house was superimposed by House 23 in its rear part, Lepenski Vir (photo: Centre for Archaeological Research, Beograd).

4 The preserved animal bones from this site will be analyzed by Dr. Vesna Dimitrijević. Reported context was examined during AMS ^{14}C samples' collection in the National Museum of Serbia, Belgrade, July 1999, that was permitted by the curator Mrs. Ljubinka Babović.

Fig.1; 1974b.35–39, T.I–IV; 1987.Figs.8–12; also see note 3), the Early Neolithic pottery assemblage examined appears to consist of a large number of possibly locally made pots, some of which are receptacles with large open mouths, standing on low pedestals (*Jovanović 1974b.T.III*), interpreted so far as preparing/serving dishes for large species of fish, such as catfish or anadromous fish. These forms were also found at Hajdučka Vodenica (*ibid. T.III/1–6*) and some other Early Neolithic sites along the Danube, such as Donja Branjevina (*Karmanski 1968.3, 22, Fig.1*) and also in large numbers at Lepenski Vir, interpreted here as primarily serving sacrificial purposes (*Srejović 1968b.Fig.1, 10; 1969a.Fig.70; 1972. Fig. 72, 86*). Some from the varieties of vessels found at Padina also have traces of intense firing. The quality of pottery varies from very crude with thick walls, to fine pottery of thin walls, frequently burnished with a red slip over the inner and/or outer surface. The temper of most of the potsherds is also full of organic-chaff inclusions, which is the main common characteristic of pottery technology in almost all Early Neolithic assemblages in the central Balkans.

Flint assemblages

But it is not only pottery that is an Early Neolithic feature associated with 'classic' houses. The striking distribution across the Balkans of one kind of flint raw material at this time is of some importance here. So-called 'Balkan' flint, also termed 'yellow-spotted' flint, is the most abundant raw material at all sites with the material culture of the Starčevo-Kőrös-Cris-Karanovo complex of the Early Neolithic in the central and northern Balkans (*cf. Voytek 1987*). The inevitable associations of artefacts with this type of raw material were reported at Padina, associated here with the dug-outs in Sectors I and III. Some major technological and typological characteristics of artefacts made from this kind of raw material include a pronounced trend towards the laminarisation of blades. Although a clear picture of the source of this raw material is still lacking, there are some indications that certain regions of north east Bulgaria (*ibid.*), such as Šumen, are the most probable locations for its origin (*Dinan 1996b.19*). The uniformity of distribution of this kind of raw material across the Balkans at these times is striking at almost all Early Neolithic sites with reported lithic assemblages, and it is possible to envisage several models of its acquisition and distribution.

Regarding the Padina site, one find provides an important clue to the use of this material, i.e. to the participation of the site's inhabitants in wider regional networks. It is a nodule with a large chalk cortex that could be refitted with a retouched piece of blade found together in the same context at Sector I of this site (Fig. 13). Such a large nodule and the possibility of refitting could serve as an example showing that a large number of nodules and cores of this raw material could have been acquired from the primary contexts, perhaps as a river pebble, (which is indicated by the presence of cortex on the surface of this nodule), and brought to the site from a long distance. One site for the production of certain artefacts, such as this retouched blade, was Sector I, next to architectural features such as hearths and houses. Everything indicates that this kind of raw material and the typologically specific artefacts made from it represent an inseparable contextual unity of material culture associations with Early Neolithic Starčevo pottery and features such as dug-in houses with trapezoidal plans.

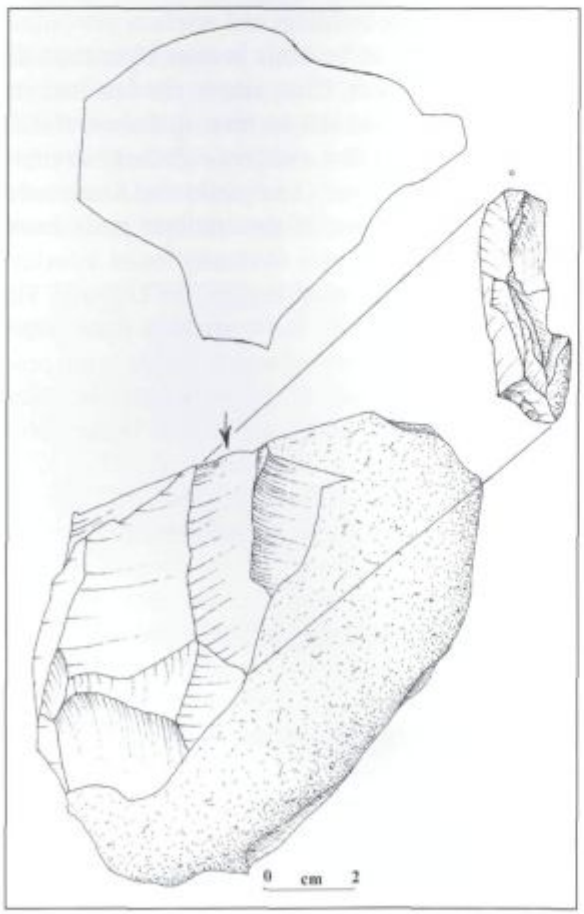
This fact is again important in regard to the lithic assemblage of Lepenski Vir. The published report on the lithic assemblage from this site indicates that the previously mentioned ambiguities of stratigraphic relations of classic buildings and artefacts attributed to the Mesolithic or Neolithic become clear even in the presented report. Thus, among the raw materials there is a considerable increase in the use of Balkan/yellow-spotted flint and grey radiolarite as compared to the Vlasac site (*Kozłowski and Kozłowski 1983.261*). Also, some of the artefacts made from these raw materials were obviously found associated with the architectural features of Lepenski Vir I–II (*ibid. appendix 1*). These artefacts show some of the indicated techno-typological trends in the production sequence, such as the pronounced laminarization of blades, again if compared to Vlasac (*ibid. 265*), and the occurrence of larger retouched artefacts, mainly on the Balkan flint (*ibid. 267, Fig. 1/14–15, Fig. 3/1–3, 7*). In the presented report on the chipped stone industry at this site, the authors studied only well-stratified artefacts, assigning them to major phases (Lepenski Vir I–III). However, in the published form it is impossible to follow their exact stratigraphic location. It is important that a large number of artefacts and debitage, mainly of local flint and with flake-based technological characteristics, are found here too which are also typologically comparable to the earlier sequence (termed Epi-Palaeolithic, Mesolithic) in the Gorges. Presently, it is possible to assume that these finds are mostly connected with the deposits mainly underneath the house floors, or in connection with stone construc-

tions that possibly represent older occupational zones at this site comparable to the lowermost levels of occupation at Sector II of Padina (see *below*). An absence of information on stratigraphic associations of this assemblage hampers clear contextual insights. The reported increase of artifacts made of Balkan flint that come not only from the deposits of Lepenski Vir III layer, but also from Lepenski Vir layers I and II, in view of the above proposed nature of a certain number of these deposits, could favour this explanation. It is worth mentioning that two hoards (Hoards 3 and 4) of blanks and cores made from the Balkan flint at this site were placed in Early Neolithic pots (*Srejović 1969.T. 95; 1972.Fig. 82–83*).

Ground polished axes

Yet another class of artifacts is of interest here: ground polished stone axes and other ground stone artifacts. A number of axes at Padina were found on the floors and inside the hearth constructions, as well as underneath house floors (Padina, field documentation). Some of the designs and raw materials are also found in abundance at Early Neolithic sites in the central Balkans. A large number of finds of this kind are also found in various deposits of Lepenski Vir (*Srejović 1972.Fig.76–77*); however, with scant publishing of the contextual position of stone axes from this site, it is hard to determine the exact context or suggest any particular conclusion.

An inevitable question is how it was possible that this kind of misreading of stratigraphic relations and material culture associations in the case of Lepenski Vir happened. There are probably several explanations; I will try to summarise the main points by contextualizing the excavations at Lepenski Vir (*see Borić in preparation*). The first point is that these rescue excavations were done in a great hurry, immediately before the whole area along the Danube was submerged up to 30 m, and that the sequence of settlement evidence turned out to be surprisingly complex. Secondly, the discovery of sculpted boulders, some with astonishing carved representations of human-fish faces and rich ornamental diversity, together with the discovery of specially built house floors and hearth constructions that had never been reported in European prehistory before, all caused a sensation on a scale never experienced until that time. This inevitably leads to the third point, that of the personality of the excavator himself, and the professional dynamics that appeared in Serbian archaeology between some of the archaeologists involved and between the main archaeological insti-



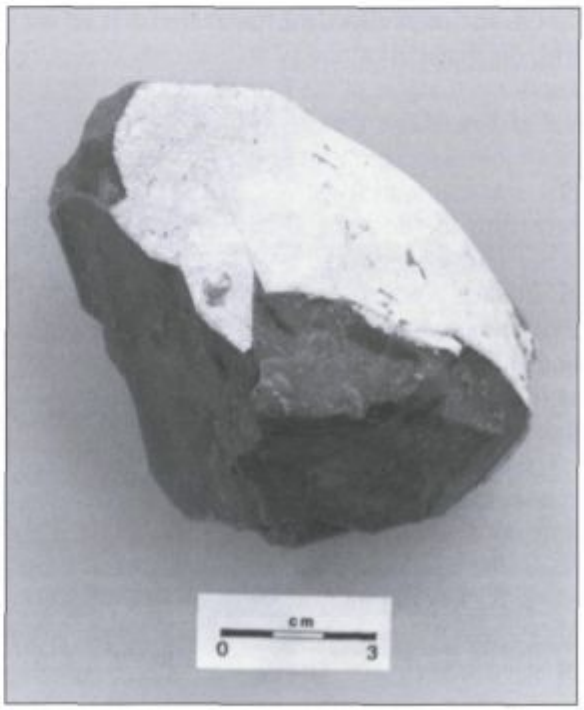


Fig. 13. Nodule refitted with a retouched blade made of Balkan/yellow-spotted flint found at Sector I, Padina (drawing and photo: D. Borić).

tutions. All these factors played certain roles in Lepenski Vir's presentation. However, it is necessary to underline that one of the greatest accomplishments of Srejović was his recognition that the sequence at this site has deep roots in the past which are connected to certain features, as will be shown below. On the other hand, to the excavator of Padina, Jovanović, we owe a debt for the possibility of a detailed understanding of the complex stratigraphic history of the site he excavated, and for the possibility of viewing the Lepenski Vir sequence in retrospect by a comparison of the two sites.

To summarise the stories of the two sites, it is important to underline that amounts of pottery and other described Early Neolithic paraphernalia found at the site of Padina indicate that it might be misleading to understand them as prestige or imported artifacts, for the simple reason that the whole variety of forms are present in amounts similar to any other site of the Early Neolithic in the central Balkans. However, this is not the only reason. In the exposition of the stratigraphic sequences and artifact associations I have tried to argue that it is necessary to fully contextualise all finds in order to make an interpretation (*cf. Hodder 1991; 1999*). Apart from the insights to be achieved on the scale of *longue durèe,* with unquestionable metanarrative importance, it is important to emphasize that a particular awareness of contextual associations should lead to a "thick description" (*Geertz 1973 [1993].6*) of time-specific deposits, with the idea of the singularity and specificity of events.

The kind of immediacies reported here demand an urgent reexamination of probably all the houses/shrines of Lepenski Vir, and of their role, dating, wider context and significance in relation to issues raised in numerous debates. It is also time to reevaluate thinking on the claims that a process of increasing sedentism was initiated by so-called "increasingly complex hunter-gatherer" groups, and that the houses of Lepenski Vir clearly serve as a proof of this, having in mind their elaboration and durable architectural elements. It seems that we should expect nothing to be that straightforward. Primacy of proper phasing has turned out to be of great importance in making a coherent story out of the excavated record. The outline of the sequence that has been proposed could partially indicate a different and new understanding of the upper sequence in the Gorges. But I need to go deeper, beneath the floors of the houses, all the way to the bedrock, to understand the time when these places were created.

THE BEGINNINGS OF DEATH

I have written above of doubts over the models constructed so far to interpret and understand the sequence of the Danube Gorges region. I tried to show that this is inseparable from the necessity of clearing up some of the confusing details intertwined with the way our data have been collected, presented, etc. Also, I put forward the assumption that we must re-read the archaeological reports from the sites discussed. These details appear crucial for understanding the question of the origins of the Neolithic in the central Balkans and Southeast Europe. This means that the sequence and architectural associations suggested above should set the stage for the proper connection of well-known architectural features from Lepenski Vir and portable material culture, contextualising its identity through wider regional connections. However, Lepenski Vir in isolation gives neither a full insight into the complexity of the record in the Gorges, nor into the well-known features of trapezoidal plan dug-out houses, and the boulders placed in connection to the central location of hearths make the only significant features here. Thus far in my discussion I have not gone beneath the house floors much, or entered the space outside the houses at these sites. Still obsessed with the durable character of floors and with the scene set by the placement of features and material forms over them. Now I need to draw closer to the individuals who set this scene and also to their forbears, going deep into time.

Who were these people in the Danube Gorges? Where were their identities anchored? What was their ideological framework, speaking of ideology as of the everyday action of individuals and the creation and realisation of their social reality, as of a system with its own logic and rigor of representation through myths, images etc., inseparable from existence, and a historical role (*Duby 1974 cited by Ricoeur 1984.110*); as a worldview of people involved in practical *habitual* activities (*Bourdieu 1977*) in their own time/space context? Questions about the identity of the men, women and children who dwelt in the Gorges have already been posed primarily to determine if they were immigrants, an outcome of the process of advance, or if they were autochthonous elements surviving in the unapproachable area of the Gorges. An anthropological argument has often been used which frequently refers to so-called 'Cromagnoid-robust' elements vs. 'gracile' Mediterranean types (*cf. Jovanović 1975; Srejović 1969b.17; Živanović 1975; 1976; 1979;*

etc.). An alternative perspective that physical anthropology may offer in this context is connected to the examination of signs of occupational stress left on human bones by people's participation in various everyday activities (*e.g., Bridges 1989*). Thus it is practical, everyday activities that particularly shape the morphology of a human body and have a great impact on what the features of the body, such as bones and teeth are like, assigning to them, crudely speaking, robust or gracile characteristics (*see also Zoffmann 1980.132–133*). But I will not enter into that debate here. First, I need to phase the individual bodies buried at the sites in the Danube Gorges and discuss the possible meanings of their placement. It is also necessary to know how recognizable they were to later inhabitants of these sites.

Although the phasing of the sites has been established for some time (*e.g., Srejović 1969a; 1972; Jovanović 1987*) and has been re-defined recently (*Radovanović 1992; 1996a*), it appears that is necessary to review the stratigraphy and chronological attributions of certain contexts. It seems that insufficient attention has been focused on clearly establishing the older features and zones in the settlements of Padina, Lepenski Vir, or Hajdučka Vodenica (another site further downstream in one of the most dramatic and mysterious parts of the Danube Gorges, even today), representing sites where contrasting interpretations appeared in connection with the presence of Early Neolithic material culture. Given the stratigraphic relation of the classic buildings to older zones in the settlements, lack of careful recognition of older features in correct relation to later contexts could have been the main point of confusion in the attribution of artefacts to particular units. It has often been overlooked that a very considerable time depth should be envisaged in the remains of these settlements. With this in mind, it is important to focus primarily on features that were, in the course of excavations at Padina (Fig. 14) and Hajdučka Vodenica (Fig. 15) dubbed the "stone construction of the necropolis" (*Jovanović 1969b.31–32, T. XIII, Fig. 3, T. XIV, Fig. 1; 1969c.T. XXIX/3–4; 1972.T. I/1, II/1–3; 1974.Fig. 1; 1984*) (these sites were dug by the same excavator). At both sites these features were neatly made in a dry-wall technique (and excavated as) built from stones in a manner that gives an impression of organised architectural intent. There were four levels of stones laid in this way at both sites; every layer of stones was covered with a layer of soil above which followed another level of stones that remarkably followed the exact outline of the first to be laid down (*B. Jovanović, personal communication*). Graves are associated with these stone constructions.

At Hajdučka Vodenica stone constructions are situated beside an area where there was a grave with a number of others in an extended position underneath, and in association with specific rectangular hearths (*Jovanović 1984.307 sq.*). Also in this area were hearths made of circles of stone blocks covered with several levels of stone constructions and placed on different levels. The excavator also notes the remains of burning, and smaller circles of piled stones in this area (Fig. 15). Only in upper parts (horizons I and II) of the constructions, were Early Neolithic

Fig. 14. 'Stone construction of the necropolis', sector III, Padina (after Jovanović 1974.T. V, Fig. 1).

Fig. 15. 'Stone construction of the necropolis', Hajdučka Vodenica (courtesy of B. Jovanović).

(Starčevo culture) pottery fragments detected (*ibid. 309–310*). This might suggest the use of these features in later periods. It is possible to envisage long-term continuity of use of these places, where later inhabitants in their practices – with both profane and ritual associations – find the use of tradition, through its constant changing elaboration, a useful and fruitful exercise in coping with the needs of a new world.

But could we properly envisage the scale of change? The scale on which archaeologists operate varies from capturing single events to reconstructing continuities, etc. However, instances described speak of places where a constant and enduring practice of (re)building stone constructions captures a very long time span, where even the introduction of new material objects, such as pottery, in great amounts, probably only introduces new possibilities for old/new metaphorical and symbolic reference points and their further elaboration.

Some dated graves from Padina give results that put the absolute age of the human remains associated with the stone construction at the end of the 10th millennium cal BC (*Burleigh and Živanović 1980. table 1*). I shall turn later to this point to capture the absolute dates in the context of the mortuary space and individual bodies.

The few chipped stone artifacts found associated with these constructions, especially since local raw materials were used for their manufacture, could also point to an early date for these constructions (*Radovanović 1981.26*). At the same time the first occupation at sector II of Padina clearly belongs to what might be chronologically termed the Mesolithic, in the stratigraphy of this cove, at Padina represented by a black earth layer that covers the bedrock of this sector at Padina, and with no pottery. The chipped stone assemblage from this layer (*Radovanović 1981*) and also bone tools (*Borić in preparation*) (Fig. 16)[5] are akin to the early developments in this region unambiguously seen in the chipped stone and bone industries and stratigraphies of Vlasac (*Kozłowski and Kozłowski 1982*), or in the early levels of Cuina Turcului (*Nalbant 1970; Paunescu 1970; 1978; Dinan 1996b*), Icoana (*Boroneant 1970; 1973*), Schela Cladovei (*Boroneant 1970; 1973; Boronenat et al. 1999*), Ostrovul Corbului (*Mogosanu 1978; Paunescu 1990; 1996*), Baile Herculane (as an important inland cave site) (*Nicolâescu-Plopsor et al. 1957; Dinan 1996a*) and other sites on the Rumanian left bank of the Danube. Also, some bone tools bear traces of a specific incised net design or zigzag continuous lines resembling examples from the Vlasac site (*Srejović and Letica 1979*) and some other sites in the Gorges.

At some of these sites burials are mostly associated with two types of feature. The first are rectangular hearths in the open air made of stone slabs, where burials cluster around a hearth or a hearth was placed over the graves (Fig. 17) (for Vlasac: *Srejović and Letica 1978.passim;* for Hajdučka Vodenica: *Jovanović 1966.Fig.I/2; 1972. T. II/4;* for Schela Cladovei: *Boronenat 1970.Fig.3/1; Boroneant et al. 1999;* for Ostrovul Corbului: *Paunescu 1990; 1996; see also Radovanović 1996a*). The second kind of feature connected to burials are stone constructions found in large numbers and well recognised at Vlasac (*Srejović and Letica 1987*).

That the stone construction of the necropolis is found on Padina at Sector III, where most of the later 'classic' phase buildings also appear, deserves particular attention. A closer examination of the burials that are connected with the stone construction, reveals that the skeletons of the two elderly

5 Most of the tools from Padina were analysed and published by I. Radovanović (*1981*). The artefacts presented here (Fig. 16) were additionally uncovered in the course of (re)analysis of the animal bone assemblage from the site of Padina, done by paleontologist Dr. Vesna Dimitrijević and myself. This contextual unit with lithics, animal bones and bone tools could be presented as a characteristic example of the activity spaces in the lowermost levels at Sector II of the site of Padina generally attributed to the Early Mesolithic sequence for the wider region according to the radiocarbon dates and typological attributes of the studied lithic assemblage (see quotations in the text).

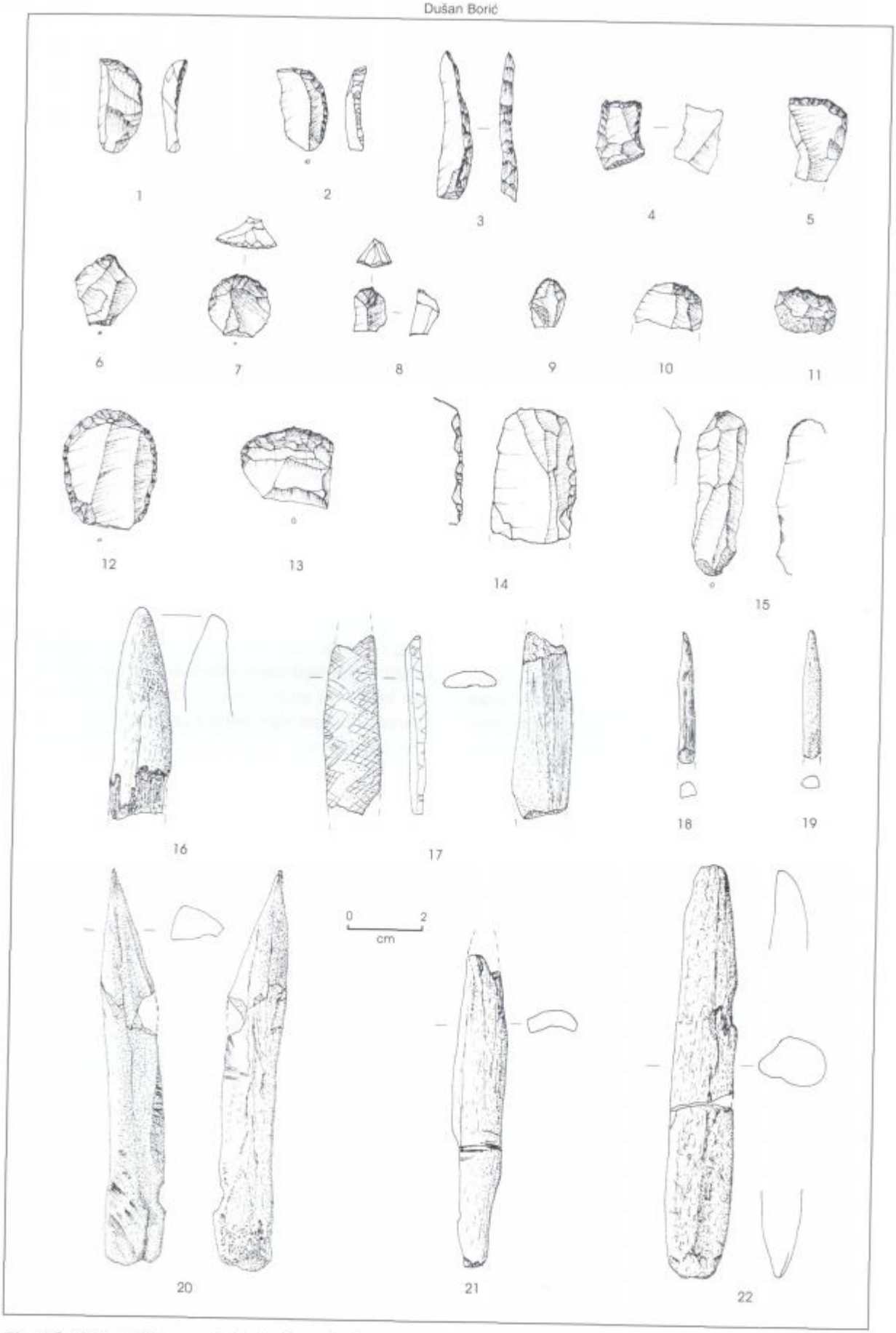


Fig. 16. Flint and bone artefacts from the lowermost levels of Sector II, Padina (drawn by A. Spasojević and D. Borić).

males were placed in a sitting 'a la turque' position, leaning against the bedrock facing the Danube (Fig. 18). Some of the bodies were in this position, with crossed legs encased in a conical stone structure up to the skull (*Jovanović 1971.31–32, T. XIII/1, XIV/1; 1972.53, T. I/1*). Also, more skeletons were uncovered in this sector mainly in the area of the upper row of houses, in the division proposed by the excavator as the latest level of occupation. However, ^{14}C analyses gave to a certain extent results contradicting the proposed division (*Clason 1981; Groningen Database*). One of the reasons for this might be that the stone construction already described and well recognised is not the only older feature here. There are two clearly visible rows of stone in front of Houses 15 and 18 (see Fig. 6). These were also connected to the placement of graves around them, next to the houses, and beneath them. The stratigraphic associations of these burials were not established during the excavation with any certainty. It could be that these graves (as already shown to some extent by ambiguities in the ^{14}C) are also older and existed before the houses were built, since "the floors of these houses (...) do not show any noticeable damage or repairs corresponding to the position of the burial pit" (*Jovanović 1972.53; also Jovanović 1969b.31*). More importantly, they also could be connected to the rows of stone in front of these two houses at Padina that probably existed here before the houses were built. If this is so, the building of these houses would somehow be an extension of the stone constructions. Also, the internal chronology of these rows of houses does not require retrieval of building activity from the river up the slope, as suggested by the excavator (*Jovanović 1969b.30; 1987.2–4*), but could also have a completely opposite sequence. The new ^{14}C dates will clearly help to sort out some of these dilemmas.

Here also, we arrive again at the inevitable question of how to deal with the presumably similar development at Lepenski Vir itself. By analogy to the proposed development at Padina, I would like to suggest that the very close relation of some of the houses and uncovered graves below or beside some of them might be misleading and falsely apparent as represented in some of the published photographs (*Srejović 1969; 1972; Radovanović 1996a.178 sq.*). The term 'condensed stratigraphy', used in geology to describe contexts where layers of different ages lie close to one another, might appear appropriate here. This means that a continuity of use of a certain location over a long period and recognition of older features by later inhabitants could create a

Fig. 17. Burials no. 51, 52 and the hearths 19, 19a at Vlasac (photo: Centre for Archaeological Research, Belgrade).

situation where there was no massive debris accumulation. I want to suggest that a certain number of graves beneath the floors of houses at Lepenski Vir belong to the early phases of creation of features at this place, as well as at some other locales along the Danube, and just may be as a phenomenon particularly confined to the right bank of the Danube. Large amounts of stones often regularly forming piles, and found in many instances underneath or beside the famous houses next to the graves and hearths at Lepenski Vir (Fig. 19) fit the picture also seen at Hajdučka Vodenica, Vlasac, or Padina. One of the newly acquired AMS dates on skeleton 72 from the site of Vlasac, in two repeated trials, gave a consistent range of 10 482–9043 with 2σ cal BC (*Bonsall et al. 1996; 1997.66, table 6*). Despite possible problems with the absorption of 'old carbon' in human bones thus obscuring the dating and giving an indication of older dates (*Bonsall et al. 1997.84*), it seems that this finding strongly confirms some of the mentioned points.

And to me it appears that these places created time here. Following up on the ontological significance of

Fig. 18. Graves 15 and 16, leaning against the bedrock, facing/watching the Danube, Padina, sector III (after Jovanović 1969b.T.XIII, Fig. 1).

human existence, in relation to the nature of time that through St. Augustine's *aporias* ('doubts of what to do') comes down as a three-fold present – the past present, the present and the future present – and, also building on Paul Ricoeur's exposition of the dialectic connection of time and narrative through a hiearchised mimesis of creation (*Ricoeur 1984. passim*), I propose that in the Danube Gorges our sites materialised the memory of the past through constructed stone piles and the placing of human remains, divorcing the continuum of eternity even further from the present, widening the gap of an already existing *distentio anima* in St. Augustine's words. Significantly, this *distentio*, i.e. extension of time as an extension of mind, is mirrored in language (*see also Thelin 1990*) thus confirming the being nature of time (*Ricoeur 1984.9*), but it is to be emphasised that it equally significantly appears through the materiality created by human action, materiality that is real, that endures and resists. A significant ontological dialectics is created between *eternity* and *time*, between *intentio* and *distentio*.

Support for the significance of this concept is to be found in the recurring ontological theme seen in numerous myths of traditional societies. The theme of the death of humans stands up as marking the beginnings of story telling in the ethnographic record. As if narration became possible along with a comprehension of the concept of death, with facing the *Sein zum Tod* in Heidegger's words (*Heidegger 1972.passim*). The death of humans created landscape for the Australian Kuri. In connection to the mythological base of many peoples, e.g. the Cree: "...in the Distant Time the landscape acquired its present form. Humans died and were transformed into the animals and plants encountered in the environment and features of the earth, such as hills or mountains." (*Tilley 1994.56*). The beginning of death is thus an awareness of death, and subsequently this awareness creates a myth of temporality, creates time in connection to the landscape, and establishes the time before, making possible a grasping expectation of what is to come. It seems that burials serve this purpose in the first place and are unlikely to be territorial markers with the idea of formal disposal areas. The recurrent motif is the death of humans, which was crucial for establishing temporal relations. Therefore, the dead first became sedentary (*Chapman 1992.81*). The bodies of those two elderly males at Padina that were leant against the bed-

Fig. 19. House 26 and burial no. 63, Lepenski Vir (photo: Centre for Archaeological Research, Belgrade).

Fig. 20. Burial no. 17, Vlasac (photo: Centre for Archaeological Research, Belgrade).

rock facing/watching the Danube are directly engaged with the bedrock, the forest, the Danube, and with the piled stones. The very materiality of their endurance, still strongly underlined by the piled stones, created and emphasised space for the existence of human time which, in St. Augustine's words, enabled expectation, attention and memory as the actions that the mind performs (*Ricoeur 1984.19*).

But nothing is simple again. The burial sequence in the Danube Gorges is rich and varied (*see Radovanović 1996a.164–224*). Radovanović (*1997*) gave a particular meaning to a certain number of burials placed in the extended position, with their heads pointing downstream, parallel to the course of the Danube. In her opinion, this could have symbolised the notion of souls going down the river. The true meaning of this practice is grasped in connection with the existence of the large anadromous beluga (*Huso huso*) in the Danube that swam upstream every spring to spawn. In the eyes of people coming to the Danube's shores in later phases of the use of these sites it might have looked as if ancestors were returning every year (*ibid.*). But some of the places where the major sites are located could have the best 'view' as well, especially of the huge whirlpools. At these places the Danube runs very fast and with strong currents and rapids (*Marković-Marjanović 1978.11, 16*). Also, the route thus created might have been connected with various rites of passage representing ceremonial stages through which an individual has to pass (*cf. Tilley 1999.154–155; also Turner 1967; 1969; 1974*). And this practice could at the same time mark the stages of the passage of time in connection with the practical seasonal activities of fishing and hunting (*cf. Bourdieu 1990*), thus blurring the distinction between the sacred and profane. In this context it is possible to see the sculpted boulders with fish/human-like figural representations as these very ancestors materialised in stone (*Radovanović 1997*). As to how impressive the whole sight could have been: this species of fish could have been up to 5 m long, as estimated from the remains of the largest specimen from Padina (*Brinkhuizen 1986.23, 33, Fig. 8*). So, could this be the reason that the two men at Padina, one at Vlasac (*Srejović and Letica 1978*) (Fig. 20) and one at Lepenski Vir (*Srejović 1969; 1972.Fig. 52*) sit with the crossed legs and watch the Danube, to enjoy the view and follow a rite of passage?

And it is possible that a particular metaphorical relation was established here that, in the course of the long history of these places, changed its paraphernalia and elaboration – its theatrical performance. That the dead is buried with the head pointing downstream might actually represent a materialised practice of allowing some of the dead to flow down the Danube. Equally, it could be connected to diachronic change and/or with the selection of certain individuals, all strongly depending on circumstances in which the death took place. However, it is important that only the site of Lepenski Vir was assigned special importance here, with 'permission' to exhibit the ancestors in sandstone boulders and, again in connection with the burials, some of them are already beneath the floors and have stone blocks piled around them. However, other features of the landscape might have given it this special importance as well.

The famous massive and trapezoidal bare porphyry mountain in front of Lepenski Vir (Fig. 21) is an impressive landmark, even in a photograph. But only a phenomenological experience of this place and its wider landscape could bring out other meanings. This bare mountain, especially in heavy rains, at-

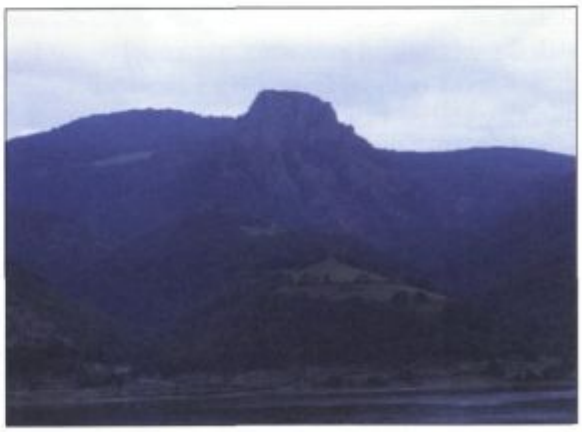


Fig. 21. View of Mt. Treskavac from the terrace above Lepenski Vir (photo: D. Borić).

Fig. 22. Close-up of a piece of floor from House 34, Lepenski Vir (photo: D. Borić).

tracts lightning strikes (experienced during June 1998), bringing enchanting, powerful and mysterious feelings. At the same time, in the upper Gorges of the Danube, where Lepenski Vir, Vlasac and Padina are situated, this landmark might have appeared as almost ever-present, there forever; at least since the time when these places were created. And there is no contradiction in the fact that the houses at Vlasac, Lepenski Vir and Padina were built to trapezoidal plans for the practical reasons of situating these architectural units on the sides of slopes, and the fact that these houses imitated a mental image of the solid and enduring landscape. And as it is for Ye'cuana of Guiana that mountains represent "the only enduring houses...the dwellings of invisible spirit beings" (*Riviére 1995.201*) it seems that at Lepenski Vir there was an arising need to harden the floor, to announce durability. The floors at Lepenski Vir are literally solid proof of this (Fig. 22). Constructed on a base of limestone particles forming a breccia-like feature (*Ney 1971*), it seems that in the later phase of development in the Gorges they metaphorically replaced features of stone constructions with the meaning of indicating referential points for the longevity of time. They also mediate "...between the body and cosmos, between the present and the past; and provide a ritual switch point between microcosm and macrocosm on which continued access to ancestral potency depends" (*Carsten and Hugh-Jones 1995. 42*). It seems that besides those ancestors that annually swam upstream, there was a special realm of spiritual beings of even greater ancestry, although possibly more anonymous than those sitting or lying in connection to the Danube. These were the spirits of mountains that marked the beginnings of time and played a continuous role in the lives of people here.

BEYOND THE CLIFFS

Is it possible now to feel the least comfortable with the above given interpretation of our data in discussing the Mesolithic-Neolithic transition of southeast Europe? The questions in mind, such as, what are, in historical terms the contributions of the local population to the creation of varied Neolithic paraphernalia in the material culture, might be answered here with a greater ease in comparison to the other regions. In the Danube Gorges the appreciation of deep time and its recognition strike us everywhere. But it does not confine these people to the past only, rejecting them as some kind of lost cause, defeated in a battle with new technology. And the striking appearance of all the features that the new world brings to the Danube Gorges only shows once again that this area was perhaps never isolated from the rest of the world (Fig. 23). There is no reluctance to take up novelties, as suggested by some authors, only a readiness to participate in yet another New World.

But then, what was actually going on beyond the cliffs of the Gorges? The Early Neolithic of the central Balkans is not without sites where people buried

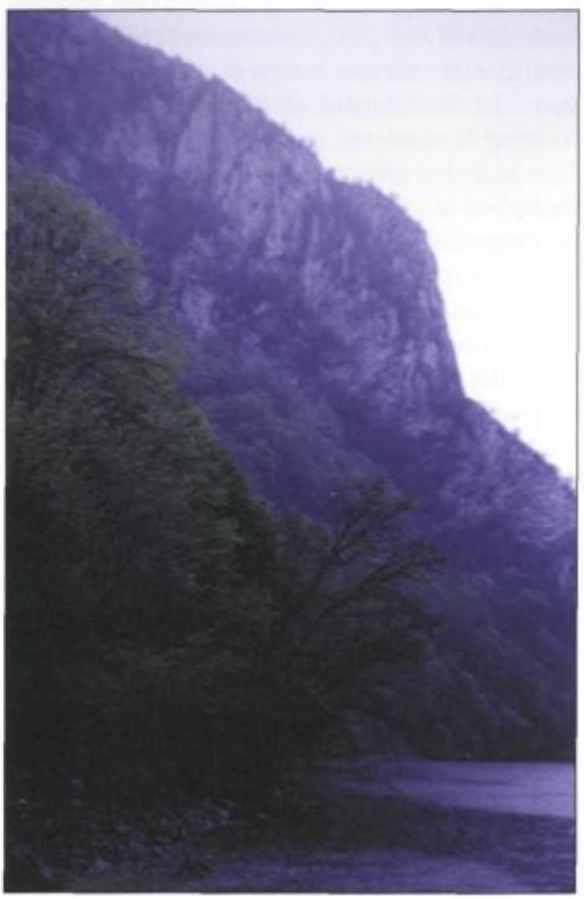


Fig. 23. View of cliffs above Hajdučka Vodenica (photo: D. Borić).

their dead. These are less aggregated, less visible, but present. A map showing only Early Neolithic sites with traces of burials adds to this point (Fig. 24). All these sites share what has been argued for as very uniform traits of purely Neolithic populations who, in the opinion of some, spread in an advancing wave over Southeast Europe. Although clay models of houses appear at some of the sites (*e.g., Garašanin et al. 1971.70, Fig. 81–82, 43, Fig. 116*), it seems that this development does not immediately associate them with increasing sedentism. But in order to get to know these people better, again going

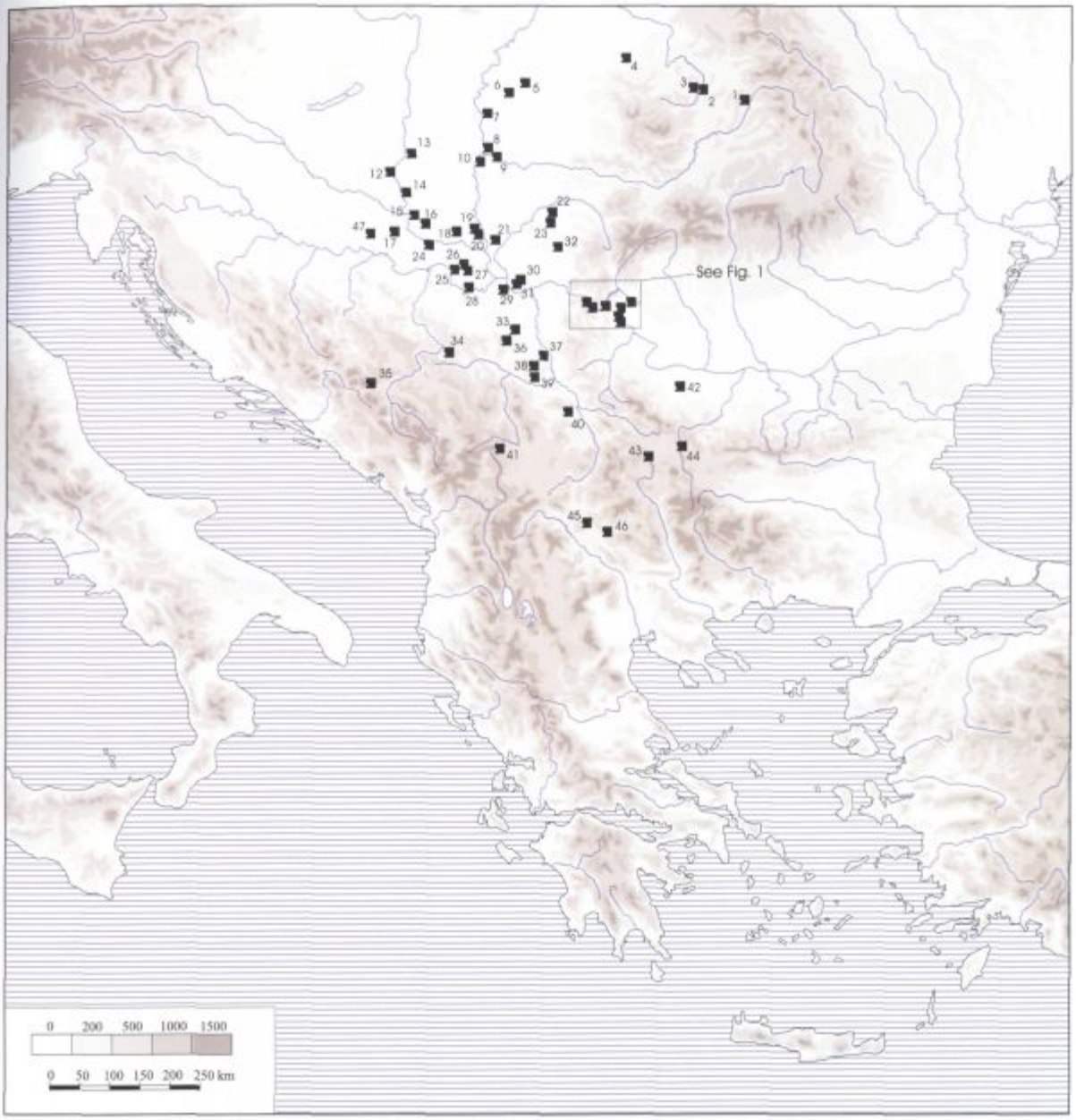


Fig. 24. Early Neolithic sites with traces of burials across the central and northern Balkans (drawn by V. Novaković). Sites: 1. Cipau, 2. Cluj-Str. 30. Decembrie, 3. Gura Baciului, 4. Solca, 5. Endród, 6. Szarvas–Szappanos, 7. Szentes–Jaksorpart, 8 (1–3). Hödmezövásarhely-Gorza, Hödmezövásarhely-Kotacpart-Vatatanya and Hödmezövásarhely-Bodzáspart, 9. Maroslele Pana, 10. Deszk, 11. Balatonendröd, 12. Lanycsók, 13. Vaskt, 14. Bački Monoštor-Opoljenik, 15. Donja Branjevina-Deronje, 16. Bač-Topole, 17. Vinkovci-Tržnica and Nama, 18. Stari Žabalj, 19. Žabalj-Put, 20. Temerin-Klisa, 21. Perlez-Batka, 22. Jaša Tomić, 23. Alibunar-Banatska Dubica, 24. Vizić-Golokut, 25. Šašinci–Kudoš, 26. Ruma-Zlatara, 27. Pečinci-Bara Alicija, 28. Obrež-Baštine, 29. Vinča-Belo Brdo, 30. Pančevo-Nadela 1, 31. Starčevo-Grad, 32. Vršac-Kozluk, 33. Divostin, 34. Višesava-Kremenilo, 35. Obre (I)–Raskršće, 36. Grivac, 37. Jagodina-Bukovačka česma, 38. Rekovac–Tecici, 39. Blagotin-Poljna, 40. Merošina-Kamenjar, 41. Rudnik (Kosmetski), 42. Gradešnica-Malo pole, 43. Vaksevo, 44. Sofia-kv. Slatina, 45. Anzabegovo-Barutnica, 46. Vršnik-Tarinci, 47. Slavonski Brod – Galovo.

Fig. 25. The region of Vojvodina before melioration work (from the larger map of the Carpathian Basin: Museum of Vojvodina).

to the real contexts seems the best point of departure. I shall here try to shed some light on a few contexts through a close-up view of several Early Neolithic burials in the area.

The context of a skeleton found at the site of Golokut in the region of Vojvodina of present-day Serbia does not differ from many others found across the region. It is a crouched burial, with no grave offerings, as shown in the published photo (Figs. 26a, b) (*Petrović 1986–1987.Figs. 7–8*). However, reading the report and close first-hand insight on this find reveals a somewhat different story. There is a mention in the published report of an aurochs' head with horncores being associated with the burial (*ibid. 19, Fig. 9*). However, only later examination of this find provided a clue to the particularities of this association. The lapse of time between the uncovering of the head and the skeleton created the confusion. However, still the calcified palm at the forehead of the aurochs' skull and the calcified knee in the horncore gave two reference points on the skeleton from which to reconstruct the original positions of the skull and skeleton (Fig. 27). So, the picture that emerged was of an auroch skull placed at top of the body, looking down. This position of looking down of red deer and auroch's skulls in association with the dead appears strikingly similar to some cases of burial at Lepenski Vir (*cf. Srejović 1969; 1972.Fig. 61; Srejović and Babović 1983*). Was there the same *Weltanschauung* among contemporaneous people in the Gorges and those across the Balkans? Perhaps.

Similarly, various animal bones were placed in the graves at Zlatara (*Leković 1985*). At Perlez, between two bodies with grave goods, a large pit was uncovered with an enormous number of animal bones, including dogs, wild horses etc. (National Museum, Zrenjanin, unpublished field documentation). This may indicate feasting or the intentional deposition of these animals in the grave. Yet another example, the placement of the two individuals at Topole-Bač (*Trajković 1978; 1988*), was done deliberately to create a binary meaning in the symmetrical arrangement of the two corpses (Fig. 28). Many other burials show this striking diversity. Yet they also have some similarities and, again, a striking uniformity of ceramic styles and used Balkan flint as raw material.

Traces of Early Neolithic occupation have been found at very different locations, ranging from marshes that have been occasionally flooded in the lowlands of the Carpathian basin (Fig. 25) to cave occupations in the central Balkan region. And yet we have not had enough reliable evidence of continuities with the previous period. I believe that this is partly an outcome of specific survey methodologies to date and many other factors connected to the investigation of the whole region. However, that the evi-

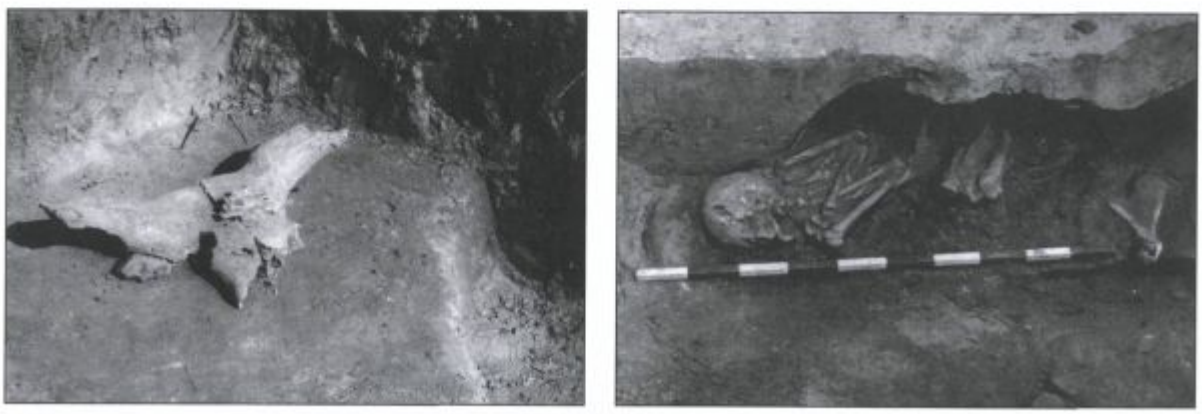


Fig. 26a, b. Grave in pit-dwelling 7, Golokut (photo: courtesy of J. Petrović).

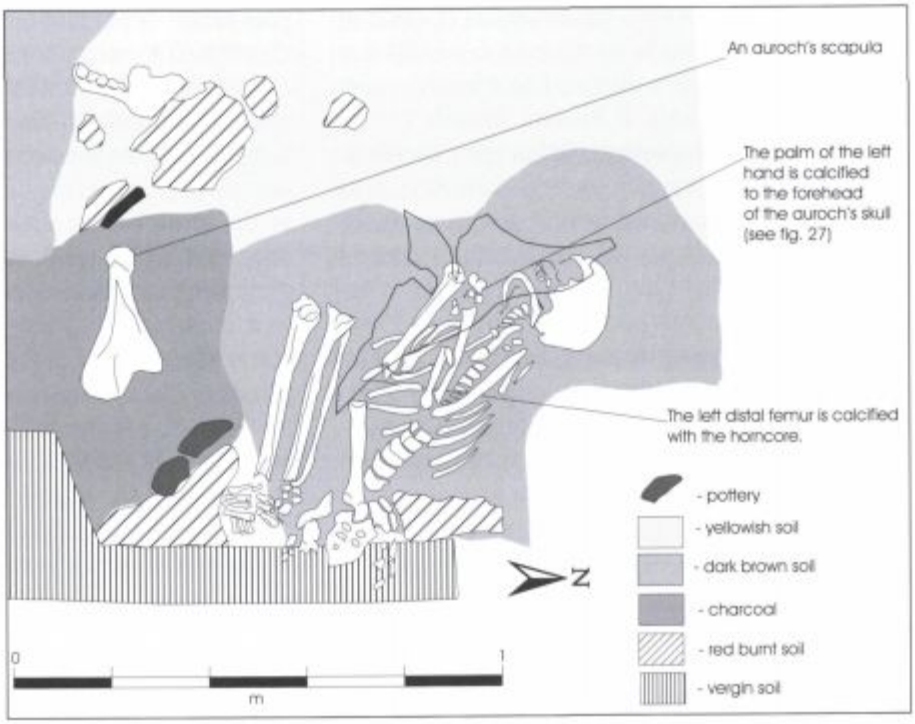


Fig. 27. Drawing of the grave in pit-dwelling 7 with the original position of the auroch skull, Golokut (*modified after Petrović 1986–1987. plan 2*).

dence of a much deeper past is also present in the material record of what in the Balkans is known as Early Neolithic communities, i.e. the Starčevo-Körös-Cris-Karanovo culture complex, has not been very clear. In my opinion even some of the points mentioned concerning their mortuary practices indicate long histories and possibly local roots to these 'new' Neolithic communities. The variety of rituals practiced indicate localised beliefs rather than uniformity. One of the above-mentioned double burials at Topole-Bač (Fig. 28) in Vojvodina, however, has the first strong indications that it is possible to connect the first ceramic users at this site with their local forebears. In the course of a recent AMS ^{14}C dating project[6] one of these two skeletons gave a result that on 2σ gave a range of 7300–6800 cal BC. This is the first such date from this region and it certainly shows that strategic sampling could make of absolute dating a powerful interpretative tool. Even more importantly, the age of this skeleton indicates the same practice of relation to ancestral traces seen at Lepenski Vir, Padina or Vlasac. This is not to claim that all the burials from the Early Neolithic sites in the Balkans indicate the existence of older features in the mortuary domain, but it is certainly to be expected that some contexts and artefacts from some of these sites conceal traces of much older occupation. The point that deserves particular attention, however, is that the recognition of the past is astonishing here, as, for example, was particularly demonstrated in the dating of Vlasac burial no. 72, mentioned above.

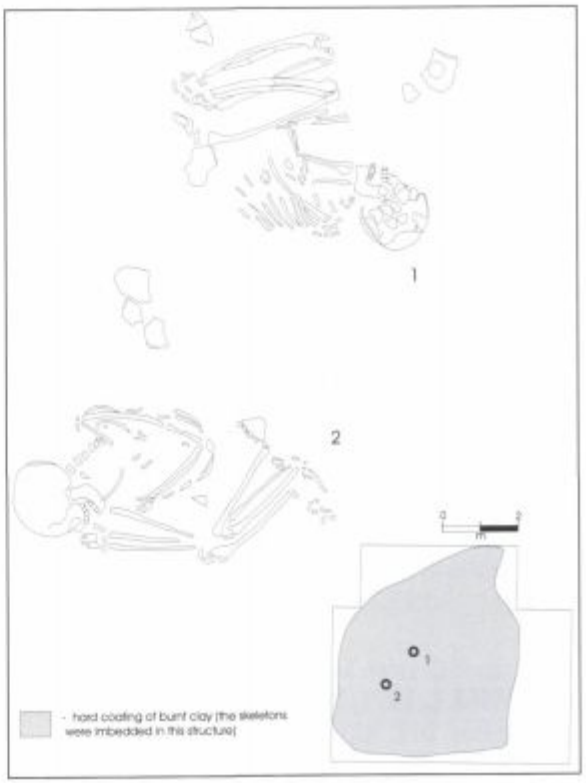


Fig. 28. Double burial, Topole-Bač (*after Trajković 1988.99*).

6 The results came out of the AMS project for dating Early Neolithic sites of the northern Balkans, directed by Prof. Alasdair Whittle (University of Cardiff Wales) and funded by Natural Environmental Research Council, UK.

As have I tried to show in the examples of some of the burials, they could be interpreted as a reflection of myths, religious practices and beliefs with roots in a much deeper past. If Richard Breadly (*1998. 24–25*) is correct in speaking of Mesolithic burials as almost exclusively containing organic materials as offerings, such as animal bones and bone tools, should I consider some of the burials described above as Mesolithic? I do not know. It seems to me that I cannot use terms such as Mesolithic and Neolithic with the absolute meaning ascribed to them. If used at all, they would have to indicate only a certain historical milieu, trajectories of time. But to distinguish between them on the basis of economies and specific cultural stages does not appear easy or possible.

CONCLUSION

As in the epigraph by Czeslaw Milosz, it seems that only in these general terms is it possible to grasp the spread of new ideas, technologies and ways of doing things. But particularities of how the whole historical process happened are hard to envisage. However, looking into the richness of the material record would be the only way to break out from well-routed concepts that freeze the picture and create a static landscape. Instead, everything is moving, and every time one opens the lid of a dusty box, smelling the soil and moisture, creates the opportunity to participate in the game with a new understanding.

I have tried primarily to focus on the correct sequencing of Mesolithic and Neolithic features in the Danube Gorges and Early Neolithic sites across the Balkans. This sequencing is crucial for understanding the process of habitation (*cf. Ingold 1993*) during this period. Only this understanding offers the possibility of a metanarrative understanding of the origins of the death and creation of the temporal dimension. The metaphoric and symbolic are at the core of this understanding. They could be seen as a way back, opposite to *distentio*. Metaphorical thought is inseparably connected to the ontological value of human existence (*Tilley 1999.51*). And dreams and myths bring back a time of wholeness. However, once established, temporal relations acquire ontological weight in connection to places, in connection to a landscape, and layers of materiality at these places pile up proof of the being nature of time. The people of Padina, Lepenski Vir and Vlasac who sit on the bedrock with crossed legs and watch the Danube bring back the idea of a pleasure that once was; they *speak* of the passage of time. At the same time, their corporeal selves here infinitely strongly erase the culture/nature divide.

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REFERENCES

ALTHUSSER L. 1971. Ideology and ideological state apparatuses. In L. Althusser (ed.), *Lenin and Philosophy and Other Essays: 121–173.*

AMMERMAN A. J. and CAVALLI-SFORZA L. L. 1973. A population model for the diffusion of early farming in Europe. In C. Renfrew (ed.), *The Explanation of Culture Change. Models in Prehistory: 343–357.*

BARTOSIEWICZ L., BONSALL C., BORONEANT V., STALLIBRASS S. 1995. Schela Cladovei: a preliminary review of the prehistoric fauna. *Mesolithic Miscellany 16(2): 2–19.*

BONSALL C., BORONEANT V., SREJOVIĆ D. 1996. AMS Radiocarbon Determinations on Human Bone from Lepenski Vir, Vlasac and Schela Cladovei. *Mesolithic Miscellany 17(2): 6–10.*

BONSALL C., LENNON R., MCSWEENEY K., STEWART C., HARKNESS D., BORONEANT V., BARTOSIEWICZ L., PAYTON R. and CHAPMAN J. 1997. Mesolithic and Early Neolithic in the Iron Gates: a palaeodietary perspective. *Journal of European Archaeology 5(1): 50–92.*

BORIĆ D. in preparation. *Mesolithic – Neolithic time views in the Balkans*. Unpublished doctoral dissertation, University of Cambridge.

BORONEANT V. 1970. La période épipaléolithique sur la rive roumaine des Portes de Fer du Danube. *Praehistorische Zeitschrift 45(1): 1–25.*

1973. Recherches archéologiques sur la culture Schela Cladovei de la zone des 'Portes de Fer'. *Dacia 17: 5–39.*

BORONEANT V., BONSALL C., MCSWEENEY K., PAYTON R., MACKLIN M. 1999, A Mesolithic Burial Area at Schela Cladovei, Romania. In A. Thevenin (ed.), *L'Europe des derniers chasseurs – Epipaleolithique et Mesolithique: 385–390.*

BOURDIEU P. 1977. *The outline of a theory of practice*. Cambridge: University of Cambridge Press.

1990. *The logic of practice*. Stanford: Stanford University Press.

BRADLEY R. 1998. *The significance of monuments. On the shaping of human experience in Neolithic and Bronze Age Europe*. London and New York: Routledge.

BRIDGES P. 1989. Changes in activities with the shift to agriculture in Southeastern United States. *Current Anthropology 30(3): 385–394.*

BRINKHUIZEN D. C. 1986. Features observed on the skeletons of some recent European Acipenseridae: their importance for the study of excavated remains of sturgeon. In D. C. Brinkhuizen and A. T. Clason (eds.), *Fish and Archaeology. Studies in Osteometry, Taphonomy Seasonality and Fishing Methods: 18–32. Oxford: BAR Int. Ser. 294.*

BURLEIGH R. and ŽIVANOVIĆ S. 1980. Radiocarbon dating of a Cro-Magnon population from Padina, Yugoslavia, with some general recommendations for dating human skeletons. *Zeitschrift für Morphologie und Anthropologie 70(3): 269–274.*

CARSTEN J. and HUGH-JONES S. 1995. Introduction. In J. Carsten and S. Hugh-Jones (eds.), *About the House, Lévi-Strauss and Beyond: 1–46.*

CHAPMAN J. C. 1989. Demographic Trends in Neothermal South-East Europe. In C. Bonsall (ed.), *The Mesolithic in Europe. Papers Presented at the Third International Symposium Edinburgh 1985: 500–515.*

1992. Social Power in the Iron Gates Mesolithic. In J. Chapman and P. Dolukhanov (eds.), *Cultural Transformations and Interactions in Eastern Europe: 71–121.*

1994. The origins of farming in South East Europe. *Préhistoire Européenne 6: 133–156.*

DINAN E. H. 1996a. A preliminary report on the lithic assemblages from the early Holocene level at the Iron Gates site of Bâile Herculane. *Mesolithic Miscellany 17(2): 15–24.*

1996b. Preliminary lithic analysis of the Epigravettian levels from the Iron Gates site of Cuina Turcului. *Mesolithic Miscellany 17(2): 25–40.*

DIMITRIJEVIĆ V. and BORIĆ D. in preparation. Animal bones from the site of Padina in the Iron Gates, Serbia. In B. Jovanović (ed.), *Padina*.

DUBY G. 1974. Histoire sociale et idéologies des sociétés. In J. LeGoff and Nora (eds.), *Faire de l'histoire, vol. 1: 149.*

GARAŠANIN M., SANEV V., SIMOSKA D., KITANOSKI B. 1971. *Les civilisations préhistoriques de la Macédoine*. Štip: Musée National.

GEERTZ C. 1973 [1993]. *The Interpretation of Cultures. Selected Essays*. New York: Basic Books.

GOB A. 1990. *Chronologie du Mésolithique en Europe. Atlas des dates ^{14}C*. Liège: C.I.P.L.

HEIDEGGER M. 1962. *Being and time*. Oxford: Basil Blackwell.

HODDER I. 1990. *The Domestication of Europe. Structure and Contingency in Neolithic Societies*. Oxford: Basil Blackwell.

1991. Interpretative archaeology and its role. *American Antiquity 56(1): 7–18.*

1993. The narrative and rhetoric of material culture sequences. In R. Bradley (ed.), *Conceptions of time and ancient society: 268–282.*

1999. *The archaeological process. An introduction*. Oxford: Blackwell Publishers.

INGOLD T. 1993. The temporality of the landscape. In R. Bradley (ed.), *Conceptions of time and ancient society: 152–174.*

JOVANOVIĆ B. 1966. Sculptures de la nécropole de l'age du fer ancien à Hajdučka Vodenica. *Archaeologia Iugoslavica VII: 31–34.*

1968a. Padina, naselje starijeg neolita i starijeg gvozdenog doba. *Arheološki pregled 10: 89–93.*

1968b. Elements of the Early Neolithic Architecture in the Iron Gate Gorge and their Functions. *Archaeologia Iugoslavica IX: 1–9.*

1969a. Padina – naselje starijeg neolita i starijeg gvozdenog doba. *Arheološki pregled 11: 129–136.*

1969b. Chronological Frames of the Iron Gate Group of the Early Neolithic Period. *Archaeologica Iugoslavica X: 23–38.*

1969c. Hajdučka Vodenica – naselje i nekropola starijeg gvozdenog doba. *Arheološki pregled 11: 92–97.*

1971. Padina kod Gospodjinog Vira. *Materijali 6: 65–70.*

1972. The autochthonous and the migrational components of the Early Neolithic in the Iron Gates. *Balcanica III: 49–58.*

1974a. Praistorija gornjeg Djerdapa (La préhistoire du Djerdap supérieur). *Starinar XII (1971): 1–22.*

1974b. Relativnohronološki odnos starijeg neolita Djerdapa i Vojvodine. *Materijali X: 31–49.*

1975. The origin of early Neoltihic in Djerdap. *Godišnjak XIV: 5–18.* Sarajevo: Centar za balkanološka ispitivanja, knjiga 12.

1984a. Hajdučka Vodenica, praistorijska nekropola. *Starinar XXXIII–XXXIV (1982–1983): 305– 313.*

1987. Die Architektur und Keramik der Siedlung Padina B am Eisernen Tor, Jugoslawien. *Germania 65(1): 1–16.*

KARMANSKI S. 1968. *Slikana keramika sa lokaliteta Donja Branjevina kod Deronja*. Odzaci.

KOZŁOWSKI J. K. and KOZŁOWSKI S. K. 1982. Lithic industries from the multi-layer Mesolithic site Vlasac in Yugoslavia. In J. K. Kozłowski (ed.), *Origin of the chipped stone industries of the early farming cultures in Balkans: 11–109.*

1983. Chipped stone industries from Lepenski Vir. *Preistoria Alpina 19: 259–294.*

LEKOVIĆ V. 1985. The Starčevo mortuary practices – new perspectives. *Godišnjak XXIII (Centar za balkanološka ispitivanja): 157–172.*

MANN M. 1986. *The sources of socila power. Vol. 1. A history of power from the beginning to A.D. 1760.* Cambridge: Cambridge University Press.

MARKOVIĆ-MARJANOVIĆ J. 1978. Geologija i stratigrafija. In M. Garašanin (ed.), *Vlasac – mezolitsko naselje u Djerdapu (Vlasac. A Mesolithic Settlement in the Iron Gates) Vol. II: 11–27.*

MILISAUSKAS S. 1978. *European Prehistory*. New York: Academic Press.

MOGOSANU F. 1978. Mezoliticul de la Ostrovul Corbului, o noua asezare de tip Schela Cladovei. *Studii si cercetari de istorie veche 29(3): 335–51.*

NALBANT T. T. 1970. Cîteva obseravatii asupra resturilor de pesti descoperite în locuirile romanello-aziliene (I–II) de la Cuina Turcului – Dubova. *Studii si cercetari de istorie veche 21(1): 41–3.*

NANDRIS J. 1968. Lepenski Vir. *Science Journal 4(1) (January 1968): 64–70.*

1971. Europe's First Monumental Sculpture: New Discoveries at Lepenski Vir. Reviews. *Proceedings of the Prehistoric Society 38: 426–429.*

NEY P. 1971. Mineralogische Analyse einer fussbodenprobe von Lepenski Vir I. In H. Schwabedissen (ed.), *Die Anfänge des Neolithikums vom Orient bis Nordeuropa, Teil 2: Östliches Mitteleuropa: 33–34*. Köln/Wien: Fundamenta, Monographien zur Urgeschichte, Reihe A, Band 3.

NICOLÂESCU-PLOPSOR C. S., COMSA E. and PÂUNESCU A. 1957. Santierul arheologic Bâile Herculane (reg. Timisoara, r. Almas). *Materiale 3: 51–58.*

PAUNESCU A. 1970. Epipaleoliticul de la Cuina Turcului-Dubova. *Studii si cercetari de istorie veche 21(1): 3–29.*

1978. Cercetarile archeologice de la Cuina Turcului-Dubova (Jud. Mehedinti). *Tibiscus istorie. Volum închinat celei de-a 60 a aniversari a Unirii: 11–56.*

1990. Locuirea mesoliticâ de tip Schela Cladovei de la Ostorvul Corbului (jud. Mehedinti). *Studii si cercetari de istorie veche 41(2): 123–47.*

1996. Ostrovul Corbului. Die mesolithische Siedlung der Schela Cladovei-Kultur 1.b. In H. Hauptmann and P. Roman (eds.), *Ostrovul Corbului: 155–214.*

PETROVIĆ J. 1986–1987. Zemunica u naselju starčevačke kulture na Golokutu. *Rad vojvodjanskih muzeja 30: 13–28.*

RADOVANOVIĆ I. 1992. *Mezolit Djerdapa.* Unpublished Ph.D. Dissertation. Beograd: Filozofski fakultet.

1996a. *The Iron Gates Mesolithic.* Ann Arbor: International Monographs in Prehistory, Archaeological Series 11.

1996b. Mesolithic/Neolithic contacts: a case of the Iron Gates region. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXIII: 39–48.*

1997. The Lepenski Vir Culture: a contribution to interpretation of its ideological aspects. In *Antidorian Dragoslav Srejović completis LXV annis ad amicis, collegis, discipulis oblatun: 85–93.*

1994. A Review of Formal Disposal Areas in the Mesolithic of Europe. *Starinar XLIII–XLIV (1992–1993): 92–103.*

RADOVANOVIĆ I. and VOYTEK B., 1997. Hunters, fishers or farmers: sedentism, subsistence and social complexity in the Djerdap Mesolithic. *Analecta Praehistorica Leidensia 29:19–31.*

RENFREW C. 1987. *Archaeology and Language.* London: Cape.

RICOEUR P. 1984. *Time and narrative,* I vol. Chicago and London: The University of Chicago Press.

RIVIÉRE P. 1995. Houses, places and people: community and continuity in Guiana. In J. Carsten and S. Hugh-Jones (eds.), *About the House, Lévi-Strauss and Beyond: 189–205.*

SREJOVIĆ D. 1966. Lepenski Vir – a New Prehistoric Culture in the Danubian Region. *Archaeologia Iugoslavica VII:13–17.*

1967. Lepenski Vir – iskopavanja 1965–1967. g. *Starinar XVIII: 156–166.*

1968a. Lepenski Vir 7000 Years Ago. *The Illustrated London News, January 20: 23–25.*

1968b. Lepenski Vir Pottery and Sculptures. *The Illustrated London News, February 3: 27–29.*

1968c. Lepenski Vir (Boljetin) – predneolitska i neolitska naselja i nekropole. *Arheološki pregled 10: 85–87.*

1969a. *Lepenski Vir – Nova praistorijska kultura u Podunavlju.* Beograd: Srpska književna zadruga.

1969b. Lepenski Vir, Boljetin – predneolitska i neolitska naselja i nekropole. *Arheološki pregled 11: 121–122.*

1969c. Lepenski Vir – naselje iz doba predneolita i starijeg neolita. In Đ. Boškovic (ed.), *Stare kulture u Đerdapu/Anciennes cultures du Djerdap: 49–56.*

1969d. The Roots of the Lepenski Vir Culture. *Archaeologia Iugoslavica X: 13–21.*

1970. Lepenski Vir, Boljetin – predneolitska i neolitska naselja i nekropole. *Arheološki pregled 12: 72–73.*

1972. *Europe's First Monumental Sculpture: New Discoveries at Lepenski Vir.* London: Thames and Hudson.

1989. The Mesolithic of Serbia and Montenegro. In C. Bonsall (ed.), *The Mesolithic in Europe. Papers Presented at the Third International Symposium Edinburgh 1985: 481–491.*

SREJOVIĆ D. and BABOVIĆ L.1983. *Umetnost Lepenskog Vira*. Beograd: Jugoslavija.

SREJOVIĆ D. and LETICA Z. 1978. *Vlasac. Mezolitsko naselje u Djerdapu (Vlasac. A Mesolithic Settlement in the Iron Gates)* (I arheologija). Beograd: Srpska akademija nauka i umetnosti.

TELLENBACH M. 1983. Materialien zum Präkeramischen Neolithikum in Süd-Ost-Europa. Typologisch-stratigraphische Untersuchungen zu lithischen Gerätschaften. *Bericht der Römisch-Germanischen Kommission 64: 21–137, Tafeln 1–48.*

THELIN N. B. 1990. On the concept of time: Prolegomena to a theory of aspect and tense in narrative discourse. In N. B. Thelin (ed.), *Verbal Aspect in Discourse: 91–129.*

TILLEY C. 1994. *A phenomenology of Landscape. Places, Paths and Monuments.* Oxford/Providence: Berg.

1999. *Metaphor and Material Culture*. Oxford: Blackwell Publishers.

TRAJKOVIĆ Č. 1978. Šecerana, Topole, Bač - praistorijsko naselje i grobovi. *Arheološki pregled 19: 23–24.*

1988. Topole - Bač. In D. Srejović (ed.), *The Neolithic of Serbia. Archaeological Research 1948–1988: 99–101.*

TREHERNE P. 1995. The warrior's beauty: the masculine body and self-identity in Bronze-Age Europe. *Journal of European Archaeology 3(1): 105–144.*

TURNER V. 1967. *The Forest of Symbols: aspects of Ndembu ritual*. Ithaca, N.Y.

1969. *The Ritual Process: structure and anti-structure*. New York: Aldine de Gruyter.

1974. *Dramas, Fields and Metaphors: symbolic action in human society*. Ithaca, London: Cornell University Press.

VOYTEK B. 1987. Analysis of lithic raw material from sites in eastern Yugoslavia. In K. T. Bíro (ed.), *Papers for the First International Conference on Prehistoric Flint Mining and Lithic Raw Material Identification in the Carpathian Basin, Budapest-Sümeg, 1986: 287–295.*

VOYTEK B. and TRINGHAM R. 1989. Rethinking the Mesolithic: the Case of South-East Europe. In C. Bonsall (ed.), *The Mesolithic in Europe. Papers Presented at the Third International Symposium Edinburgh 1985: 492–499.*

WHITTLE A. 1985. *Neolithic Europe: A Survey*. Cambridge: Cambridge Univeristy Press.

1996. *Europe in the Neolithic. The creation of new worlds*. Cambridge: Cambridge University Press.

1998. Fish, faces and fingers: presences and symbolic identities in the Mesolithic-Neolithic transition in the Carpathian Basin. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXV: 133–150.*

ZOFFMANN K. Z. 1983. Prehistorical skeletal remains from Lepenski Vir (Iron Gate, Yugoslavia). *Homo 34: 129–148.*

1979. Further evidence on Cro-Magnon Man in the Iron Gate Gorge of the Danube. *Current Anthropology 20(4): 805.*

ZVELEBIL M. 1986. Mesolithic prelude and Neolithic revolution. In M. Zvelebil (ed.), *Hunters in Transition: 167–187.*

1994 (1995). Neolithization in Eastern Europe: a view from the frontier. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXII: 107.*

ŽIVANOVIĆ S. 1975. A note on the anthropological characteristics of the Padina population. *Zeitschrift für Morphologie und Anthropologie 66(2): 161–175.*

1976. Cromagnon in the Iron Gate Gorge of the Danube. *Nature 260: 518.*

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Documenta Praehistorica XXVI

"Neither person nor beast" – dogs in the burial practice of the Iron Gates Mesolithic[1]

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ABSTRACT – *Research into burial practices of the Iron Gates Mesolithic is here focused upon the dog burials and human burials associated with dog remains in the sites of Vlasac and Lepenski Vir. The analyses of these remains was undertaken in regard to the study of human-animal relationship in the Iron gates, especially that of humans and canids, the canid domestication process, and the possible role of canids in the Iron Gates Mesolithic belief system. It was argued that canid-human relationship, as it is reflected by material remains both in the settlement and formal disposal areas, was varied and became more ambiguous at the time of contact with the Early Neolithic. Certain aspects of that relationship are firmly incorporated into a broader network of metaphors operating the worldview of the Mesolithic community.*

IZVLEČEK – *V članku se osredotočamo na raziskave mezolitskih pokopov psov v Železnih vratih in na pokope ljudi, ki so povezani z ostanki psov na najdiščih Vlasac in Lepenski vir. Analize teh ostankov smo opravili z namenom, da bi raziskali razmerje med človekom in živaljo, še posebej razmerje med ljudmi in psi, udomačevanje psa in njihovo morebitno vlogo v verskem sistemu mezolitskih Železnih vrat. Razmerje pes-človek se je, kot kažejo materialni ostanki v naselbini in na določenih odlagališčih, spreminjalo in je postalo bolj negotovo v času stikov z zgodnjim neolitikom. Določeni vidiki tega razmerja so trdno vpeti v širšo mrežo svetovnonazorskih metafor mezolitskih skupnosti.*

KEY WORDS – *Danube Gorges; Mesolithic burial practices; human-animal relationship; domestication process; belief system*

INTRODUCTION

This paper aims to explore the archaeological evidence of the practice of dog burials and placement of dogs or dog skeletal remains in human burials at Iron Gates Mesolithic sites (further: IGM). Interpretation of that evidence is based upon various associations of material remains within their immediate contexts. Possible associations of humans and canids over the course of time and the visibility of some of these in the IGM archaeological record are discussed.

ARCHAEOLOGICAL EVIDENCE OF IGM BURIALS WITH CANIDS OR HUMAN/CANID ASSOCIATIONS

There are only four graves containing canids and/or human-canid associations, and compared to the total number of human burials within formal disposal areas of the IGM, they represent only a small, statistically almost negligible fraction[2]. They were recorded at the sites of Vlasac (three graves) and Lepenski Vir (one grave), situated on the right bank of the Danube in the Upper Gorges (*Srejović 1969; Srejo-*

1 I wish to thank M. Budja for inviting me to cover the topic of dog burials from the Iron Gates Mesolithic perspective – a topic neglected in my previous studies of funerary rites of the area. A characterization of the dog being "neither person nor beast" is borrowed from J. Serpell's (*1995.254*) inspiring essay on the ambiguous nature of the dog's role in various societies.

2 The total number of human burials in the IGM is 687, and that of burials associated with dogs represents only 0.58% (*Radovanović 1996.161*). However, the mentioned total number now differs in regard to results of the re-analysis of skeletal material from the right bank of the Danube (*Roksandić in prep. pers. com.*) and to recently discovered burials at one of the IGM sites, Schela Cladovei (*Bonsall et al. 1997*). As no additional burials associated with dogs were reported on these occasions, their number for now remains unchanged.

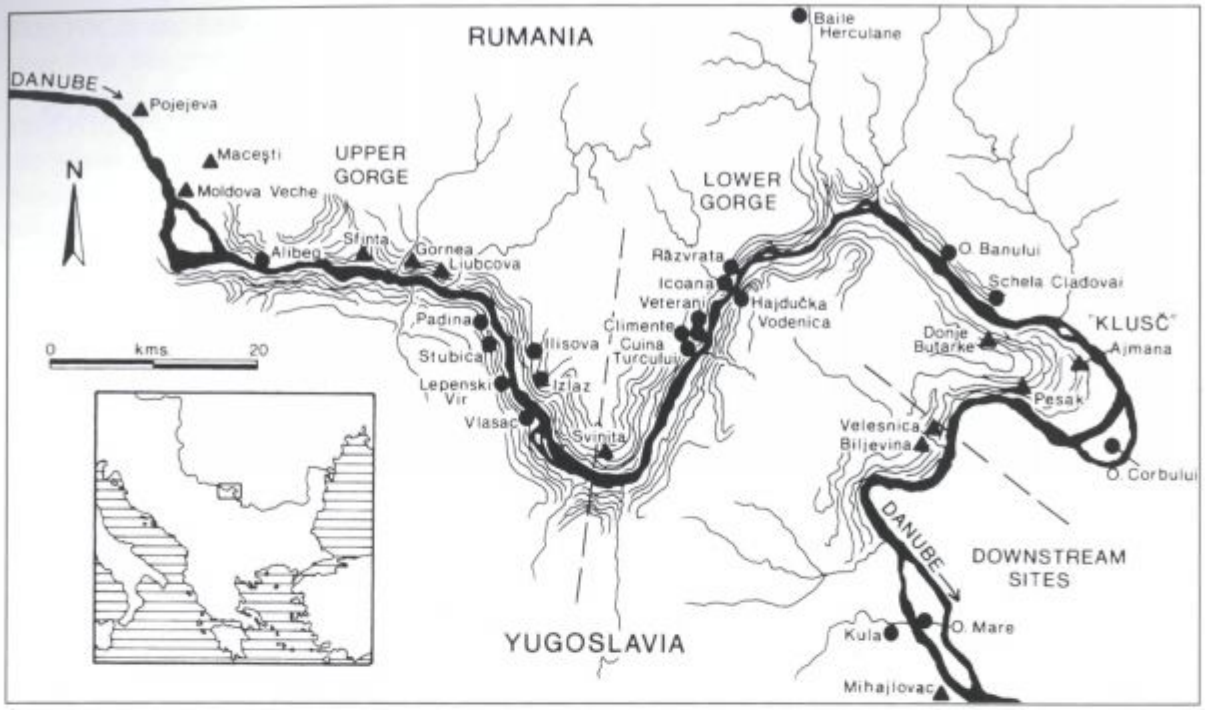

Fig. 1. Map of the Iron Gates Late Palaeolithic, Mesolithic and Early Neolithic sites (after Radovanović and Voytek 1997).

vić & Letica, 1978; Zoffmann 1980) (Fig. 1). All four canid graves belong to the late phases of the local Mesolithic, dated between the mid-seventh and mid-sixth millennium BC (*Radovanović 1996.289*). Thus, all four represent IGM burials in settlements which are contemporaneous with the first Early Neolithic settlements in the region (*Radovanović 1996a*). They are described as follows.

Vlasac (phase II and III)

Burial No. 25 (Fig. 2)

Recorded at the very end of the downstream part of the Vlasac terrace (sq. C/IV), perpendicular to the course of the river, the head towards the rear of the site (*Radovanović 1996.210*). This burial also belongs to the later type of the IGM formal disposal areas and could be related to the Vlasac II settlement phase, although attribution to phase III is a possibility (*Srejović and Letica 1978.62; Radovanović 1996.358*). According to Srejović and Letica, the deceased was extended on his back, with his right hand placed across his left on the pelvic area, and with his legs extended. A stone-lined construction could be observed along both sides of the body, with a larger stone covering the head. An animal mandible fragment was recorded upon the chest of the deceased.

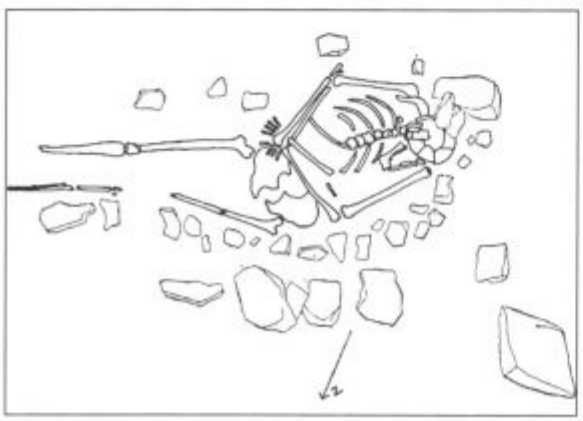

Fig. 2. Burial No. 25, Vlasac (after Srejović and Letica 1978).

Skeletal analyses describe the human as a 53–59 year old man, while the animal mandible is that of a dog.

Burial No. 27 (Fig. 3)

Recorded in the upstream, western part of the settlement (sq. b/18) in the location that seems to have been reserved for burials since the initial establishment of a formal disposal area at Vlasac. The burial was placed above an area previously used for a number of interments around house 2 (belonging to the Vlasac I phase and interpreted as a possible structure related to funerary practices). Although that structure collapsed long before the No. 27 interment, it is obvious that this location itself maintained the role of a formal disposal area, for it was used repeatedly over a long time span. According to

Srejović and Letica (*1978.62*), burial No. 27 belongs to phase II of the Vlasac settlement although also, possibly, to an early phase III[3]. According to the results of neutron activation analysis, these skeletal remains are dated later, to 5650±50 BC (*Radovanović 1996.367*).

By the burial's prevailing attributes, it belongs to a later type of IGM formal disposal area (*Radovanović 1996.206, 215–217*). Its position in relation to Structure XI above it is similar to the relation of Vlasac I burials (in the central part of the settlement) to the circular stone constructions of Vlasac II erected above them. Therefore, in this case as well, it could be assumed that the grave has some meaningful association with the structure erected above it.

No traces of a burial pit were noted at the time of excavation. Skeletal remains are perpendicular to the course of the river, with the head facing the rear of the site[4] (*Radovanović 1996.206*). Srejović and Letica (*1978.62*) reported that the human deceased was laying extended on his back with his right arm across his waist and left arm placed 'in the secondary position' below the rib cage and left hand in the pelvic area. The legs were extended, but the right leg was placed across the left one, below the knees. A fragment of animal mandible was recorded just next to the right knee.

According to the skeletal analyses, this human was a 51–57 year old male, while the animal mandible was that of a dog.

Burial No. 81 (Fig. 4)

Unfortunately, the evidence for this burial is deficient. Burial No. 81 was recorded in the rear of the upstream, western part of the Vlasac terrace, in the periphery of the prehistoric settlement (sq. d/15). It is perpendicular to the course of the river, with the feet facing the rear of the site and the head facing the river, although unfortunately, the head and upper parts of the body remained unexcavated. This burial belongs to the later type of IGM formal disposal areas (*Radovanović 1996.206*) and to the Vlasac II phase in terms of settlement stratigraphy (*Srejović and Letica 1978.62, 64*). The human's legs are extended, while an animal skeleton, buried parallel to the course of the river with the head pointing downstream, was recorded 'not far from the feet of the deceased'. No traces of a burial pit or stone lining were observed.

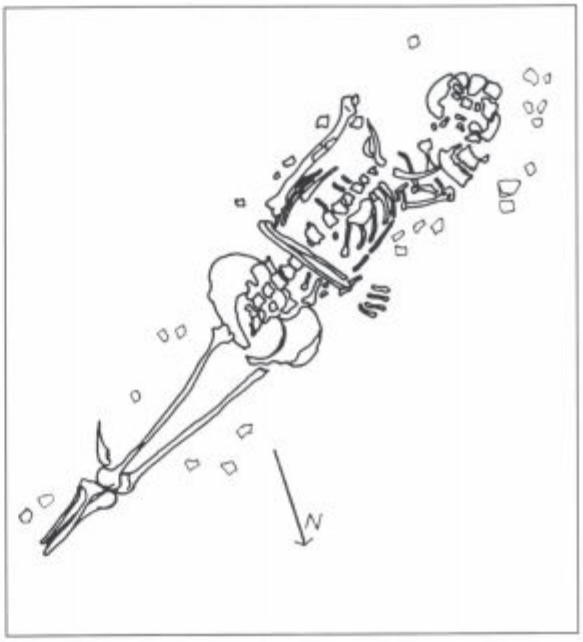

Fig. 3. Burial No. 27, Vlasac (after Srejović and Letica 1978).

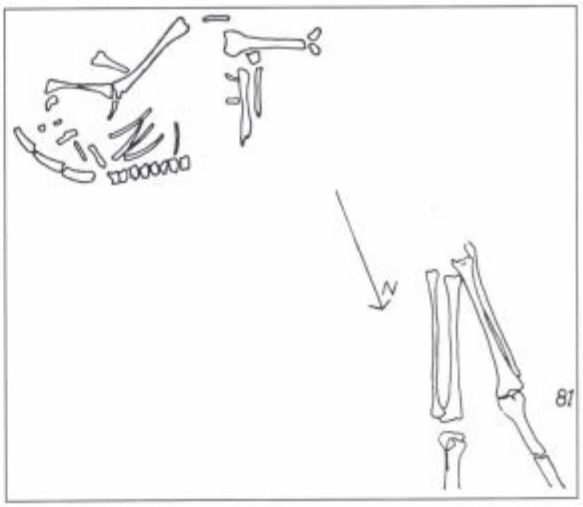

Fig. 4. Burial No. 81, Vlasac (after Srejović and Letica 1978).

3 It was uncovered below Structure XI dated to Vlasac phase III. Structure XI was erroneously labeled as Structure X in the original publication about Vlasac (*compare figs. 25, 39, 40 and 49 in Srejović & Letica 1978*). Unfortunately, I repeated the same error in illustrations for my book (*see figs. 3.39 and 3.44b in Radovanović 1996*). In my opinion, grave No. 27 already belongs to Vlasac III: the very same location in sq. b/18 contains Structure IV (belonging to Vlasac II) unearthed at 64.78 m above sea level; the noted, more substantial Structure XI (Vlasac III) was found between 65,70 and 65,50 m above sea level, while Burial No. 27 was interred below it at 65.30 m, and thus could be contemporaneous or roughly contemporaneous with Structure XI (*see also Radovanović 1996.353-354*).

4 On grave orientation patterns in the IGM see Radovanović 1996.167.

Skeletal analyses have shown that burial No. 81 belongs to a woman older than 23, while the animal skeleton is that of a dog. According to a field sketch (Fig.4), the dog's skull and neck are missing. They are also missing in Bökönyi's list of measurable bones related to that skeleton (*1978.51-55; data for sq., d/15, e.l. IX*). One could assume that the skull was not found due to extremely bad preservation conditions, but since the postcranial bones were rather well preserved in this case, and since skull bones - especially the teeth and mandible - are usually better preserved than the rest of the skeleton, it could also be assumed that this dog's head was removed before its burial[5].

Dog burial was clearly practised in the IGM. Only in this case, it remains uncertain whether this dog was buried in its own right, or in association with the woman in burial No. 81[6].

Lepenski Vir I (phase 3)[7]

Burial No. 70 (Fig. 5)

The secondary disposal of human bones (femur, ribs and an ulna) and an animal mandible were uncovered 'slightly above the floor' in the rear of the hearth belonging to house 32. House 32 is placed in the rear of the settlement, and according to the site's stratigraphy and its structural properties, it belongs to the latest phase 3 (or Srejović's phases d-e) of Lepenski Vir I. It is placed in Location 14, which was repeatedly used during phase 3 of LV I (*superimposed houses 66, 20, 33, 32, see Radovanović 1996. 108-110, fig. 90*). An aniconic 'altar' was placed at the rear of house 32's hearth (*Radovanović 1996. table 3.3*). Six 'signs/supporters'[8] are situated alongside the right border of the hearth, and one is placed left of the rear axis of the hearth, just left of the 'altar' (*Srejović & Babović 1983.177*).

The human bones belong to a 35-55 year old man, while the animal mandible is that of a dog (*Radovanović 1996.185, after Zoffmann 1983 and field documentation*).

The immediate context of these burials implies that humans and dogs in the IGM had some kind of relationship which was at least not an indifferent one. In three cases, the placement of a dog mandible was recorded within burials of men. In one case, the con-

Fig. 5. House 32 containing burial 70, Lepenski Vir (after Srejović and Babović 1983).

5 The practice of disarticulation/mutilation of interred bodies was observed in human burials of the later type in the IGM, generally prevailing among women and children. Those with missing skulls, i.e., 'headless', are children (burials 42a, 21, and 7 - all in the same location within the formal disposal area, *Radovanović 1996.206-210, 218*). Vlasac male burials such as No.3 (fragments of a skull found in the cultural layer; *Srejović and Letica, 1978.63*), No. 16 (a skull associated with burial 17; *Radovanović 1996.216*), and No. 43 (a skull without the mandible placed within a grave structure, *Srejović and Letica, 1978.63*) are not postcranial remains, while Vlasac female burials 71 and 73 are indeed postcranial remains, but with lower jaws recorded and thus excluded from the 'headless' category, as I erroneously listed them in *1996.207-8, 210*).

6 However, a possible association with the human burial, i.e., within the same grave, seems to be rather improbable in this case. This dog certainly lies close to the woman's feet, but not close enough: if they were really buried together in the same grave, the spatial disposition of their skeletal remains would have been more 'compact' (see figure 4).

7 The phases are labeled according to my reinterpretation of the Lepenski Vir site stratigraphy (*1996.104-114*).

8 "Stone plaquettes arranged in the form of the letter A were variously interpreted either as the supporters for the construction above the hearth (Jovanović) or signifiers which stood for the dead members of the family from that house (Srejović). They seem to stand as the construction supporters in some cases only, when they are arranged symmetrically around the hearth, but in many cases they are arranged only at one border of the hearth, or asymmetrically, or in unequal number at both sides, or just one of them, so that Jovanovic's assumption remains to be verified. Srejović's assumption that these were signs is more plausible, although it is not clear whether the greater number of these signs in later LV houses really coincided with the introduction of burials below the houses and in the house floors. In regard to their predecessor - the human mandible (*Srejović 1969.2-73, 140-141; Radovanović 1996.134*) and in view of my comments on the mandibles at the end of this paper, Srejović's assumptions seems to be closer to their actual meaning, in that they were primarily symbolic and not constructive elements."

trasting burial of a 'headless' dog may possibly be associated with a woman buried in a nearby grave.

No traces of other grave goods were recorded in association with any of the noted burials. A formal grave construction was visible in only one case (Vlasac burial No. 25). The relation of burials to dwelling structures was noted in two cases (Vlasac burial 27 and Lepenski Vir burial 70). All human burials contained direct interments except for the Lepenski Vir secondary interment of a man's femur, ribs, and ulna.

Another consideration should be made here in regard to the chronology of these burials. Both Vlasac and Lepenski Vir I burials belong to the late type of formal disposal area in the IGM. Two Vlasac burials with canid remains are characterised by a 'generalised' pattern of man/animal mandible association (*Radovanović in prep.*) and the third one is the noted exception – a 'headless' dog burial. All the mentioned Vlasac burials appear to fall within the second part of the VII millennium BC. Even if they are related to the Vlasac III phase (i.e., closer to the turn of the VII/VI millennium), they still might be earlier than Lepenski Vir burial No. 70 (belonging to the latest horizon of phase 3 in LV I).

However, the spatial and temporal discontinuity of human/canid association in burials does not appear to be that significant if these burials are analysed within a somewhat broader context of human/animal, i.e., human/animal mandible associations. As already noted, the later type of IGM funerary practice is marked by a placement of human or animal skulls and human or animal mandibles[9] within graves (*Radovanović 1994; 1996; but in greater detail in: Radovanović 1996b.20. Table 9*). All human and animal skulls and animal mandibles are associated with either direct or secondary burials of men, while human mandibles seem to be associated with women and children. Animal skull or mandible remains are always associated with men, and it was therefore assumed that they are somehow related to hunting activities, especially because the men buried with such remains are found to belong to *adultus* and *maturus* age categories (with the exception of one *juvenilis)*, i.e., those expected to engage in such activities (*ibid.*). For this reason, the canid skeletal remains associated with men's burials should be considered a part of the more general category of an animal-man, or more precisely, an animal-hunter relationship. However, I am not inclined to think that all aspects of the human/canid relationship in the IGM should be interpreted in terms of some generalization about hunters and their "faithful dog companions" and I shall try to explain why I think so in the course of this paper.

HUMAN/CANID RELATIONSHIP IN THE IRON GATES

Several interpretations of the human/canid relationship in the IGM are possible. But first I would like to review a number of important general issues in regard to the human/canid relationship, in particular that of the human/wolf. Ecologically, these two species would appear to stand in a relation of rivalry, for both hunt the same repertory of game within a variety of niches (*Fox 1978.25; Sharp 1978.77; Clutton-Brock 1994.25*). In terms of social biology, both are marked by complex patterns of behaviour. They are social hunters, who, apart from hunting, perform all other actions within the social group – the band and pack, respectively – which operates within a marked territory (*Hall 1978; Peters 1978. 95–96; Peters 1979.135ff; Peters and Mech 1978. 134; Mech 1970.68ff; Clutton-Brock 1995.8*). Both species are aware of each other's presence in the same niche (or territory); both are aware of each other's behaviour and its impact on practically the same staple food resources (*Mech 1970.8*). Human awareness of animals (including that of wolves) and an understanding of their relations may, of course, be well illustrated by various mythical narratives and scientific reports (*Ingold 1994*). An understanding of the wolf's awareness of humans is more difficult. It may, however, be discerned through analyses of the cognitive abilities of wolves and their impact on various aspects of its social behaviour (*Mech 1970; Fox 1975; Klinghammer 1979; Hall and Sharp 1978*) and, especially, of the changes in that behaviour, the most profound of which relate to the so-called domestication process.

The results of these analyses led many scholars to assume that during the Pleistocene of Eurasia, humans and wolves established a relationship which was not exactly a symbiosis, but rather a sort of *alliance* (*Clutton-Brock 1994.25*). It is in this frame-

9 Animal bones (unidentified) were uncovered in male graves at early Vlasac (one case) and Lepenski Vir I (two cases), and in children's graves in Lepenski Vir I (two cases). Antler is recorded in male graves of early Vlasac (one case) and later in Lepenski Vir I (four cases), but it is associated with women only in Lepenski Vir II (four cases).

work of *alliance* that I shall further analyse my data, trying not to focus exclusively on the benefits that these two species may have gained in terms of their successful subsistence on a daily survival basis.

The contexts of human/canid relationships in the IGM could be broadly examined as:
- Human and wolf
- Human and tamed wolf
- Human and dog

Human (hunter-gatherers) and wolf

The remains of wolves in the Iron Gates sites that precede the VIII millennium BC are recorded in the Cuina Turcului rock-shelter which was used by mobile hunter-gatherers both in its earlier stratum (XIII millennium BP) and in the later one (XI millennium BP) (*Radovanović 1996.321 with further reference*). The percentage of wolf bones, compared to other species hunted and brought to the camp, is rather low, but still (statistically) higher than the percentage recorded in later Mesolithic settlements in the Iron Gates (*Radovanović 1996.52–55 with references*). In Cuina Turcului I, the wolf ranks in third place in the faunal record, although far below the wild boar and beaver. It also holds the third place in stratum II, far below the chamois and aurochs. A question may be posed as to whether these wolves (MNI 2 and 1, respectively) were killed as rivals over prey, or whether they were hunted for food and fur. That these haphazard remains belong to wolves killed for interfering with human hunters in capturing and/or dismembering game is not very probable because wolves would rather wait until human hunters leave the kill spot (*Mech 1970.8; Catlin 1989.257*). Social-biological and ethnographical observations show that both prey and hunting strategies of the human and wolf may be similar and overlap in the same territory, but as Sharp (*1978.77–78*) notes, their approach is different, and rivalry is thus more of an indirect than a direct struggle. Wolves generally avoid close contact with humans, especially when it could lead to conflict. They tend to remain close to their dens or rendezvous area during the day and are fully active during the night (*Zimen and Boitani 1979.63*). Mech (*1970.6–7, 292 ff*) observed that the wolf is aggressive only in three cases: when harassing prey, when meeting strange wolves, and when protecting its offspring. If wounded, the wolf is more inclined to act as if it expects help from man rather than act aggressively in defense.[10]

The incidence of wolf remains is also low during the early IGM (VIII– mid VII millennium BC) at Icoana, Vlasac and Padina A (MNI 10 or below it).

However, such remains are not recorded at all in the late IGM (mid VII to VII/VI millennium BC transition). They reappear in the very late Padina B settlement in the first half of the VI millennium and later in the fully Neolithic settlement of Starčevo type at Lepenski Vir. The low frequency of wolf remains in both the Early Mesolithic and Neolithic and their absence in the late Mesolithic is probably just a consequence of sample randomness and lack of identifiable and measurable bones. Be that as it may, there is an apparent disinterest in capturing wolf as prey in both the mobile and sedentary camps and settlements (*Bökönyi 1978.51, Clason 1980.150; Radovanović 1996.53–54*). If hunting for wolf fur was practised, one would perhaps expect a larger amount of wolf remains on the IGM archaeological sites. However, the animals could have been skinned immediately at the kill site. In this case, no archaeologically visible traces of such an activity would be expected within camps or settlements[11]. Unfortunately, available data on the state of wolf bones in the IGM sites do not reveal whether they were eaten on such occasions. Bökönyi (*1978.50*) mentions the complete lack of wolf bones of maturus and senile age. However, if only fur was brought into the camp or settlement and the animal was left behind at the kill site, perhaps the wolf was not regarded as an acceptable food. Such an interpretation is even more plausible if we consider certain aspects of human behaviour toward fully domesticated canids, dogs, which are already present in the IGM

10 Reports of wolf attack on humans in modern times seem to imply that in all cases the attacks were by rabid wolves (*Mech 1970.289–294*). Human perception of the wolf as a villain dates back only to the beginning of animal husbandry, when livestock became an object for wolves to attack (*Mech 1970.298*). Such a derogatory perception is thus highly improbable for the IGM hunters and gatherers, although it could have been present in its later phases (since the late VII millennium BC) due to contact with Neolithic communities in the neighbourhood. The ethnographic record also appears to confirm that hunter-gatherers did not perceive wolves as 'bloodthirsty aggressors' (*Stephenson and Ahgook 1975.288*).

11 Ethnographical evidence also suggests that prey (including wolves) could have been given special treatment after death. For example, the native American Cree suspend bones and carcasses of certain animals on trees (in regard to their beliefs on those animals' reincarnation and regeneration), so that such remains are never left scattered around the camp to be gnawed or eaten by dogs or other animals (*Brightman 1993.117–119; 132–133*).

from the first half of the VII millennium. These dog remains are mostly fragmented, bearing traces of contact with fire, as well as engravings and gnaw marks (*Clason 1980.150 for late Vlasac, Padina A and B and Lepenski Vir I–II*)[12].

The remaining issue deserving attention is that of the possible human perception of wolves at that time. Ethnographical evidence for small-scale societies such as those of mobile or sedentary hunter-gatherers describes human attitude toward wolves primarily as one of *respect* (*Stephenson and Ahgook 1975. 288; Fox 1978.26; Hall &Sharp 1978.xiii*). Our data do not contradict a possible similar attitude toward wolves in the IGM. Both humans and wolves in the Iron Gates shared the same interest in their main prey, the red deer[13]. As mentioned above, hunting approaches and strategies of both humans and wolves were such that they were not direct competitors, so that direct mutual struggles over game can generally be excluded. Their relationship can be described as either one of mutual tolerance or alliance, as Clutton-Brock put it, or that of the kind described in the ethnographical record. Ethnography also notes that other animals were equally treated with respect and trust (*Brightman 1993.103ff; Ingold 1994.15–16; Serpell and Paul 1994.130–131 with further references*), even if, and often precisely because, they were hunted as prey. Respect for the wolf must therefore derive from the perception of *particular aspects of its behaviour* as valued or desirable in a particular human society[14]. This behaviour could be desirable both for an individual (i.e., hunting skill, respect for intragroup hierarchy) and for the group (advantages of social hunting). It is in this respect that the wolf may have attained the role of metaphor, a metaphor that could most straightforwardly express particular ideological norms (*Tilley 1999. 49*). Thus, the process of canid incorporation into human society could have started with the introduction of the wolf as a metaphor, i.e., within the domain of the belief system of a particular society. A process of 'metaphorical' incorporation of animals into human society can be generally traced throughout the Upper Palaeolithic, back to the appearance of anatomically modern humans (*Mithen 1999.99*). Nor is there any reason to argue against such a metaphorical role for the wolf, bearing in mind the overall social and ideological complexity of the groups belonging to the IGM and illustrated by various aspects of their material culture (*Radovanović 1996 with further references*). The wolf was experienced not only as a part of human society's environment, but also as an integral part of the society's worldview.

My assumptions concerning the human/wolf relationship in the IGM can be summarised as follows:

1. The wolf was probably experienced as a metaphor that could help maintain certain ideological norms related to both individual and group social behaviour of humans. Its metaphorical role was probably expressed through a variety of symbolic representations, none of which, however, are directly observable in the IGM archaeological record to date.

2. Wolves were probably hunted for their fur. They could have been skinned at the kill site, but their other remains were not brought to the settlement, or, if they were, they were not eaten or allowed to be eaten by other animals. Archaeological evidence of wolves in the IGM is generally scanty. However, the scantiness of the record may be evidence in itself of human attitudes toward wolves, as proposed above. Hunter-gatherers could experience and at the same time 'justify' hunting for the wolf's fur within the noted 'metaphorical' framework.

3. Far less probable is that wolves were hunted as competitors over game. They could be skinned for fur on such an occasion, but were still not eaten.

12 If wolf bones were in a similar condition, I would suppose that the authors of the IGM faunal remains' analyses would have at least mentioned it, for it is clear that gnaw marks on bones did not escape their attention.

13 The wolves hunt their preferred prey cooperatively; as a rule, their preferred prey are ungulates larger than themselves (*Sullivan 1978.31*) such as deer, reindeer, moose and musk ox. In the Iron Gates and its hinterlands, large ungulates also captured by humans were bison, elk, wild horse (all three species present until the beginning of the Holocene – probably related to the Epipalaeolithic and very Early Mesolithic), wild ass (only since the Atlantic climatic period – its remains are found in Neolithic settlements), aurochs and red deer (continually over the millennia). In contrast to aurochs, humans in the IGM (*Radovanović 1996. 52–54*) hunted red deer very intensively.

14 This interpretation is partly in line with Brightman's, i.e., that human foragers' economic, technical and ritual practices related to animals cannot be fully understood if one neglects the consideration that the foragers were experiencing the animals as "social others". In his discussion of the materialist and symbolic dichotomy, Brightman points out that the issue is "not recognition of the necessity of signs but rather the position taken on the relationship between social meanings – in structure, ideation, and practice – and their material coordinates" (*Brightman 1993.1–2, 324*).

Both archaeological and ethnographical records strongly oppose the notion that the IGM community perceived the wolf as a direct rival or an enemy.

This pattern of the human/wolf relationship in the IGM would have remained unchanged from the preceding Late Palaeolithic period. The contexts of human/ tamed wolf and human/ domesticated canid relationships are discussed below.

Human (hunter-gatherers) and tamed wolf

According to both social biological data of wolves and the ethnographical record, there is only one instance which might enable the appearance of a tamed wolf: the capture of a wolf pup at a certain age and its upbringing within a human environment. It is impossible to tame an adult wolf, and if such an attempt is made, it would only take place in 'laboratory' conditions of modern times, as an experiment with the intent, but dubious prospects of success (*Mech 1970.9–11; Serpell and Jagoe 1995.83*). Let us consider when the mobile or sedentary hunter-gatherers could, and why at all they would, capture and keep a wolf pup.

When

Wolves breed once a year in wintertime, when their packs are in a 'concentration' phase; the pups are born in springtime and kept in dens that are dug several weeks before that, during the pack's 'dispersal' phase (*Sharp 1978.66*). According to Mech's data (*1970.143*), the pups do not leave the den at all before they are three weeks old, and abandon it finally when they are two months old, living from then on with the pack in temporary rendezvous sites. By the time the pups are three months old, they are already socialised, having established strong and complex bonds with their parents, litter mates and other members of the pack (*Mech 1970.10*). If this primary socialisation were to take place within a human environment, it would be accomplished according to the same genetically predisposed pattern of behavioural changes during the pup's development. These changes would lead to an establishment of strong bonds with humans, as they would otherwise have lead to the establishment of strong bonds with the wolf pack.

This socialisation process allows approximately a 10-week period in the summertime, when it is possible to capture *a wolf pup capable* of exhibiting behaviour perceived as 'agreeable' (and today labelled as 'tamed') in respect to its human surroundings[15]. The capture's location would be either the den or its immediate vicinity within a fixed period of six weeks (when the pup is between 2 and 8 weeks old), or at the rendezvous area during a four week period (when the pup is between 8 and 12 week old, at the very end of the primary socialisation period).

Once captured, the pup would have to be kept alive and offered the kind of food that it would be capable of consuming. It would be impossible to maintain a pup without milk, which is its critical food resource in the first month of life, while pre-digested food (i.e., regurgitated by the parents or other members of the wolf pack) is critical for one to four month old pups (*Mech 1970.139, 143–144*). The only milk available in a prehistoric hunter-gatherer community would be that of breastfeeding women. Indeed, ethnographic evidence records a large number of examples of infant animals (wolves included) that were suckled at the breast alongside human infants (*Serpel and Paul 1994.130; Serpell 1996.64–65 with further references*).

Pre-digested food needed in the next critical feeding stage could effectively have been replaced with cooked food, which was undoubtedly prepared and consumed at least since Late Upper Palaeolithic times.

However, a tamed wolf pup (a pup with a strong social bond established with its immediate human environment, instead of that with other wolves[16]), will maintain an 'agreeable' behaviour only until it reaches adulthood (22 months). After reaching adulthood, the tamed wolf would remain with humans only if the individual was marked by a specific 'agreeable' character. This specific character should dominate its other behavioural traits that could either encourage the young wolf to rejoin the pack, or discourage the humans from tolerating it in their camp (*Clutton-Brock 1995.10*).

Thus, wolves could remain in human camps after reaching adulthood only if they exhibited very specific *individual* behavioural traits. If such 'docile' wolves had an opportunity to breed among themselves, in isolation from wolves outside the human camp (*Coppinger and Schneider 1995.36*), and if they had depended on food given by humans (a

15 Pups would probably not survive if captured during their neonatal phase, i.e., before they are two weeks old.

16 The same three month "deadline" for successful primary socialization is also observed for dog pups (*Serpell and Jagoe 1995*).

diet which is not exclusively based on raw meat and bone), then a morphological change in these wolves would have occurred after several generations. Notwithstanding the importance of the change in diet, it should be emphasised that a decisive role in morphological change is played by the factor of breeding isolation from the wolf pack. Needless to say, such isolation is very difficult to envisage in regard to the mobility of Upper Palaeolithic hunter-gatherers and in regard to the tamed wolf's behaviour when it reaches adulthood. Such isolation is more likely to be envisaged in the case of sedentary hunter-gatherer camps, although it would still be very difficult to imagine how that isolation could be maintained (*A. Choyke, pers. comm.*). Taking into account the variability of behaviour among individual wolves (some could be more docile, some more sociable, some more aggressive, etc.), this isolation would have to mean that the particular wolf, marked by a particularly 'tame' character, remained in the human camp after reaching adulthood and raised its offspring among humans. Further breeding of such tame wolves would consequently result in the preservation of 'docile' behavioural traits in their offspring[17], and, after several generations, would also result in morphological change.

It is impossible palaeontologically to differentiate tame and wild wolf remains. In certain Upper Palaeolithic European sites, wolf skeletal remains are sometimes, albeit very rarely, marked by morphological changes such as a smaller skull and teeth crowding (*Bökönyi 1989.25; Clutton-Brock 1995.10; Eriksen 1996.119–120*). It could be assumed then that under very specific conditions noted above, tamed wolves could have been kept in Upper Palaeolithic camps, and that several generations of such wolves could possibly live with humans for some time, the length of that time depending on a particular hunter-gatherer community's settlement logistics and on the degree of interference with wolves outside the camp.

Why

These conditions immediately open the question of why wolf pups would be captured at all and why they would be allowed to participate in "food-sharing activities" in the human camp. I would argue that pups were not captured purposefully, but rather because they were either found abandoned alone in the den or temporarily left in the rendezvous area when the adult wolves were away from it (*Mech 1970.144–145*), i.e., under conditions when they were most vulnerable. Many pups of different ages could thus occasionally have been brought to human camps, but only those being less than three months old would eventually behave agreeably, i.e., appear to be 'tamed'. The practice of pup capture could be described at least as a random one, whose purpose was not taming, but rather saving vulnerable wolf pups. Tame behaviour would be more a matter of coincidence – the pup saved when less than three months old would socialise with humans in the same way that it would have socialised with members of its own species. The question of why the wolf pup would be brought into human camps was often raised in dealing with explanations of the origin of dogs. A number of scholars accept the 'pet theory' as the explanation of taming and domestication of animals in general (*Serpell 1989; 1996*). This theory is attractive, but, in my opinion, wolf pup adoption by humans could only be explained in terms of the wolf's experience in a particular hunter-gatherer society, as proposed earlier. The interest in pup adoption would arise precisely from the existing alliance between humans and wolves that I tried to explain as initially metaphorical in character. One can assume that it was almost a duty to adopt and raise the abandoned offspring of wolves (whether it was a metaphor for 'the skilled hunter', 'the wolf ancestor' or something else, one can only imagine).

The label 'tame' thus seems rather unsatisfactory in the case of wolves. The tamed wolf's agreeable or friendly behaviour toward the humans who raised it and its possible subsequent friendliness even after rejoining the pack (*Henshaw et al. 1979.339–341*) is a part of the wolf's behaviour as a species, and not the result of purposeful human interference.

Such behaviour on the part of the wolf, after being raised in a human environment and especially after remaining in the human camp during adulthood, would certainly have reinforced its role as a metaphor. It would also have consequently reinforced the status of those individuals who adopted the wolf, or the status of the human group that these individuals belonged to.

It could be assumed that both wild and tame wolves were a part of the same metaphor, and, in this way, firmly incorporated into the particular society's

17 Coppinger and Schneider (*1995.26*) explained that behaviour is "inherited not in the sense that it is the result of a gene product, but inherited in a sense that behaviour is a consequence of, and limited by, the animal's morphological, and physiological structures." See also Belyaev's experiment in taming foxes (*ibid., p. 37; Belyaev and Trut 1975*).

worldview and belief system. Tamed wolves could, in addition, be physically incorporated into human society for a limited period of time.

In summary, tamed wolves could be raised in hunter-gatherer camps under the minimum following conditions:

1. If the wolf pups were caught at a particular age.

2. If the wolf pups could be kept alive on the food appropriate for their growth (milk and food which could replace pre-digested food).

3. If the wolves were incorporated within the belief system of human society, being experienced as "social others" and as metaphor.

All these conditions seem to have been met in the IGM, since in spite of the absence of archaeologically observable traits, the practice of wolf taming is implied by palaeontological evidence on domestication of the local wolf population at Vlasac (*Bökönyi 1978.38ff*). But before I return to this question, let us examine the evidence for the human/dog relationship in the IGM.

Human: hunter-gatherers – Canid: dog

Apart from the earlier described finds of four burials at Vlasac and Lepenski Vir, dog remains in the IGM are recorded at Vlasac, Padina, Lepenski Vir and Hajdučka Vodenica (*Radovanović 1996.57 with references*). The earliest dog to date has been found at Vlasac (*Bökönyi 1978.38*); it dates to the first half of the VII millennium BC. The large sample of identifiable dog remains (MNI 160) at Vlasac prompted Bökönyi (*1978.39–43*) to postulate its origin from the 'local wolf subspecies'. The dogs' skulls are described as belonging to a "running dog type...its size ranging between that of a large Mittelschnautzer and a medium Collie" and "entirely different from dog skulls from the Early Neolithic (Körös-Starčevo complex of Southeast Europe of the so-called *palustris* type domesticated in another region (e.g. Near East)". The Vlasac type of dog skulls differ from the *palustris* type in that the brain case more closely resembles that of the wolf, while the position of the teeth resembles that of Mesolithic dogs found in other parts of Europe (Denmark, England and South Germany). This type of skull is also found in Lepenski Vir and Starčevo sites, but together with a number of skulls belonging to the smaller-size and more gracile *palustris* bread which is allegedly of southern origin. Clason's (*1980*) data on Padina dogs do not reveal whether they were of the Vlasac or *palustris* type or both. However, the majority of dog bones at Padina are collected in its latest settlements (VII/VI and first half of the VI millennium BC). Both Vlasac and Padina dog bones were often, as noted above, scorched by fire and marked by traces of carving and gnawing.

It could immediately be noted that the record on dogs and human behaviour towards them in the IGM differs considerably from that toward wolves and/or tamed wolves. The wolf remains are altogether scanty and it was inferred here that the wolf was not hunted either as a rival over game or in order to be consumed as food. If it was caught for fur, it was either skinned and its carcass left on the kill site, or, if carried back to the human camp, it could be skinned and its carcass treated with 'respect', i.e., removed in such a way that it was not exposed to the scavenging of other animals such as dogs and pigs – which were present in IGM settlements since the first half of the VII millennium BC. The wolf's scantiness in the faunal record is here explained by a particular behaviour of humans toward the wolf, which resulted from experiencing it as a metaphor. This interpretation of its metaphorical role in human society may be further reinforced by data which imply that tamed wolves undoubtedly lived alongside humans in the IGM, for if they did not, the dogs found in IGM settlements of the first half of the VII millennium BC would have exhibited morphological traits different from those that point clearly to their local origin. Vlasac dogs have their origin in the local wolf population, which means that a number of generations of tamed wolves must have been bred in the IGM settlements. As I have explained earlier, the taming of wolves, in my opinion, would not have been possible if the wolf was not experienced as a metaphor, if it was not incorporated into the IGM society's ideology.

In all probability, the wolf still maintained its specific metaphorical role at the time when its domesticated cousin became a permanent dweller at IGM settlements.

The human attitude toward dogs, as suggested by the deposition of faunal remains, was quite the opposite of that toward wolves in a few respects. On the one hand, the dog was often eaten and its remains were not removed from the settlement, but left to be scavenged by other animals, including other dogs. Only from the second half of the VII millenni-

um BC could one expect a change in how humans perceived the dog, implying that it also became a metaphor. At this time, the material representation of the metaphor is preserved, it is archaeologically visible – dog remains, restricted to lower jaws only, were found, as described above, in the graves of men. They could be viewed in terms of a 'solid' metaphor (*Tilley 1999.264*).

The change in human attitudes toward dogs as observed in the IGM could be examined from several angles. Chronologically, this change falls within a period of first contact with Early Neolithic groups, and this contact was confirmed in many other aspects of IGM material culture (*Radovanović 1996a. 41–42; Radovanović and Voytek 1997.26*) in the second half of the VII millennium BC. In terms of the local evolution of the dog population, the lapse of time between the appearance of the first Vlasac dogs and the appearance of their remains in human burials would be long enough to allow the process of purposeful breeding and upbringing of work (hunting and/or guard) dogs. This process could undoubtedly have been triggered or accelerated by the introduction of the 'Neolithic' *palustris* type of dog into the IGM. The faunal record actually implies such an introduction, since both the local Vlasac and the *palustris* type of dog existed concurrently in both the late IGM as well as in the local Early Neolithic. For now it remains uncertain whether the introduction of the *palustris* dog led to interbreeding with local dogs, or whether the local dog was selectively bred as a work dog even before that. Be that as it may, the appearance of the *palustris* dog in the IGM coincides with the local community's new perception of the dog as a species[18]. However, this perception was altogether an ambiguous one. Dogs were eaten, their remains were scattered around the camp, their bones gnawed by other animals. At the same time, dog remains were placed in human graves, and it should be noted once again that it was their mandibles that were chosen to be placed in these exclusively male graves.

I consider the mandible as a metaphor, which was related to some kind of more general category in the IGM belief system (*Radovanović in prep.*). The more general category of mandible had a meaning that was associated with both dogs and men, or as Tilley (*1999.50*) puts it, 'a frame for its referential extension' was provided. Thus, dog remains in the burials of men and the scattered remains of dogs in the settlement could have reflected two quite different meanings. The overall perception of dogs by the IGM community seems to have been 'burdened' by at least two contrasting meanings, and that ambiguity of the human perception of dogs has also been recorded in many different places and in different prehistoric and historic periods (*Serpell 1995 with further references*). Serpel (*1995.254*) notes that "in symbolic terms, the domestic dog exists precariously in the no-man's-land between the human and non-human worlds. It is an interstitial creature, neither person nor beast, forever oscillating uncomfortably between the high status animal and low status person". The dog (as a species) was physically incorporated into human society and the status of *each individual* dog depended on how strong its bond was with individual humans. In contrast to the dog, *the wolf as a species* was metaphorically incorporated into human society, its physical incorporation being possible only in the case of individual 'tame' wolves. Dogs both shared the destiny of the human community that kept them, and the destiny of human individuals to which they were attached. Some were eaten, as in the case of the IGM and a large number of ethnographic examples, although pet dogs (those attached to particular humans) seem to have been killed only for sacrificial purposes (*Catlin 1989.224, Serpell 1989.14; 1995.248–250*). Ethnographic evidence also confirms that dogs were given ceremonial burials (*Serpell 1989.12–13*). Archaeological evidence, especially from the Mesolithic, is rather straightforward in this respect (*Belfer-Cohen 1995.11; Thorpe 1999.17, 67, 83; Boyd 1995. 21; Larsson 1989.218–220; 1989a.373– 374; Tilley 1996.35; Bradley 1998.26–27; Schulting 1998*).

CONCLUDING REMARKS

The three men's burials at Vlasac and Lepenski Vir, each containing a dog mandible, obviously do not fall into the category of the dog's 'proper' ceremonial burial, but they are equally important in understanding some aspects of the Mesolithic belief system. The remaining burial described at the beginning of this paper is the Vlasac burial of a decapitated dog, which is the only IGM 'proper' dog burial. As already noted, the unclear record of that burial does not allow a discernment of whether the dog was decapitated and buried in its own right, or

18 It would be interesting to see whether the palustris introduction has anything to do with a supposed "expanded exogamous breeding network" of the IGM in the contact period with Early Neolithic communities (*Radovanović and Voytek 1997.29*).

whether it is related to a woman's burial in its vicinity. The deposition of a headless dog close to the legs of the buried woman at Vlasac closely resembles the placement of a headless dog across the lower legs of a woman in grave VIII at Skateholm II (*Larsson 1989a. 373–374; Tilley 1996.35*).

In his comment on southern Scandinavian dog burials, Tilley (*1996.65*) argued that "the dog, as the only domesticated animal living and eating with humanity, would be a highly ambiguous and anomalous creature, a kind of potential mediator between the two worlds of humans and animals, acting as an agent for the transference, through the hunt, of animal life-forces into human powers."

The IGM record, however, implies that further distinctions could be made within such a metaphorical and clearly ambiguous role. Placement of mandibles in male graves at Vlasac and Lepenski Vir could probably be interpreted along the lines of Tilley's argument, that it was a metaphor for certain beliefs related to hunting, but other possible meanings should not be excluded. The Vlasac dog burial, whether it was isolated or related to the woman buried close to it, implies yet another metaphorical role for the dog, which is not related to ideas maintained in respect to hunters and hunting, but rather to the human settlement itself. The peripheral position of this dog's burial in relation to the settlement and formal disposal area may imply its role as a guard dog, and moreover its role as a metaphor that could reinforce an idea of maintaining order in the world as it was perceived by the local foragers, comprised of both the actual world and the mythical world of the ancestors. Both the IGM and later Scandinavian Mesolithic communities had reason to ensure that their world was well encapsulated from the different way of life and different values of their Neolithic neighbours. The existence of Mesolithic/Neolithic contact and its consequences is another point of similarity between the IGM and the South Scandinavian Late Mesolithic, notwithstanding their chronological and geographical distance.

In regard to the ambiguous symbolic meanings associated with the dog, perhaps it should be explored beyond the dichotomy of person::beast or domestic::wild. Dog remains scattered around the settlement show not only that they were eaten, but also that they were not paid any special respect (since their bones were left to be scavenged). I assumed in my earlier discussion on the relation of humans to wolves in the IGM that wolves had a special animal status in view of the scarcity of their bones on sites, apparently disproportionate to the probable actual capture of wolves for fur[19]. The dog did not replace the wolf's role as metaphor in the IGM belief system, whatever the metaphor's precise meaning.

As stated above, dog mandibles in hunters' burials in the IGM are assumed to be related to the dog's role in hunting. However, in the broader context of IGM funerary practices, and in view of various associations of human and animal mandibles to burials and architectural remains, some other probable mean-

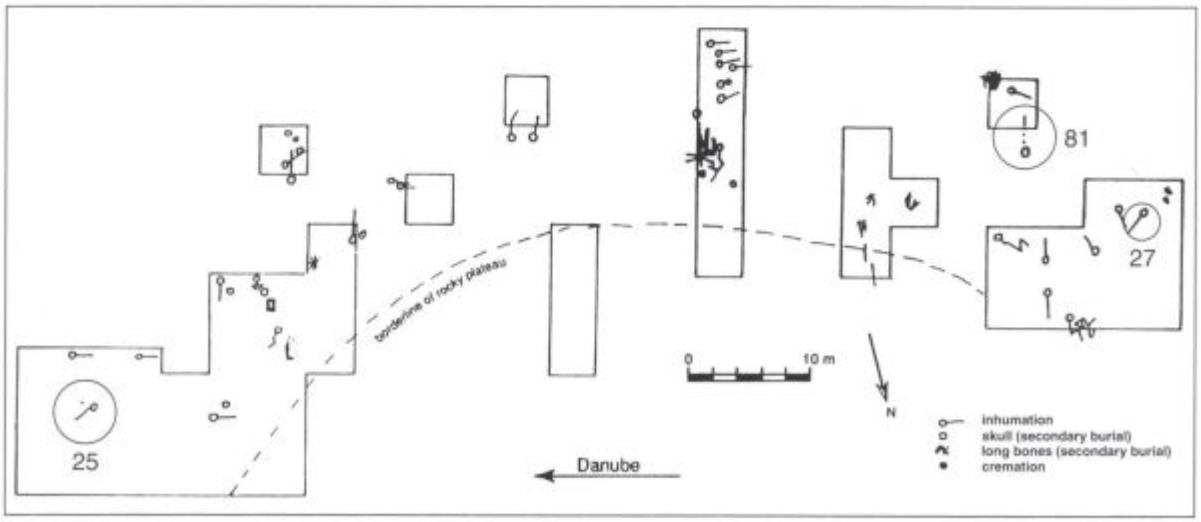

Fig. 6. Location of burials associated with dog remains in the Vlasac II/III formal disposal area (after Radovanović 1996).

19 There also are some other bone 'scarcities' in the IGM which need to be re-examined along these lines, such as those of beluga and perhaps auroch (*Radovanović 1996.53–54, table 2.9; 1997.89*).

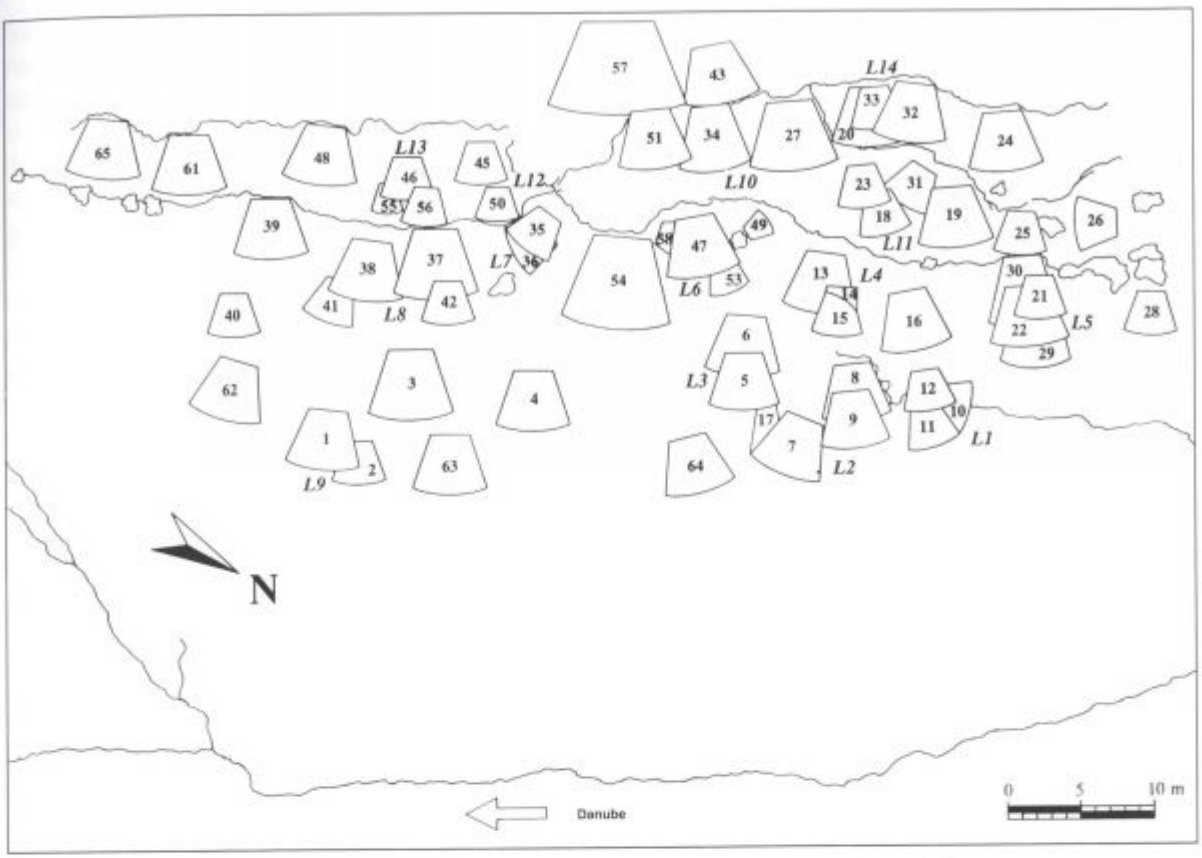

Fig. 7. Location of house 32 in Lepenski Vir (phase 3) (after Radovanović 1996).

ings could also be discerned (*Radovanović 1996b*). For instance, if only an association of burials and mandibles is considered, one can see the following associations and oppositions: man::dog mandible and woman::man mandible. Woman::man mandible is noted only in Vlasac. Man::dog mandible is noted at Vlasac and Lepenski Vir. At Lepenski Vir it is in fact man secondary burial::dog mandible associated with the rear of the hearth in house 32 (phase 3). On the other hand, it must also be noted that all burials associated with dogs at Vlasac (including the burial of a woman with a decapitated dog burial nearby) are oriented perpendicularly to the river's course in contrast to the then already prevailing orientation parallel to the river. A further observation is that man-dog mandible burials are placed with the human head facing the rear of the settlement, similarly to the rare burials in a sitting position found elsewhere in the IGM (and one in Vlasac, too). Their position and orientation on the steep Vlasac terrace may imply that they are, in a manner of speaking, watching over the entire settlement. It can further be observed that each of the man-dog mandible burials is placed at the extreme ends of the settlement: one is at the furthest point upstream and another is at the furthest point downstream (Fig. 6). The man-dog mandible burial in house 32 at Lepenski Vir is also placed at the very rear of the settlement. Such a position may further reinforce the interpretation that these burials symbolised 'guarding' (Fig. 7). In regard to the female burial, it is also oriented perpendicularly to the river, but her head is pointing toward the river. The orientation of the grave is thus the opposite of that of the men. However, the dog burial by her legs marks the rear of the settlement boundary.

Thus, the man-dog mandible association could be interpreted as not necessarily related primarily to hunting, but also, as in the case of the 'proper' dog burial, to guarding both the settlement and the ancestors buried within it. In view of this interpretation, one could question whether the dog in the IGM is really placed only in "no-man's land' between person and beast (*Serpell*) or between the human and animal world (*Tilley*). The dog's place could also be that of a guardian, on the border of and communicating between the actual and the ancestral world of the IGM, and perhaps also on the border of the IGM world and that of their Neolithic neighbours. Therefore, the association human burial + dog + human burial location + human burial orientation suggests meanings of encapsulation and protection of a worldview. On the other hand, the dog mandible

and decapitated dog suggest the presence of a number of other 'referential extensions', which act as 'point metaphors' (*Tilley 1999.266*) in the IGM belief system's framework, or even better, of the network, a concept I explore elsewhere (*Radovanović in prep.*).

In summary, the human/canid relationship in the IGM reflects different attitudes toward wolves on the one hand and dogs on the other. Although there would have been no dogs if the wolf had not been tamed, both the dog and the wolf seem not to have been experienced in terms of the biological continuity of the process of domestication in the Early Mesolithic. The wolf probably maintained a metaphorical role that dated back to Upper Palaeolithic times. It would probably be more appropriate to ascribe the ambiguous meaning of 'neither person, nor beast' to wolves (and some other animals), for they were integrated into the worldview of foragers as unthreatening, 'social others'. The metaphor of the wolf would have acquired a 'threatening' connotation only after animal husbandry had been well established. The attitude toward the dog was entirely different. It is also ambiguous, but it is ambiguous in the same way that perhaps the attitude of humans to other humans might be. The dog, as a species, is physically entirely incorporated into the human world, and each dog's treatment was largely dependent on its particular relation with humans; its 'dog status' depended on the strength of its developed bond with humans. Some dogs were considered as pets and friends or as good work (hunting or guard) dogs, and the ethnographical record is explicit in that such dogs were not eaten except for sacrificial purposes in some societies. As a rule, a pet dog – a friend – is not eaten even in cultures where dogs are bred as a food resource (*Serpell 1995.248–249*). But other dogs that did not gain such a status probably were. The metaphorical role of the dog is generally similar to that of the wolf in that it is related to certain aspects of its behaviour valued as desirable in a particular human society, and as we have seen, this was probably the case in the IGM also. However, the content of the dog and wolf metaphors was entirely different.

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REFERENCES

BELFER-COHEN A. 1995. Rethinking Social Stratification in the Natufian Culture. The Evidence from Burials. In Campbell S. and A. Green (eds.), *The Archaeology of Death in the Ancient Near East: 9–16.*

BELYAEV D. K. and TRUT L. N. 1975. Some genetic and endocrine effects of selection for domestication of silver foxes. In Fox M. W. (ed.), *The Wild Canids, their Systematics, Behavioral Ecology and Evolution: 416–426.*

BÖKÖNYI S. 1978. The Vertebrate fauna of Vlasac. In Srejović D. and Letica Z. (eds.), *Vlasac, vol. II geologija-biologija-antropologija: 35–65.*

1989. Definitions of animal domestication. In Clutton-Brock J. (ed.), *The walking larder, Patterns of domestication, pastoralism, and predation: 22–27.*

BONSALL C. *et al.* 1997. Mesolithic and Early Neolithic in the Iron Gates: a palaeodietary perspective. *Journal of European Archaeology 5(1): 50–92.*

BONSALL C. (ed.) 1989. *The Mesolithic in Europe: Papers Presented at the Third International Symposium, Edinburgh 1985.*

BOYD B. 1995. Houses and Hearths, Pits and Burials: Natufian Mortuary practices at Mallaha (Eynan), Upper Jordan Valley. In Campbell S. and Green A. (eds.), *The Archaeology of Death in the Ancient Near East: 17–23.*

BRADLEY R. 1998. *The Significance of Monuments, On the shaping of human experience in Neolithic and Bronze Age Europe*, Routledge, London and New York.

BRIGHTMAN R. A. 1993. *Grateful Prey, Rock Cree Human-Animal Relationships*, University of California Press, Berkeley.

CAMPBELL S. and GREEN A. (eds.) 1995. *The Archaeology of Death in the Ancient Near East: 9–16.* Oxbow Monograph 51.

CATLIN G. 1989. (1832–1839), *North American Indians*, edited and with an introduction by P. Matthiessen, Penguin Nature Library, Penguin Books, N. Y.

CLASON A. T. 1980. Padina and Starčevo: Game, Fish and Cattle, *Palaeohistoria XII: 141–173.*

CLUTTON-BROCK J. 1989. Introduction to domestication. In Clutton-Brock J. (ed.), *The walking larder, Patterns of domestication, pastoralism, and predation: 7–9.*

1994. The Unnatural World: Behavioural Aspects of Humans and Animals in the Process of Domestication. In Manning and J. Serpell (eds.), *Animal and Human society, Changing perspectives: 23–35.*

1995. Origins of dog: domestication and early history. In J. Serpell (ed.), *The domestic dog, its evolution, behaviour, and interactions with people: 7–20.*

CLUTTON-BROCK J. (ed.) 1989. *The walking larder, Patterns of domestication, pastoralism, and predation.*

COPPINGER R. and SCHNEIDER R. 1995. Evolution of working dogs. In Serpell J. (ed.), *The domestic dog, its evolution, behaviour, and interactions with people: 21–47.*

ERIKSEN B. V. 1996. Resource Exploitation, Subsistence Strategies, and Adaptiveness in Late Pleistocene-Early Holocene Northwest Europe. In Straus L. G. *et al.* (eds.), *Humans at the End of the Ice Age, The Archaeology of the Pleistocene-Holocene Transition: 101–128.*

FOX M. W. 1978. Man, Wolf, and Dog. In Hall R. and Sharp H. S. (eds.), *Wolf and man, evolution in parallel: 19–30.*

FOX M. W. (ed.) 1975. *The Wild Canids, their Systematics, Behavioral Ecology and Evolution.*

HALL R. 1978. Variability and Speciation in Canids and Hominids. In Hall R. and Sharp H. S. (eds.), *Wolf and man, evolution in parallel: 153–177.*

HALL R. and SHARP H. S. (eds.) 1978. *Wolf and man, evolution in parallel.*

HENSHAW R. et al. 1979. Experimental Release of Captive Wolves. In Klinghammer E. (ed.), *The Behaviour and Ecology of Wolves: 319–345.*

INGOLD T. 1994. From trust to domination, An alternative history of human-animal relations. In Manning A. and Serpell J. (eds.), *Animal and Human society, Changing perspectives: 1–22.*

KLINGHAMMER E. (ed.) 1979. *The Behaviour and Ecology of Wolves.* Proceedings of the Symposium on the Behaviour and Ecology of Wolves held on 23–24 May 1975 at the Annual Meeting of the Animal Behaviour Society in Wilmington, N.C.

LARSSON L. 1989. Big Dog and Poor Man. Mortuary Practices in Mesolithic Societies in Southern Sweden. In Larsson T. B and Lundmark H. (eds.), *Approaches to Swedish Prehistory, A spectrum of problems and perspectives in contemporary research: 211–223.*

1989a. Late Mesolithic settlements and cemeteries at Skateholm, southern Sweden. In Bonsall C. (ed.), *The Mesolithic in Europe: Papers Presented at the Third International Symposium, Edinburgh 1985: 367–378.*

LARSSON T. B and LUNDMARK H. (eds.) 1989. *Approaches to Swedish Prehistory, A spectrum of problems and perspectives in contemporary research, BAR International Series 500.*

MANNING A. and SERPELL J. (eds.) 1994. *Animal and Human society, Changing perspectives.*

MECH L. D. 1970. *The Wolf: the ecology and behavior of an endangered species.* The Natural History press, Garden City, New York.

MITHEN S. 1998. The Supernatural Beings of Prehistory and the External Storage of Religious Ideas. In Renfrew C. and Scarre C. (eds.), *Cognition and Material Culture: the Archaeology and Symbolic Storage: 97–106.*

(ed.) 1998. *Creativity in Human Evolution and Prehistory*.

PETERS R. 1978. Communication, Cognitive Mapping, and Strategy in Wolves and Hominids. In Hall R. and Sharp H. S. (eds.), *Wolf and man, evolution in parallel: 95–107*.

1979. Mental Maps in Wolf Territoriality. In Klinghammer E. (ed.), *The Behaviour and Ecology of Wolves: 119–152*.

PETERS R. and MECH L. D. 1978. Scent-marking in Wolves. In Hall R. and Sharp H. S. (eds.), *Wolf and man, evolution in parallel: 133–147*.

RADOVANOVIĆ I. 1994. A Review of Formal Disposal Areas in the Mesolithic of Europe. *Starinar XLIII–XLIV (1992–1993): 93–102*.

1996. *The Iron Gates Mesolithic*. International Monographs in Prehistory, Archaeological Series 11. Ann Arbor.

1996a. Mesolithic/Neolithic contacts: a case of the Iron Gates region. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXIII: 39–48*.

1996b. Some Aspects of Burial Procedure in the Iron Gates Mesolithic and Implications of Their Meaning. *Starinar XLVII: 9–20*.

1997. The Lepenski Vir Culture: a contribution to interpretation of its ideological aspects. *Antidoron Dragoslavo Srejović completis LXV annis ad amicis, collegis, discipulis oblatum: 87–93*.

in prep. Art of the Lepenski Vir Culture: Iconography, Ideology and Belief System of the Mesolithic Community (VIII–VI millenium BC).

RADOVANOVIĆ I. and VOYTEK B. 1997. Hunters, fishers or farmers: sedentism, subsistence, and social complexity in the Djerdap Mesolithic. *Analecta Praehistorica Leidensia 29: 19–31*.

RENFREW C. and Scarre C. (eds.) 1998. *Cognition and Material Culture: the Archaeology and Symbolic Storage*.

SCHULTING R. 1998. Creativity's coffin: innovation in the burial record of Mesolithic Europe. In Mithen S. (ed.), *Creativity in Human Evolution and Prehistory: 203–226*.

SERPELL J. 1989. Pet-keeping and animal domestication: a reappraisal. In Clutton-Brock J. (ed.), *The walking larder, Patterns of domestication, pastoralism, and predation: 10–21*.

1995. From paragon to pariah: some reflections on human attitudes to dogs. In Serpell J. (ed.), *The domestic dog, its evolution, behaviour, and interactions with people: 245–256*.

1996. *In the company of Animals, A study of human-animal relationships*. Cambridge University Press, Cambridge.

SERPELL J. and JAGOE J. A. 1995. Early experience and the development of behaviour. In Serpell J. (ed.), *The domestic dog, its evolution, behaviour, and interactions with people: 79–102*.

SERPELL J. and PAUL E. 1994. Pets and the development of positive attitude to animals. In Manning A. and Serpell J. (eds.), *Animal and Human society, Changing perspectives: 127–144*.

SERPELL J. (ed.) 1995. *The domestic dog, its evolution, behaviour, and interactions with people*.

SHARP H. S. 1978. Comparative Ethnology of the Wolf and the Chipewyan. In Hall R. and Sharp H. S. (eds.), *Wolf and man, evolution in parallel: 55–79*.

SREJOVIĆ D. 1969. *Lepenski Vir: Nova praistorijska kultura u Podunavlju*. Srpska Knjizevna Zadruga, Belgrade.

SREJOVIĆ D. and LETICA Z. (eds.) 1978. *Vlasac, vol. I: Arheologija, vol. II geologija-biologija-antropologija*.

1978. Vlasac – mezolitsko naselje u Djerdapu. In Srejović D. and Letica Z. (eds.), *Vlasac, vol. I: 1–170*.

SREJOVIĆ D. and BABOVIĆ L. 1983. *Umetnost Lepenskog Vira*. Jugoslavija, Belgrade.

STEPHENSON R. O. and AHGOOK R. T. 1975. The Eskimo hunter's view of wolf ecology and behavior. In Fox M. W. (ed.), *The Wild Canids, their Systematics, Behavioral Ecology and Evolution: 286–291*.

STRAUS L. G. *et al.* (eds.) 1996. *Humans at the End of the Ice Age, the Archaeology of the Pleistocene-Holocene Transition.*

SULLIVAN J. O. 1978. Variability in the wolf, a group hunter. In Hall R. and Sharp H. S. (eds.), *Wolf and man, evolution in parallel: 31–40.*

TILLEY C. 1996. *An Ethnography of the Neolithic, Early prehistoric societies in southern Scandinavia.* Cambridge University Press, Cambridge.

1999. *Metaphor and Material Culture.* Blackwell Publishers, Oxford.

THORPE I. J. 1999. *The origins of agriculture in Europe, (2nd edition).* Routledge, London and New York.

ZIMEN E. and BOITANI L. 1979. Status of the Wolf in Europe and the Possibilities of Conservation and Reintroduction. In Klinghammer E. (ed.), *The Behaviour and Ecology of Wolves: 43–83.*

ZOFFMANN K. Z. 1983. Prehistorical skeletal remains from Lepenski Vir (Iron Gate, Yugoslavia). *Homo 34: 129–148.*

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Concerning the transition to farming in the East Baltic

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ABSTRACT - *The aims of this paper are three-fold: to review current theory regarding the general, practical (animal and plant resource utilization) transition to farming; to draw attention to problems in the data base from which theoretical conclusions are made; and to explore specific, contextual socio-cultural changes that occurred simultaneously during the practical transition, in particular those reflected in the changing forms of burials.*

IZVLEČEK - *Cilji članka so trije: pregledati sedanje teorije, ki govorijo o splošnem, praktičnem vidiku prehoda v kmetovanje (koriščenje rastlinskih in živalskih virov); usmeriti pozornost na težave s podatki, na katerih temeljijo teoretični sklepi; ter raziskati specifične družbeno-kulturne spremembe, ki so se pojavile sočasno s praktičnim prehodom, še posebej tiste, ki se kažejo v spremenjenih oblikah pokopov.*

KEY WORDS - *Lithuanian; transition to farming; contextual socio-cultural changes; changing forms of burials*

Chronological data is key in any assessment of evolution, including the transition to farming. What is important is not only how we define archaeological periods and subperiods, but also continuous refinements and clarifications of the chronological data themselves. It must be pointed out that East Baltic archaeological periods are not all currently defined either clearly or uniformly (see below). More importantly, however, new chronological data have recently come to light that make it clear that certain of our contextual evolutionary classifications are in dire need of reevaluation, and this is the primary concern in this paper.

The defining signature of the Neolithic in the East Baltic is not domestication, but rather the appearance of pottery - beginning roughly in the middle of the seventh millennium bp (by the site of Zvidze in Latvia: 6535±60 BP; TA-862, also 6450±250 BP; MGU-1008. See *Loze 1992*) uncalibrated[1]. The subsistence economy at the start of the East Baltic Neolithic appears to have been a continuation of the previous Mesolithic tradition that relied on hunting, fishing, and gathering. This is suggested by tool inventories, animal bone data, palynological analyses and some macrofossil finds such as nutshells and such. The existing data show that here the domes-

1 Calibrated BC dates for the East Baltic Neolithic have been proposed by R. Rimantienė 1992: Early Neolithic 5500-3400 BC (6450-4750 uncal. BP); Middle Neolithic 3400-2800 BC (4750-4350 BP); Late Neolithic 2800-2000 BC (4350-3750 BP). Although in the last few years an effort to calibrate dates is being made by some East Baltic archaeologists, calibrated archaeological period dates are often still a source of confusion, as uncalibrated bc typologies (^{14}C date uncal. minus 1950) have been standard. Nor are they exactly the same in each of the three Baltic states. Moreover, East Baltic archaeologists are acknowledging problems with current periodization (conference seminars on periodization, for example, have recently taken place in the Lithuanian History Institute on May 10, 1999, with the next one shceduled for Sept. 10, 1999), so many period boundaries are at this time esp. not agreed upon. However, in Latvia, the most recent classification is - Early Neolithic 4500-3400 uncal.bc, Middle Neolithic 3400-2500/2400 bc, Late Neolithic 2500/2400-1500 bc (*see Vasks 1999*). In Lithuania, the typically used dates have been Early Neolithic 4000-2900 bc, Middle Neolithic 2900-2300/2100 bc, Late Neolithic 2300/2100-1800/1600 bc (*see Rimantienė 1984; Girininkas 1994*). In Estonia, the rough subdivisions have been Early Neolithic 3000 (3500?)-2500 bc, Middle Neolithic 2500-2000 bc, Late Neolithic 2000-1500 bc (*see Jaanits 1965, Selirand and Tõnisson 1984*), though A. Kriiska will soon be proposing an updated and calibrated periodization of Early Neolithic 5000-4200 BC; Middle Neolithic 4200-3200 BC, Late Neolithic 3200-1500 BC (*personal communication*).

tication of plants and animals was a very slow, several millennia-long process (*for example, Paaver 1965; Zvelebil 1986; 1993; 1994; 1998; Zvelebil and Rowley-Conwy 1986; Dolukhanov 1986; 1993*). A model for the slow transition to farming that especially fits the East Baltic area was originally proposed by Marek Zvelebil and Peter Rowley-Conwy fifteen years ago. The model distinguishes an availability phase, when foraging is the principal means of subsistence, and domesticates and cultigens constitute less than 5% of total remains; a substitution phase, when farming strategies develop, but foraging strategies are retained and domesticates and cultigens comprise about 5–50% of total remains; and a consolidation phase, when farming is the principal mode of subsistence, and domesticates and cultigens comprise more than 50% of total remains (*Zvelebil 1986. 12*). This slow model of the transition to farming has also been taken up by Lithuanian researchers investigating early prehistoric economy evolution (*Daugnora and Girininkas 1995; 1996; 1998*).

Intensive management of floral and wild animal resources such as water chestnuts and hazelnuts, fish, and pig by complex hunter-fisher-gatherers engaged in various trade could have been the initial backdrop for the appearance of domesticates in the East Baltic (*Zvelebil 1995; 1998*). The main defining feature of the Middle Neolithic is the appearance or influence of the Comb-and-Pit Pottery culture. The Corded Ware culture horizon of the Late Neolithic is considered by many East Baltic archaeologists decisively influential in the adoption of farming, although it is acknowledged that farming was not an overall significant part of the economy in the Stone Age. Paaver's East Baltic faunal data base published in 1965 is still one of the most comprehensive and available, and shows that the gradual shift to animal husbandry in the East Baltic occurred sometime between 1500 and 500 BC or during the Bronze Age, and that slightly before this shift an increase in the exploitation of secondary, optimal sources like seal is noticeable. Botanical data are generally not as well researched as the faunal, though perhaps fit this same basic pattern.

Recent analyses in some East Baltic microregions supplement this picture and illustrate variability within the region. In the last few years, Lithuanian archaeologist Algirdas Girininkas and osteologist Linas Daugnora have researched the evolution of the economy in Lithuanian territory and their basic conclusions are (going by their published chronology):

❶ In Western Lithuania, the availability phase may have occurred as early as the Early Neolithic (in Girininkas' and Daugnora's chronological scheme this is 4800/4600–2900/2700 bc)[2], the substitution phase – in the Middle (2900/2700–2300/2100 bc) and Late Neolithic (2300/2100–1800/1600 bc), and the consolidation phase – in the Early Bronze Age (1800/1600–1100 bc).

❷ In Eastern Lithuania, the availability phase occurred during the Middle and Late Neolithic, the substitution phase – during the Early Bronze Age, and the consolidation phase – in the Late Bronze (1100–500 bc) and Early Iron Age (500 bc–0 AD).

❸ Cereal agriculture developed first and more intensively in western Lithuania than in eastern Lithuania, where animal husbandry was more prevalent.

Researchers have stressed the importance of examining not only the evolution of the practical side of domestication, its specific nature and locational variance, but also the evolution of other aspects of material culture occurring and changing in tandem with practical domestication. The transition to farming was part of an interdependent behavioural complex that included not only changing ecological conditions, trading networks and population expansion, but also the actual people, changing kinship networks (connubia), burial rites, the possible demarcation of "ethnic groups". The domestication process must be understood as part of this interdependent complex, in its entire context.

On the level of theory, how we classify our data will strongly impact our interpretations, and it is important to clearly define our classifications. But theoretical conclusions about the evolution of economy and prehistoric societies in general are drawn and interpretations made mainly from the material data. Although we may have enough data to paint a rough sketch of the long transition to farming in the East Baltic, we are far from a fine resolution view of the transition's development. A myriad of problems exist, from uneven preservation of material and uneven regional or chronological site representation, to no or very little systematic recovery of plant

2 A. Girininkas postulates that the Early Neolithic (Narva culture) must have begun in Lithuanian territory at about the same time as in the nearby Lubāna lowland in Latvia, and uses the Zvidze date of 4820±60 BP; TA-856 (*Girininkas 1994.272; Loze 1992*).

macrofossils, minimal functional analyses of tools and not enough regard to the complexities of site formation processes. But a very fundamental and foundational problem that needs to be rectified for proper interpretation concerns actual chronological data, the evolutionary sequence.

I would like to draw attention to Lithuanian chronology as a case in point. To the credit and steadfast efforts of anthropologists Dr. Kenneth Jacobs at the Université de Montréal and Dr. Rimantas Jankauskas of Vilnius University, AMS radiocarbon dating was done at Oxford on skeletal material from Lithuanian Stone Age graves[3]. The results (see OxA listing in Tab. 1) show that six out of the nine dates are significantly different than have been assumed and published. This proportion is of great consequence, since there are not many Stone Age skeletal remains to date recovered in Lithuania and these dates concern token site material. These new dates require reorientation in the interpretation of Lithuanian Stone and Bronze age social, economic, physical, ideological evolution. They show that certain important previously assumed and published chronological contexts can simply no longer be considered valid.

The Kirsna skull was found in southwest Lithuania's Marijampolė region, near the Kirsna River, during the draining of a peat-bog in 1930. Among this peat-bog's finds at that time were many bone artefacts, bone axes, daggers, harpoons, as well as flint knives found in a stone-lined pit, and typologically dating to the Mesolithic. By association, the skull was also dated to the Mesolithic. Since the first publications of the Kirsna skull in 1931 (*Žilinskas*), it has been and is still often cited as representative of the oldest Lithuanian inhabitant and one of two main anthropological types in Lithuania's earlier Stone Age. The skull belongs to a 25–30 year old male (Fig. 1) who was hypermorphic, dolichocranic, with a high, narrow face, a Europoid related to Eastern Cro-Magnon-type people (*Česnys 1990; Žilinskas and Jurgutis 1939*). The Oxford AMS date of this skull is 2895± 55 BP (OxA–5931) (see Tab. 1 for a listing of calibrated BC dates) – it actually dates to the Late Bronze Age, about 5000 years later.

Three out of four graves found at the site of Spiginas in western Lithuania's Samogitian Highland at Biržulis Lake (Fig. 2) have been previously dated (*Butrimas 1992*). One, crouched burial nr. 2, with no grave goods, dated to 4080±120 BP (GIN–5570) – the Late Neolithic. Grave nr. 4, a 30–35 year old mesomorphic, brachycranic woman (Fig. 3), representing a massive Europoid of Central European type (*Česnys 1990; Balčiūnienė et al. 1992*), buried with ochre, a projectile point, pendants of elk/red deer and boar teeth, was radiocarbon dated to the middle of the 8th mil. bp (7470±60 BP; GIN 5571). Spiginas gr. 1 of a 35–45 year old male with lots of

Lab.nr.	Grave	^{14}C Age BP	Uncal. bc*	CALIBRATED BC**
OxA-5925	Spiginas gr. 3	7780±65	5830±65	6750 (6637, 6623, 6594) 6460
GIN-5571	Spiginas gr. 4	7470±60	5520±60	6440 (6380, 6307, 6302, 6283, 6269) 6220
OxA-5924	Duonkalnis gr. 4	6995±65	5045±65	5990 (5869, 5861, 5842) 5720
OxA-5926	Kretuonas gr. 3	5580±65	3630±65	4540 (4446, 4421, 4398, 4381, 4367) 4260
OxA-5935	Kretuonas gr. 1	5350±130	3400±130	4460 (4223, 4182, 4168) 3830
GIN-5569	Spiginas gr. 1	5020±200	3070±200	4320 (3793) 3370
OxA-5936	Plinkaigalis gr. 242	4280±75	2330±75	3090 (2893) 2640
GIN-5570	Spiginas gr. 2	4080±120	2130±120	2910 (2618, 2611, 2596, 2593, 2582) 2290
OxA-5928	Plinkaigalis gr. 241	4030±55	2080±55	2860 (2568, 2518, 2499) 2460
OxA-5931	Kirsna 1	2895±55	945±55	1290 (1049) 920
OxA-5927	Turlojiškė 1	2835±55	885±55	1210 (998) 830
OxA-5937	Plinkaigalis gr. 317	1910±65	AD 40±65	Cal BC 40 (cal AD 82) cal AD 240

Tab. 1. Lithuanian Stone Age Grave Dates.
OxA = History of Art; radiocarbon dates in Ramsey et al. 2000,* Archaeometry *journal 42 (1), in press.
GIN = Geological Institute, Russia; radiocarbon dates in Butrimas 1992.
* ***Dating typology used by many East Baltic archaeologists.***
** ***The extremes of the 2 sigma ranges are given with the calibrated ages in between them in parentheses and the ranges are rounded off to the nearest decade, as suggested by M. Stuiver and P. J. Reimer. Dates were calibrated using Stuiver and Reimer's 1999 Radiocarbon Calibration Program Rev. 4.1.2. See Stuiver and Reimer 1993 and Stuiver et al., 1998, in References.***

3 These were funded by a grant to Dr. Jacobs from the Canadian Social Science and Humantities Research Council.

Fig. 1. Face reconstruction of Kirsna man by Urbanavičius (Rimantienė 1996.108).

ochre, 2 rhomboid projectile points and 57 animal teeth pendants was also previously dated to approximately the very end of the 6th mil. bp (5020±200 BP; GIN-5569). This date has seriously been doubted, however, based on the Late Mesolithic-type grave goods (the type of points) found in the grave, and the fragments from which the date was made (*Butrimas 1992*). Analogies of Spiginas' grave goods and burial rites are made to Maglemose/Kungemose culture-type burials in northern Latvia's Zvejnieki cemetery, the Janislawice grave in Poland, and others in southern Scandinavia. One new ^{14}C date was made at Oxford from this cluster of graves - Spiginas' grave nr. 3 of a woman of unknown age, unique body build, and no grave goods was dated to 7780±65 BP (OxA-5925)[4]. Spiginas 3 may be a little older than Late Mesolithic. Most importantly, however, this burial is now the oldest known burial in Lithuania.

The "Turlojiškė man" (Fig. 4) is a 25-30 year old male, found in the same general area and peatbog as the Kirsna skull (*Rimantienė 1984; Česnys 1990*). It was originally dated by association with other artefacts to the Neolithic and considered the representative anthropological type of southern Lithuania's earlier Neolithic, Nemunas culture people: brachycranic with protolaponoid elements. The new Oxford date of this individual is 2835±55 BP (OxA-5927) - the Late Bronze Age.

The two main cemeteries of Lithuania that have represented the bulk of known Neolithic inhabitants are at Duonkalnis, along the same Biržulis Lake as Spiginas (see Fig. 2), and also at Kretuonas 1B, in northeastern Lithuania, on the southeast edge of Kretuonas Lake. Both of these "cemeteries" are associated with contemporaneous settlement sites. One

Fig. 2. General situation plan of Mesolithic sites near Biržulis Lake: 1 - Stone Age cemeteries, 2 - Mesolithic habitation sites, 3 - isolated Mesolithic finds (Butrimas 1992.4).

4 This date is very simliar to Zvejnieki gr. 154's (7730±70 BP; Ua-3644), a male buried with ochre, stones at the feet end, and fragments of bird bone.

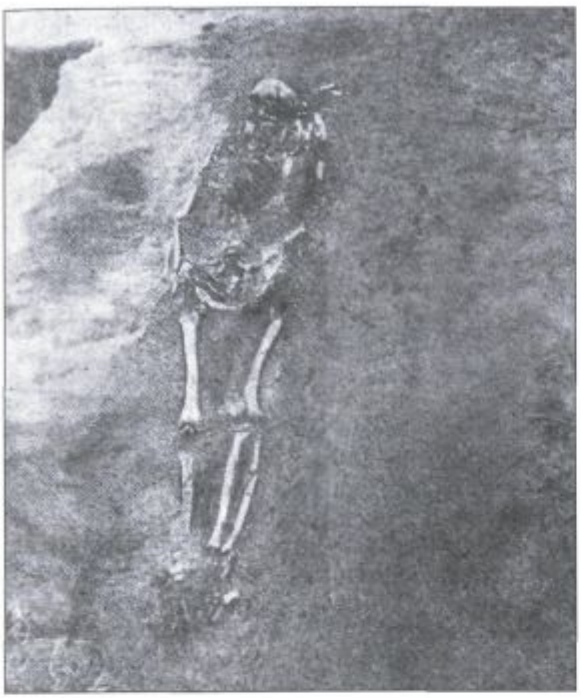

Fig. 3. Spiginas grave nr. 4 (Butrimas 1992.7).

grave from Duonkalnis and two from Kretuonas 1B have new dates. Supposedly falling chronologically between Kretuonas and Duonkalnis are three graves from Plinkaigalis, also token data base burials.

Kretuonas 1B (Fig. 5) has six graves and is the second largest Stone Age "cemetery" in Lithuania. It is associated with the Middle Neolithic Narva culture, representative of the Narva culture anthropological type – mesomorphic, mesocranic, Europoid, with a slightly flattened face (*Girininkas et al. 1985; Girininkas 1990; Česnys 1990*). Grave nr. 3 is that of a 50–55 year old male with two horse teeth as grave goods. The individual dates to 5580±65 BP (OxA–5926). Kretuonas 1B's grave nr. 1 is of a 20–25 year old female with a 0.4 cm layer of dark soil underneath the upper portion of her body and a broken bone dagger under her right forearm, and dates to 5350±130 BP (OxA–5936). These Kretuonas graves actually date to the time that has been classified as Early Neolithic, some 1000 years earlier than previously believed. It is likely that the associated settlement falls within this same chronological framework. Moreover, Kretuonas 1B grave nr. 3's date is now the oldest Neolithic date in all of Lithuania. (The oldest Neolithic site before now was at Žemaitiškė 3: 5510±60 BP (Bln–2594; *Girininkas 1994; Rimantienė 1996*), also one of the Kretuonas series of sites.) If the associated settlement site is truly contemporaneous with the graves, and if we keep the criteria of the appearance of the Comb-and-Pit Pottery culture as marking the beginning of the Middle Neolithic, this would mean that the Middle Neolithic in Lithuania begins in the 6th mil. bp; Kretuonas 1B does exhibit "influences" of the Comb-and-Pit Pottery culture.

Three of the newly dated graves are from Plinkaigalis, a cemetery in central Lithuania, in the Kėdainiai district. Most of the graves in the Plinkaigalis cemetery date from the 3rd to the 6/7th cen. AD, but these three have been ascribed to the Boat Battle Axe or Early Corded Ware culture horizon by their crouched manner of burial and (1 case) grave goods (*Butrimas et al. 1985; Kazakevičius 1993.160, 165*). Craniologically, all three of these individuals fit well into the frame of the "classic" type of hyperdolichocranic, hypermorphic Europoids with high faces and marked clinoprosopy (*Butrimas et al. 1985; Česnys 1990*). The first of the three, Plinkaigalis gr. nr. 242 (Fig. 6) is of a woman over 40, buried with 2 flint blades-knives and one retouched flint knife, bent legs, and with much charcoal in the burial pit. The date of this burial is 4280±75 BP (OxA–5936) and it falls nicely into the Boat Battle Axe horizon. Plinkaigalis' nr. 241 (Fig. 6) is of a 50–55 year old woman with very worn teeth and bent legs (who may have had two wooden boards on two of her sides),

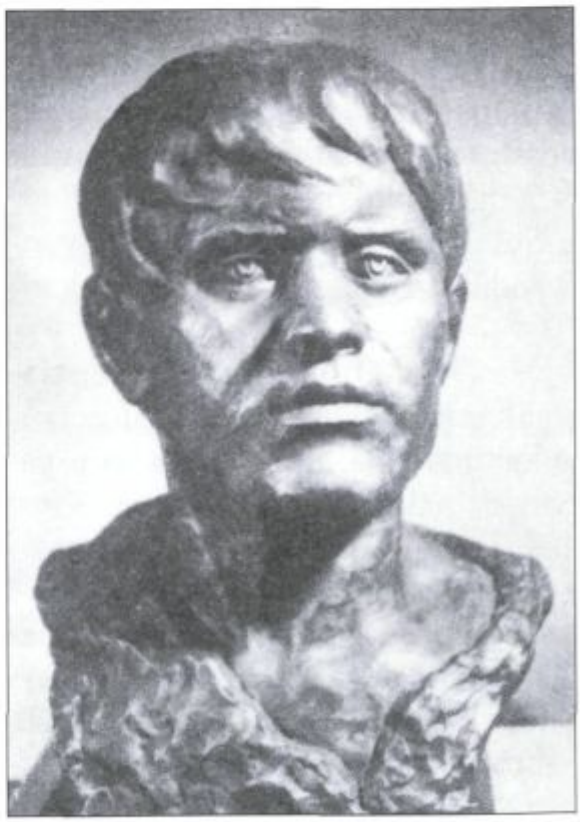

Fig. 4. Face reconstruction of the Turlojiškė man by Urbanavičius (Rimantienė 1996.206).

Fig. 5. Situation plan of Kretuonas 1B burials (Girininkas 1990.98).

dating to 4030±55 BP (OxA-5928) and also falls into Corded Ware culture times. The third Plinkaigalis grave, nr. 317 (Fig. 7), however, dates to 1910± 65 BP (OxA-5937), placing it already well into the Iron Age. This grave is of a 50-55 year old woman with bent legs and no grave goods. Plinkaigalis nr. 317's date illustrates that crouched burials (and the "classic" anthropological type mentioned above) do not necessarily imply Corded Ware culture burials.

Duonkalnis has 7/8 intact graves[5] and is the largest Stone age "cemetery" in Lithuania associated with the Late Neolithic Baltic Haff culture representative of this culture's physical anthropological type and burial rites (*Kunskas et al. 1985; Česnys 1990*). The Baltic Haff culture's anthropological type is characterised as a hybrid between autochtonous mesocranic, and immigrant hypermorphic, hyperdolichocranic early Corded Ware Pottery bearers. Duonkalnis nr. 4 is of a 50-55 year old man buried with 83 animal tooth pendants (Fig. 8) and intensive ochre. Its new date is 6995±65 BP (OxA-5924) - not the Late Neolithic as was believed, but rather Late Mesolithic - 2.5 to 3 thousand years earlier. Known isotopic analysis from grave nr. 2 (Fig. 9), a male buried with a female at his feet and of special interest, suggests that grave nr. 2's individual is slightly older than grave nr. 4. This double burial will be redated[6]. These new dates affect not only the assumed chronology; they also affect contextual interpretations concerning the evolution of anthropological types, their material culture affiliations, economy, burial rites, social structure and ideology.

Stone age archaeological cultures in the East Baltic are quite often associated with linguistic/social groups - Narva culture people as *in situ* locals and Pre-Indo-Europeans (or even Indo-Europeans), Comb-and-Pit Pottery culture as emigrating Finno-Ugrians, Corded Ware culture as incomer Indo-Europeans. A citation from the Journal of Indo-European Studies: "The neolithization of the East Baltic area began only with the coming Indo-European speakers, the early Corded Pottery people. Their spread northward was halted by the Comb-and-Pit-marked Pottery people, presumed to be Finno-Ugric speakers, who had entered Estonia and Latvia before the Indo-Europeans (*Rimantienė 1980.407*)."

The Duonkalnis cemetery has been noted for its similarities of burial rites to other cemeteries of the Late Mesolithic tradition. Previously deemed Late Neolithic and Baltic Haff culture, it was interpreted as an illustration of the long-standing spiritual tradition of local Narva culture inhabitants dominating in Late Neolithic Baltic Haff culture, which was a mixture or assimilation of mostly local Narva culture and incomer Corded Ware culture groups. This old burial tradition included extended burials, ochre deposits, animal tooth pendants. Double grave nr. 2 and 3 (see Fig. 9) was interpreted as a shaman, with the wealthiest of grave goods and ochre, and the female with bent legs at his feet and no grave goods, as representative of Corded Ware culture and patriarchal Indo-European burial elements. One musing was that "with the patriarchal social order taking hold, in special cases (like in burying a shaman), women were sacrificed (*Rimantienė 1996.304*)..." If this "shaman's" grave dates to the Late Mesolithic, and grave nr. 3 is contemporaneous, Corded Ware and Indo-European culture elements are especially unlikely to have been a part of the burial rite here.

In Lithuania we now have no anthropological data associated with the Nemunas culture, no absolutely clear Narva culture representatives for most of the 5th mil. bp (or what has been called the Middle Neolithic[7]), only a possibility of a Baltic Haff culture re-

5 There are also six more 'pits' with human remains found at Duonkalnis; they are fragmentary remains only and are considered to be out of their primary burial context. Since they have been analyzed minimally only, I shall not discuss them further here.

6 It must be pointed out that not all Lithuanian researchers believe graves 2 and 3 are contemporaneous.

7 Only undated skeletal fragments from Šventoji 23 (*Rimantienė 1979.148, 1996.207*). The site itself dates to a late 4190±80 BP (Vib-1).

presentative. Anthropological types supposedly characteristic of one time or associated with one material culture have either moved up or back on the time line as much as 5000 years, or totally disappeared. The generalised evolution of anthropological types in the Stone Age in Lithuania must be totally reassessed.

Perhaps the generalisation of anthropological types into ethnic or racial groups from the Stone Age is altogether a fruitless endeavour. In their article entitled "Pitfalls in the Search for Ethnic Origins: a Cautionary Tale regarding the Construction of 'Anthropological Types' in Pre-Indoeuropean Northeast Europe", Jacobs, Wyman and Meiklejohn (*1996.285–301*) elucidate the theoretical constraints of such typologies with the concept of the connubium or mating network – the aggregation of groups from which a member of any given focal group will obtain a mate. The main point is that low population densities of forager societies in at least most of the Stone Age would have required relatively open connubia, leading to a high gene flow rate across larger geographical expanses. Only at relatively high population densities does it become possible for regionally based connubia to define themselves as closed endogamous groups and for what we call 'anthropological types' to develop as distinct entities.

Recent anthropological research of the large Zvejnieki Stone Age cemetery in northern Latvia appears to support this notion. Data on the body build of people buried at Zvejnieki show much diversity in anthropological composition. Aside from the marked lack of continuity observed between individuals of the Late Mesolithic and those in the Transition Period (from the Late Mesolithic into the Early Neolithic), as well as those from the Early Neolithic to the Late Neolithic, Zvejnieki Early Neolithic individuals show a strong lack of homogeneity in physical type and body build (*Gerhards 1996; 1997; 1999*).

As for economic research in Lithuania thus far, the token Neolithic site representing East Lithuania's 5th mil. bp economy data in research on Lithuania's transition to farming has been Kretuonas 1B. Given the good possibility that the Kretuonas 1B settlement is contemporaneous with the Kretuonas 1B graves, the 5th mil. bp data base of Eastern Lithuania from which economy assessments have been made is left empty. The percentage of domestic animal bone at Kretuonas 1B (over 4046 bones) is noted as almost 7%, which by Zvelebil and Rowley-Conwy's availability model would put this eastern site into at least the availability phase by the mid-6th mil. bp, if not into the beginning of the substitution phase. Also, in the Lithuanian economy evolution assessments, faunal data from the Duonkalnis graves and settlement have been counted together and regarded as Late Neolithic. Whether the Duonkalnis settlement site is actually contemporaneous with the Duonkalnis graves may be more disputable, due to the presence of Corded Ware culture pottery in the settlement area and a very high percentage of domestic animal bone. Problems with stratigraphy may be another important consideration at this site. Coming

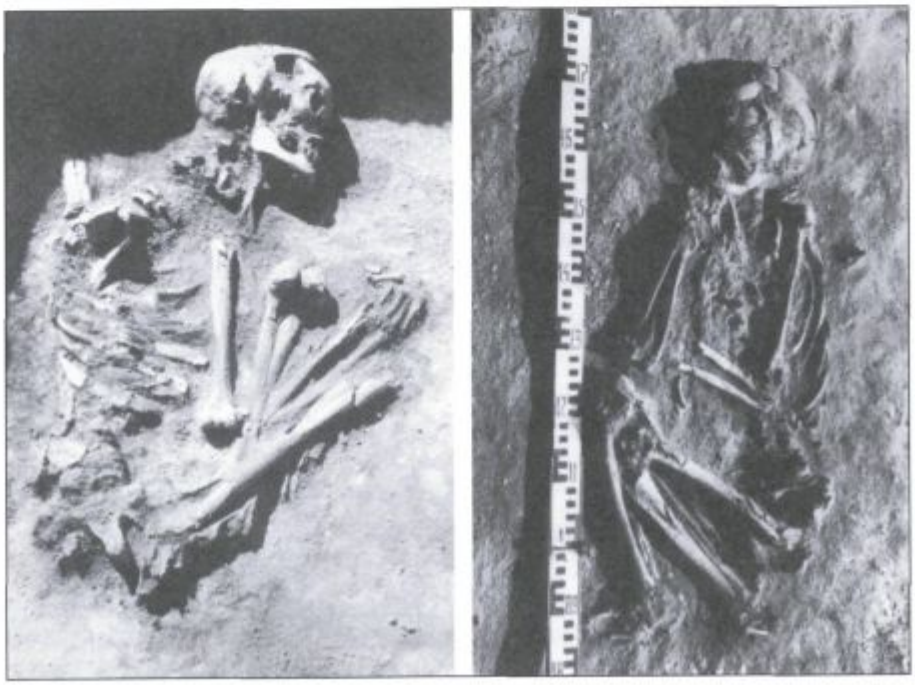

Fig. 6. Plinkaigalis burials nr. 242 (left) and 241 (right) (Rimantienė 1996.224).

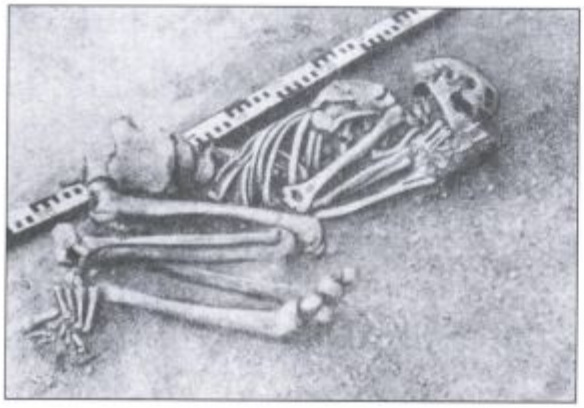

Fig. 7. Plinkaigalis burial nr. 317 (Butrimas et al. 1985.19).

back to the burials, however, an interesting discovery made recently is that two of the Duonkalnis graves have eight cattle teeth among the various tooth pendants in the graves (*Daugnora 1998*). One of these is in the newly dated Late Mesolithic grave of Duonkalnis 4, a 50–55 year old male with 83 pendants. If the cattle teeth actually date to the Late Mesolithic, which would seem likely, this could be evidence of local contact with farmers by the early 7th mil. bp. Perhaps the cattle teeth were acquired through trade with farmers, perhaps considered a prestige item? The other Duonkalnis grave with cattle teeth among the many animal teeth is nr. 5, the grave of one or two 5–7 year old children.

In terms of the availability model for the transition to farming, the new chronological data suggest that at least the availability phase of both west and east Lithuania started earlier than previously believed.

Seven out of 20 dates done from the skeletal material of graves in Zvejnieki (*Zagorska 1994; 1997*) or 35% of the dated graves fall within the 7th mil. bp, while 9 out of 20 or 45% cluster in the 6th mil. bp. A radiocarbon date of human bone from the supposedly Late Neolithic cemetery of Tamula in eastern Estonia (Grave nr. 10 (or 11?); 5310±85 BP; Ua-4828 (*Lõugas, Liden, Nelson 1996*) turned out to be roughly contemporaneous with the newly dated graves of Kretuonas 1B in eastern Lithuania – almost the middle of the 6th mil. bp[8]. These clusters are in themselves an interesting point. We have no radiocarbon dated graves from then until the burials associated with the time of the Early Corded Ware culture horizon almost 1000 years later. Another millenium absolute dating gap covers the end of the Late Neolithic and Early Bronze Age. The vast majority of Lithuanian and other East Baltic Late Neolithic graves associated with the period of the Corded Ware culture lack absolute dates; typology and stratigraphy are usually employed to date them (*Butrimas et al. 1985; Zagorskis 1961; 1987; Loze 1979; 1995*). Since these relative dating methods have proved *inadequate*, it would be most beneficial to radiocarbon date some human bone associated with this period – like the burials of Veršvai, Rešketa, Kurmaičiai, skeletal material from the Abora, Kreiči, Kiviutkalns cemeteries. Serious doubts still remain about the chronology of yet undated graves at Duonkalnis, Tamula. These doubts, added to the large gaps in material evidence, further confuse the view of social and ideological processes involved in the evolution of domestication. These constitute large missing chunks of the transition to the farming period – large portions of the substitution and consolidation phase times – without which a fine resolution view of the transition to farming's multidimensional process is not possible.

Fig. 8. Tooth pendants found in Duonkalnis grave nr. 4's neck and chest area (Butrimas; Kunskas et al. 1985.43, 42).

8 It is possible that the human bone from which the radiocarbon date was made was contaminated, but there is an equal chance that it was not. Also, there are 2 types of burial at the Tamula cemetery, one type possibly older than the other. Until very recently, however, these graves have all been considered contemporaneous with the Late Neolithic settlement site.

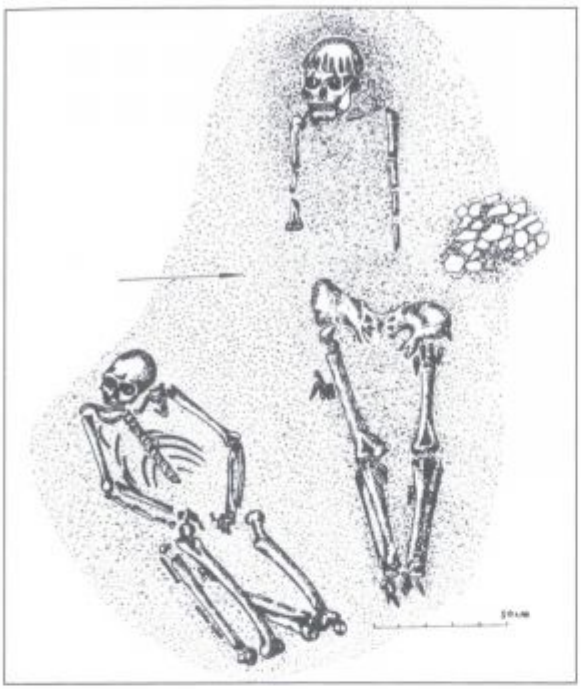

Fig. 9. Duonkalnis "shaman" grave nr. 2 (right) along with grave nr. 3 (left) (Butrimas; Kunskas et al. 1985.36).

From the Neolithic burial data that we do have in the East Baltic, the heterogeneity of burial rites must also be stressed. There most certainly is not only chronological and regional lacunae and variance, but site variance as well. The simple fact, for example, that in the largest cemetery of Zvejnieki, almost one third of Neolithic graves have no grave goods (*Zagorskis 1987, tables; Antanaitis 1998*), deserves attention. As far as general trends in graves that do have grave goods here, dominating earlier grave goods that may be associated with the availability phase are ochre, animal tooth pendants and large stones. Zvejnieki's later funerary assemblages, like those of the 6th mil. bp and that may be associated with the beginnings of the substitution phase (?), are dominated more by amber pendants and processing tools. Collective burials also become more common. At the Tamula cemetery in Estonia (*Jaanits 1957*) which at least partially dates to the mid-6th mil. bp (?), bird bone or works of art and amber are among the more frequent of goods. Lithuania's Kretuonas burials have very few grave goods altogether. There are no known Neolithic burials with amber in Lithuania[9].

Traumatic lesions occur in the Duonkalnis burials: the skull of the old male in Late Mesolithic grave nr. 4 has an area of periostitis which could be caused by an infection after a local scalping trauma. This individual also has a parry fracture of the left ulna, as does the mature female of grave nr. 6. These traumas have been interpreted as the possible result of an individual raising his hand to protect his head from a blow (*Jankauskas 1995.18*). Grave nr. 3 at Duonkalnis of a young female adult has a small shallow oval depression on her right parietal lobe. This could be a healed blunt injury to her skull vault. The skull of the 50–55 year old male of Kretuonas' grave nr. 3 has eight healed-over small shallow impressions of varying shapes on both parietals. The Late Bronze Age young adult male of Turlojiškė also has three impressed fractures (Fig. 10) on his skull, all connected by fracture lines. The impressions were probably made by a blunt hard instrument that could also have been the cause of this individual's death. A high proportion of apparent violence is reflected by the (few known) Lithuanian human remains of the early 7th, mid-5th and early 3rd mil. bp If these are suggestive of territoriality, competition and conflict, then their occurrence is of an early and recurring scope.

Social structure before the consolidation phase of the transition to farming would probably have been similar to that of ethnographically recorded hunter-fisher-gatherers, though some researchers have stressed that the complexity of foragers at that time must have been of the sort that is not fully comparable to the modern situation. Farmers are typically more sedentary. The consolidation phase of the prac-

Fig. 10. General view of the Turlojiškė man's skull vault (Jankauskas 1995.13).

9 Except, possibly, for some human bone fragments found in association with an amber pendant at Šventoji 23 (*Rimantienė 1996. 205*)?

tical transition to farming process in Lithuania appears to have occurred mostly in the Bronze Age (although hunting - mostly for trade - was important even in the Iron Age). The Bronze Age is also known for its defensive and high energy investment structures - defence walls, ditches, hill-forts (as well as burial types - barrows or burial mounds - similar in form). The implied higher population density and increased territoriality would make more endogamous mating networks possible, perhaps suggesting the beginnings of the formation of ethnic/ sociolinguistic groups (Balts? Indo-Europeans?) at this time.

A more *complete* and *certain* chronological foundation of material data related to both the practical and ideological processes involved in the East Baltic's slow transition to farming would allow a better understanding of its evolution.

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REFERENCES

ANTANAITIS I. 1998. Interpreting the Meaning of some East Baltic Neolithic Symbols. *Cambridge Archaeological Journal. Vol. 8, No. 1: 55–68.*

ANTANAITIS I., JACOBS K. 2000. *Commentary on Lithuanian Stone Age Grave Dates. Archaeometry 42 (1) in press.*

BALČIŪNIENĖ I., ČESNYS G., JANKAUSKAS R. 1992. Spigino Mezolito Kapų Kraniometrija, Odontologija, Osteometrija ir Paleopatologija. *Lietuvos Archeologija, Vol. 4: Akmens Amžiaus Gyvenvietės ir Kapinynai: 10–15.*

BUTRIMAS A. 1992. Spigino Mezolito Kapai. *Lietuvos Archeologija Vol. 8: 4–9.*

BUTRIMAS A., KAZAKEVIČIUS V., ČESNYS G., BALČIŪNIENĖ I., JANKAUSKAS R. 1985. Ankstyvieji Virvelinės Keramikos Kultūros Kapai. *Lietuvos Archeologija, Vol. 4: 14–24.*

BUTRIMAS A., GIRININKAS A. 1990. Staryje Mestnyje i Novyje Pogrebalnyje Obriady v Neolite Litvy. *Issledoanija v Oblasti Balto-Slavianskoj Dučovnoj Kultury 85: 147–156.*

ČESNYS G. 1990. *Lietuvių Etninės Paleoantropologijos Pagrindai.* Vilnius: Vilniaus Universiteto Leidykla.

DAUGNORA L. 1998. Osteologiniai duomenys. Baltų Ūkio Raida. Girininkas L., Daugnora L., Motuza G., Antanaitis I. Lietuvos Valstybinio Mokslo ir Studijų Fondo remiamo darbo ataskaita už 1998 m. kovo-gruodžio mėn. Vilnius.

DAUGNORA L., GIRININKAS A. 1995. Neolithic and Bronze Age mixed farming and stock breeding in the traditional Baltic culture-area. In V. Kazakevičius and R. Sidrys (eds.), *Archaeologia Baltica: 43–51*

1996. *Osteoarcheologija Lietuvoje. Vidurinysis ir Vėlyvasis Holocenas.* Vilnius: Savastis.

1998. Stock Breeding in the Baltic Culture Area. In Kazakevičius V., Olsen A. B. and Simpson D. N. (eds.), *Archeologia Baltica, Vol. 3: 223–234.*

DOLUKHANOV P. 1993. Foraging and Farming Groups in North-Eastern and North-Western Europe: Identity and Interaction. In Chapman J. and Dolukhanov P. (eds.), *Cultural Transformations and Interactions in Eastern Europe: 122–145.*

1986. The Late Mesolithic and the Transition to Food Production in Eastern Europe. In Zvelebil M. (ed.), *Hunters in Transition: 109–119.*

GERHARDS G. 1996. Zvejnieku Kapulaukā Apbedīto Iedzīvotāju Ķermeņa Garums un Tā Izmantošanas Iespējas Kapulauka Iekšējās Struktūras Pētniecībā. *Latvijas Vēstures Institūta Žurnāls: 5–21.*

1997. Mezolīta un Agrā Neolīta Iedzīvotāju Ķermeņa Fiziskā Uzbūve. *Latvijas Vēstures Institūta Žurnāls. Gada Nr. 4: 5–23.*

1999. Neolīta Iedzīvotāju Ķermeņa Fiziskā Uzbūve. *Latvijas Vēstures Institūta Žurnāls. Gada Nr. 1: 5–20.*

GIRININKAS A. 1990. *Archeologija Litvy VII: Kreton – Srednij i Pozdnij Neolit.* Vilnius: Mokslas.

1994 *Baltų Kultūros Ištakos.* Vilnius: Savastis.

GIRININKAS A., ČESNYS G., BALČIŪNIENĖ I., JANKAUSKAS R. 1985. Kretuono 1-os Gyvenvietės Vidurinio Neolito Kapai. *Lietuvos Archeologija, Vol. 4: 5–14.*

JAANITS L. 1957. Neue Gräberfunde auf dem spätneolithischen Wohnplatz Tamula in Estland. *Seorsum ex Suomen Muinaismuistoyhdistyksen Aikakauskirja Finska Fornminnesföreningens Tidskrift 58: 80–100.*

1965 Über die Ergebnisse der steinzeitforschung in Sowjetestland. *Finkst Museum LXXII: 5–46.*

1984. Die kennzeichnende Züge der Sielung Tamula. *ISKOS 4: 183–192.*

JACOBS K., WYMAN J., MEIKLEJOHN C. 1996. Pitfalls in the Search for Ethnic Origins: a Cautionary Tale regarding the Construction of 'Anthropological Types' in Pre-Indo-European Northeast Europe. The Indo-Europeanization of Northern Europe. *Journal of Indo-European Studies Monograph Nr. 17: 285–305.*

JANKAUSKAS R. 1995. Traumatic Lesions in Human Osteological Remains from Neolithic Lithuania. In Kazakevičius V. and Sidrys R. (eds.), *Archeologia Baltica: 12–19.*

KAZAKEVIČIUS V. *Plinkaigalio kapinynas. Monografija. Lietuvos Archeologija vol. 10.* Vilnius: Mokslo ir Enciklopedijų Leidykla.

KRIISKA A. 1999. Personal communication with Chair of Archaeology at Tartu University.

KUNSKAS R., BUTRIMAS A., ČESNYS G., BALČIŪNIENĖ I., JANKAUSKAS R. 1985. Duonkalnis: Vėlyvojo Neolito Gyvenvietė, Alkas ir Kapinynas. *Lietuvos Archeologija, Vol. 4: 25–66.*

LÕUGAS L., LIDEN K., NELSON D. E. 1996. Resource Utilization along the Estonian Coast during the Stone Age. In Hackens S., Lang V., Miller U. and Saarse L. (eds.), *Coastal Estonia: Recent Advances in Environmental and Cultural History PACT 51: 399– 420.*

LOZE I. 1979. *Pozdnij neolit i Ranniaja Lubanskoj Ravniny.* Rīga: Zinātne.

1992 The Early Neolithic in Latvia – the Narva Culture. *Acta Archaeologica 63: 119–140.*

1995. Late Neolithic Burial Practices in Latvia. In Kazakevičius V. and Sidrys R. (eds.), *Archeologia Baltica: 33–42.*

MEIKLEJOHN C., ZVELEBIL M. 1991. Health Status of European Populations at the Agricultural Transition and the Implications for the Adoption of Farming. In Bush H. and Zvelebil M. (eds.), *Health in Past Societies – Biocultural interpretations of human skeletal remains in archaeological contexts. B.A.R International sereis 567: 129–145.*

PAAVER K. 1965. *Formirovanije Teriofauny i Izmenčivost Mliekopytayuščich Pribaltiki v Golocene.* Tartu: Akademiya Nauk Estonskoii SSR.

RAMSEY C. B., PETTITT P. B., HEDGES R. E. M. and HODGINS G. W. L. 2000. *Radiocarbon dates from the Oxford AMS System: Archaeometry datelist 29. Archaeometry 42 (1), in press.*

RIMANTIENĖ R. 1979. *Šventoji, vol. I: Narvos Kultūros Gyvenvietės.* Vilnius: Mokslas.

1980. The East Baltic in the Fourth and Third Millenia BC. *Journal of Indo-European Studies, Vol. 8, Nos. 3&4 (Fall/Winter): 407–414.*

1984 *Akmens Amžius Lietuvoje.* Vilnius: Mokslas.

1992. The Neolithic in the Eastern Baltic. *Journal of World Prehistory 6: 97–143.*

1995. *Lietuva iki Kristaus.* Vilnius: Vilniaus Dailės Akademijos Leidykla.

1996. *Akmens Amžius Lietuvoje (2-as papildytas leidimas).* Vilnius: Žiburio Leidykla.

SELIRAND J., TÕNISSON E. 1984. *Through Past Millenia: Archaeological Discoveries in Estonia.* Tallinn: Perioodica.

STUIVER M., REIMER P.J. 1993. Extended ^{14}C database and revised CALIB radiocarbon calibration program. *Radiocarbon 35: 215–230.*

STUIVER M., REIMER P. J., BARD E., BECK J. W., BURR G. S., HUGHEN K. A., KROMER B., McCORMAC F. G., v. d. PLICHT J., SPURK M. 1998a. INTCAL98 Radiocarbon age calibration 24,000 - 0 cal. BP. *Radiocarbon 40: 1041–1083.*

VASKS A. 1999 Latvian archaeology: research and conclusions. In Jensen O. W., Karlsson H. and Vijups A. (eds.), *Inside Latvian Archaeology, Gotarc Series A, vol.2.* Göteborg University, Department of Archaeology and University of Latvia, Faculty of History and Philosophy.

VOLKAITĖ-KULIKAUSKIENĖ R. (ed.) 1987. *Lietuvių Etnogenezė*. Vilnius: Mokslas.

ZAGORSKA I. 1994. Jauni Dati par Zvejnieku Akmens Laikmeta Kapulauka Hronoloģiju. *Latvijas Vēstures Institūta Žurnāls Nr. 4 (13): 9–27.*

1997. The First Radiocarbon Datings from Zvejnieki Stone Age Burial Ground, Latvia. *Suomen Muinaismuistoyhdistys Finska Fornminnesföreningen. ISKOS 11: 42–47.*

ZAGORSKIS F. 1987. *Zvejnieku akmens laikmeta kapulauks*. Rīga: Zinātne.

1961. Kreiču neolita kapulauks. *Archeologija un Etnogrāfija 3: 3–18.*

ZVELEBIL M. 1986. Mesolithic Prelude and Neolithic Revolution. In Zvelebil M. (ed.), *Hunters in Transition: 5–15.*

1993. Hunters or Farmers? The Neolithic and Bronze Age Societies of North-East Europe. In Chapman J. and Dolukhanov P. (eds.), *Cultural Transformations and Interactions in Eastern Europe: 146–162.*

1994. Plant Use in the Mesolithic and its Role in the Transition to Farming. *Proceedings of the Prehistoric Society 60: 35–74.*

1995. Hunting, Gathering, or Husbandry? Management of Food Resources by the Late Mesolithic Communities of Temperate Europe. *MASCA Research Papers in Science and Archaeology. Vol. 12 Supplement: 79–104.*

1998. Agricultural Frontiers, Neolithic Origins, and the Transition to Farming in the Baltic Basin. In Zvelebil M., Domanska L. and Dennell R. (eds.), *Harvesting the Sea, Farming the Forest. The Emergence of Neolithic Societies in the Baltic Region*. Sheffield Academic Press.

ZVELEBIL M., ROWLEY-CONWY P. 1986. Foragers and Farmers in Atlantic Europe. In Zvelebil M. (ed.), *Hunters in Transition: 67–93.*

ŽILINSKAS J. 1931. *Akmens Periodo (Mesolithicum-Neolithicum) Žmogus Žemaitijoje ir Suvalkijoje – jo Kilmė ir jojo Ainiai*. Kaunas. Medicinos Fakulteto leidinys.

ŽILINSKAS J., JURGUTIS A. 1939. Crania Lithuanica (XX amžiaus ir iškastinės lietuvių kaukolės). *Vytauto Didžiojo Universiteto Medicinos Fakulteto darbai. Vol. 5, Book 3: 303–468.*

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Documenta Praehistorica XXVI

Pots, symbols and territories: the archaeological context of neolithisation in Mediterranean Spain

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ABSTRACT - *The central idea in this paper is that the spread of agriculture within the Iberian Peninsula resulted from both a kind of demic spread and the acculturation of the Mesolithic substratum. The suggestion of the dual model presented earlier (*Bernabeu 1996; 1997*) emphasises precisely this aspect and its consequence: the existence of a certain regional diversity in the processes of agricultural distribution. Within this context, it is suggested that the variability associated with decorative patterns and styles of impressed pottery and rock art has a clear territorial component. The spread of these symbolic manifestations can be better understood in the context of the interaction between farmers and hunters, and by assuming that assimilation was not the only result of this interaction process.*

IZVLEČEK - *Glavna misel v članku je ta, da je širjenje kmetovanja na Iberskem polotoku posledica obeh vrst demskega širjenja in akulturalizacije mezolitskih prebivalcev. Že predstavljen model dvojnosti (*Bernabeu 1996; 1997*) poudarja prav ta vidik in tudi njegove posledice: obstoj določenih regionalnih razlik v procesih širjenja kmetovanja. V okviru tega menimo, da ima raznolikost vzorcev okraševanja in stilov impresso keramike ter skalne umetnosti izrazito teritorialen pomen. Širjenje teh simbolnih manifestacij lahko bolje razumemo, če upoštevamo medsebojne vplive med kmetovalci in lovci/nabiralci ter če predvidevamo, da asimilacija ni edini rezultat teh medsebojnih vplivov.*

KEY WORDS - *Mediterranean Spain; Neolithisation; migration; colonisation; acculturation; pottery decoration*

1. OVERVIEW

In Mediterranean Spain, as in other Mediterranean regions, subsistence systems based on domestic resources are found together with impressed pottery.

Changing patterns over time in decorative techniques are used to organise the evolution of archaeological entities or cultures (*Bernabeu 1989*). However, the decoration of the first ceramic phases exhibits a rich and complex variety of motifs, including so-called "symbolic" pottery, the relationship of which with post-Palaeolithic rock art (Fig. 1) has been noted in recent studies (*Martí 1989; Hernández and Martí 1994; Martí and Hernández 1988*).

Post-Palaeolithic rock art in Mediterranean Spain has been divided into three major styles: Macro-schematic, Schematic and Levantine. Differences between the first two styles are ambiguous, and probably based upon chronology and evolution. Both are centred on human figures and other abstract motifs, both exhibit a high degree of conceptualism and/or preference for schematism and they are rarely descriptive. On the other hand, the Levantine style is more naturalistic, and combines both human and animal representations, showing a clear descriptive intention. All have good parallels with Neolithic pottery (Fig. 2), which is why recent research claims a Neolithic origin for all post-Palaeolithic rock art *styles (Martí 1988; Hernández and Martí 1994)*. On the other hand, ceramic chronology suggests a priority in the case of the Macro-schematic-Schematic styles; but their spatial distribution seems to show a clear

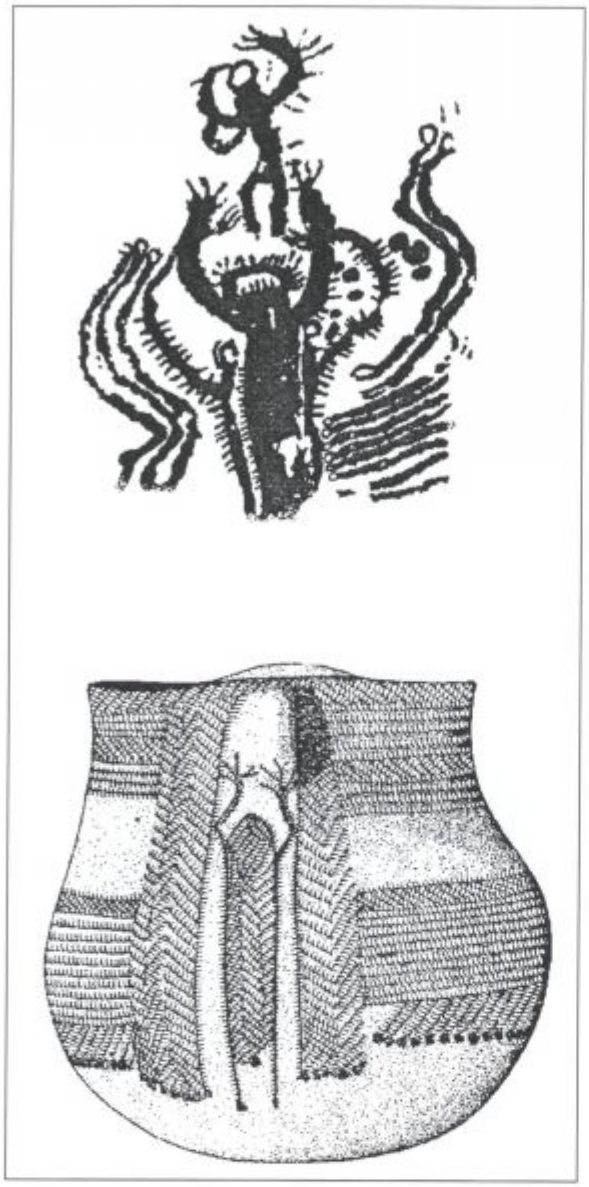

Fig. 1. Human figure from a cardial vase (the Or cave, Alicante) and from the macro-schematic rock shelter of Petracos (Alicante). No scale.

correlation between the Levantine style and Mesolithic ceramic groups, and the Macro-schematic-Schematic style with fully Neolithic groups (*Martí 1989*). Although Schematic style has a clear Neolithic origin, exhibits a greater variability both, in chronology and motifs. Some of them, at lees, could be related with Copper and, probably, Bronze Age cultures. In this circumstances the spatial distribution and association with other archaeological variables are clearly out of meaning in relation with the problem analysed in these paper: the role-played by these symbolic manifestations in the context of the neolithisation process.

For this reason, I think it could be useful to begin by explaining the decorative techniques and their evolution. Next, I will focus on the main features of the neolithisation process, particularly those of the so-called "Dual Model" (*Bernabeu 1996; 1997*), and finally, I will return to the pottery styles, especially those called Symbolic Styles.

1. CHRONOLOGY AND POTTERY DECORATION

The Classical *Cardial* area is a part of the Mediterranean Impressed Ware Group, which includes the Mediterranean regions of Southern France, Spain and Portugal. For this reason it is known as the French-Iberian region. *Cardial* decoration in this region is mainly a coastal phenomenon, which only rarely and occasionally pushes into the nearest inner areas. The cardial area in the Iberian Peninsula includes the Eastern and Southern peninsular regions, where most of the sites in which this decorative technique is quantitatively important are located.

Broadly speaking, the evolution of the Neolithic in the Iberian Peninsula will be summarised as a succession of pottery decoration techniques defining different phases.

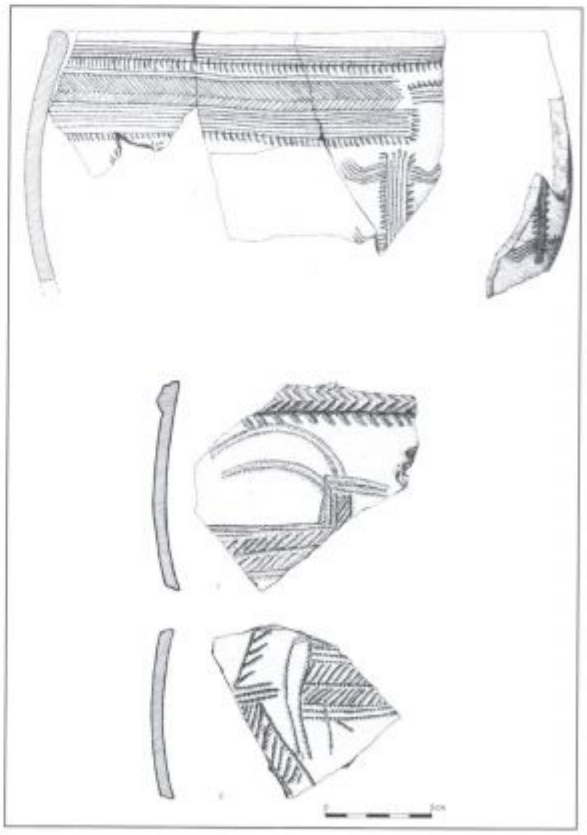

Fig. 2. Ceramic sherds from the Or cave (Alicante) showing a clear relationship with the top/bottom Schematic (up) and Levantine Rock Art styles (down).

The stratigraphy of Cendres Cave (Alicante) exemplifies this evolution. The stratigraphy of this site shows the evolution of pottery decoration from the very beginning of the Neolithic to the Bronze Age. The radiocarbon dates obtained there range through the Holocene layers from 6800 bp to 3800 bp (Fig. 3). Here the first stages of cardial decoration stand out, but they are not alone. Other types of decoration (other impressed, incised, and painted and reliefs) are present from the beginning. We can find this *Cardial* Phase scattered all over the region, but with different starting points: from ca. 6800 bp in Southern France-Catalonia to ca. 6500 bp in southern Portugal.

Between 6400-6200 bp, the non-cardial impressed and incised decorations become more common. The neolithisation of inner peninsular regions, from western Andalusia to north of the Meseta, would have taken place in this period - which is known as the *Epicardial* - as recent findings show (*Kunst and Rojo 1999; Estremera Portela 1999*).

Thenceforward, evolution seems to show a higher regional variability. In some places, *Epicardial* decorations ended at around 5600 bp, and a new style, with plain, black burnished ware, sometimes decorated with carved incisions, emerges. This is the case of the Chassey Culture in France, the early Fosa Graves Culture in Northern Catalonia, and Neolithic IIA in the Valencia region.

The Andalusian region, the central Meseta, and possibly Portugal, seem to continue the same *Epicardial* tradition until around 5000 bp, but show a high degree of variability between them.

Considering the above, I suggest the following phases (chronology is approximate):

- *Cardial*. 6800-6300 bp. *Cardial* decoration and reliefs predominate, their values rising up to 75-90 % of all decorated pottery. Technically, impressions made with a gradine are found quite close to cardial impressions, and sometimes it is difficult to distinguish one from the other.

- Early *Epicardial*. ca. 6300-5800 bp. Incised and impressed non-cardial decorations become more common and are often mixed on the same vase. These combinations include neither gradine nor cardial impressions; this latter technique decreases quickly and disappears from the pottery repertoire before 6000 bp.

- Late *Epicardial*. 5800-5000 bp. It is present in Andalusia and the inner peninsular regions. Decorations are rare and still within the *epicardial* tradition.

- Post-Impresso. 5800-5000 bp. They are only present in those coastal regions where the cardial phase was important. New techniques emerge, e.g. that of a carved style, while incisions and impressions tend to disappear.

'*Cardial*' and '*Epicardial*' do not denote ceramic styles, but refer to a series of decorative techniques

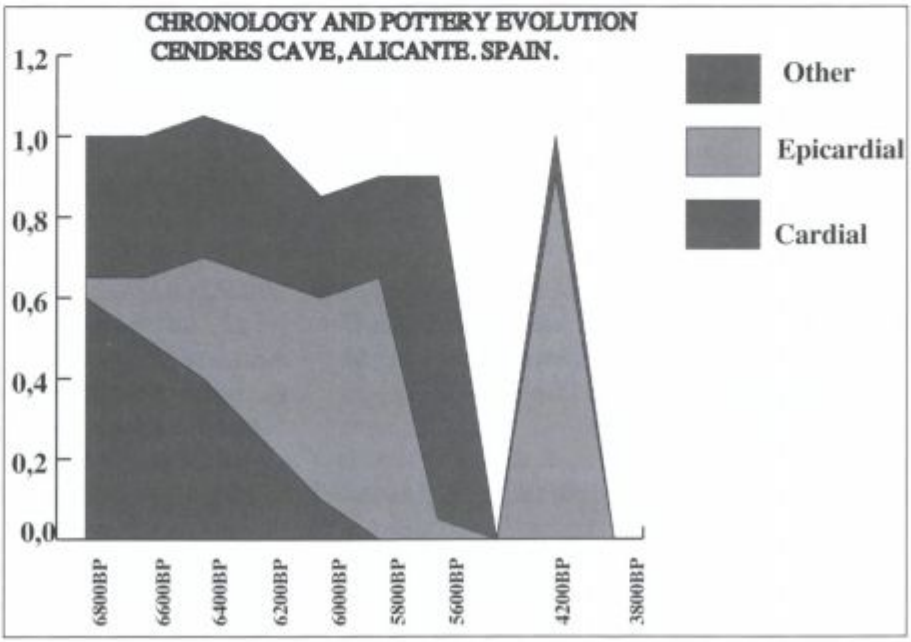

Fig. 3. Chronology and pottery evolution (decorative techniques) between ca. 6800-3800 bp. Cendres cave (Alicante).

which appear associated in space and time. Within them, the cardial phase is a much more uniform group, with rare regional variability.

2. ORIGINS

Considering the chronological gradation from East to West, as well as the absence throughout Europe of most of the wild types on which farming is based (mainly wheat and ovicaprines), the diffusionist thesis is broadly accepted nowadays, and the main debate on the origin of food production focuses on the role played by movements of people and the response of Mesolithic groups. Despite the risk of being too simplistic, one can say that the different points of view have arrived at a confrontation between what I call migrationists (*e.g. Zilhão 1993*) and indigenists (*e.g. Vicent 1998*). From my point of view, both types of models, indigenist and migrationist, are not only compatible, but in fact complementary. The dual model proposal focuses precisely on this aspect.

2.1. Theoretical framework

The **dual model** assumes that the neolithisation process was the result of combining some kind of demic expansion (farming colonisation) with the neolithisation of the Mesolithic substratum in different ways. On this basis, one may predict the existence of three different processes of neolithisation.

- **Colonisation**, the result of the expansion and occupation of new lands by farming groups. This expansion was CONTINUAL in time, but limited by diverse conditions:
  - ecological (adaptability to new environments)
  - or social (increasing circumscription)

and NON-RANDOM, guided by the availability of better resources, those which help reduce risks arising from dependence on farming.

From a historical point of view, there are two proposals that try to explain this spreading process: the Advancing Front model (*Ammerman and Cavalli-Sforza 1984*) and that of Maritime Pioneer Colonisation (*Zilhão 1993; 1997*).

As other researchers have pointed out (*Dennell 1985*), given the low demographic density which is assumed to be associated with early farming settlers, it is likely that the movement of farming expansion was accompanied by an assimilation process, which implies the disappearance of Mesolithic groups and their traditions, but not their genes, when women, as wives, join the expanding farming groups. From a purely logical perspective, we can also admit an assimilation contrary to that in the paragraph above: Mesolithic groups come to assimilate newcomers, becoming both farmers and stockbreeders (*Zilhão 1997*). From a migrationist perspective, assimilation tends to be presented as the most likely result of the interaction between farmers and hunters (*Zilhão 1993; 1997*). Although logically it is a result of the interaction between Farmers and Hunters, I consider assimilation together with colonisation, because their archaeological results are more or less the same.

- **Direct Neolithisation.** In the agricultural borderland, the interaction processes between farmers and hunters-gatherers will lead to the neolithisation of the latter. Regardless of their inner peculiarities, the importance of this interaction process lies in the fact that it will probably act as a filter, selecting information which will be disseminated among Mesolithic groups beyond the border.

- **Indirect Neolithisation.** The spread of Neolithic techniques and economy through social networks within Mesolithic groups. This process develops beyond the agricultural border, and may be considered as a derivation of the previous one.

Both processes begin after the agricultural border is established, which means that Mesolithic groups stay in their territories with a great part of their traditions. In this case, the spread of agriculture, of farming systems, was the result of adapting, by Mesolithic groups and through their own social networks, new technological and economic innovations introduced by expanding Neolithic groups. We can assume acculturation as a process through which farming and herding come to change the economic foundations of hunting and gathering systems of the Late Mesolithic. The result of such interaction would not have been the marginalisation of the Mesolithic groups, but increasing territorialisation between them and the Neolithic groups. Two worlds, two social and economic systems, each with its own traditions, would coexist for a longer or shorter period. Although the border between them could be permeable, from the described circumstances some given expressions of material culture can be understood as territorial markers. These is because the interaction process between Hunters and Farmers promote a competitive territorial behaviour and in these

circumstances both, techniques and styles of material culture (lithics and ceramics) will have a strong territorial pattern that could be related with subsistence and settlement pattern.

Undoubtedly, the idea that some elements of the material culture could be understood as signs of social boundaries is controversial (*see Stark 1998*). I do not aim to discuss the general validity of this assumption now; I only note that, given the particular conditions under which farming expanded, one may expect patterns of spatial distribution of certain material items might be understood as territorial signs.

From a historical or anthropological point of view, several models can be advanced to explain how the neolithisation process developed. In the Iberian Peninsula and, on a wider front, in the Western Mediterranean, the Capillarity model (*Vicent 1997*), which assumes and revises some aspects of the Filter model (*Lewthwaite 1986*), seems to be a reasonable alternative to processes defined as Indirect Neolithisation.

The availability model, in its most recent formulations (*Zvelebil 1996*), seems more suitable for explaining those processes defined as Direct Neolithisation.

2.2. Empirical Implications

Assuming the premises above implies assuming a certain regional variability and, consequently, developing the empirical implications which are necessary to contrast them. Most of the arguments used to evaluate the migrationist hypothesis are based on anthropological or DNA analyses, the results of which, however, are not without problems. The debate on the Portuguese case is highly illustrative (*Zilhão 1997; Lubell et al. 1994; Jackes et al. 1997*).

I do not share the pessimism of those who assume that the archaeological record is unable to decide properly between the suppositions above (*Cavalli-Sforza 1996.52*). The migrationist hypothesis is sound enough to assume that, given these conditions, the archaeological record would remain stable. The settlement of farmers in a new area must be visible through archaeological variables such as the technology and style of material culture, or subsistence and settlement patterns.

The **dual model** provides a definition of the record which should be expected in a hypothetical area where an interaction between Neolithic farming groups and the remaining Late Mesolithic cultures occurs. Given that the spread of the Neolithic involved the joint dissemination of technical (pottery) and economic (domesticated) features, first I use the emergence of pottery as the turning point for dividing the archaeological record into three phases.

Phase 0

This includes the phases immediately prior to the emergence of pottery. Subsistence, technology and settlement will define a system (pre-ceramic Mesolithic) which will be taken as a point of reference when comparing these three factors with those in phase 1.

Phase 1

When the first pottery appears, we must find two groups of settlements showing:

a) a different territorial pattern;
b) a different subsistence system, measured as the level of dependency on domesticated plants and animals;
c) a different technological system. To approach this variable, I will use some technical and stylistic characteristics of the lithic industry, as these are the only comparable aspects in all these archaeological groups.

One of these could be related to the pre-ceramic Mesolithic: people settled the same sites in nearly the same regions as earlier, in pre-ceramic times; their subsistence was based on wild resources, and lithic technology and styles could be related to the former. This is the CERAMIC MESOLITHIC.

On the other hand, the other group will show a preference for settling new sites, in regions different from earlier ones; their subsistence is based on a mixed arable/pastoral system; and finally, technology will show a break-off in relation to pre-ceramic sites. This is the NEOLITHIC COMPLEX. The length of this Phase 1 will be variable.

Phase 2

This occurs when the dual subsistence pattern such as that described in phase 1 can no longer be distinguished. If Mesolithic groups finally become "neolithicized", in phase 2 we should expect to find the distinctive traits of their cultural tradition. That is, if assimilation was not the only result of the interaction processes between farmers and hunters, then we expect to find a territorial pattern very similar to that described earlier, but affecting only some cultural traits.

3. TESTING THE MODEL: GROUPS AND TERRITORIES IN MEDITERRANEAN SPAIN

Using the variables of lithic technology and subsistence economy (domestic resources) in a combined PCA-Cluster analysis, the layers of the most familiar sites in Mediterranean Spain have been divided into five groups (*Bernabeu 1996; 1997*). Technological and economic traits, as well as the radiocarbon dates of these groups, suggest a good correlation with the implications of the Dual Model (Fig. 4).

- Groups 1 to 4 represent the Mesolithic Complex from pre-ceramic times (G1 ca. 7600- 7100 bp) to the Late *Epicardial* period (G.4, ca. 5800-5200 bp). The technological linkage between all these groups can be reflected in the technology and style of geometric tools. Hence I call it the Geometric Complex.

G1 and G2 represent the Pre-ceramic Phase. The main features of their geometric tools are their trapezoidal (G1) and triangular (G2) shapes, with abrupt retouch and concave sides, using the microburin technique (Fig. 5).

G3 represents the so-called Ceramic Mesolithic (Fig. 6), with no domestic resources, and a starting point of around 6400 bp (radiocarbon dates are inconclusive). It includes both the *Cardial* and Early *Epicardial* Phases. This ceramic Mesolithic could probably be earlier in the agricultural border, in relation to group 2, as the assemblages and dates of Forcas 2 (*Utrilla and Mazo 1994*) and Can Ballester (*Gusi and Olaria 1991*) seem to show.

Finally, G4 represents the Late *Epicardial* Phase. Its lithics are characterised by lunates with hellwan retouch (Fig. 6) and its subsistence system is based on domesticates.

- Group 5 represents the Neolithic Complex, ranging from ca. 6800-5000 bp and including all pottery styles (*Cardial*, *Epicardial* and Plain wares). From the beginning, its subsistence economy is based on domestic resources, and its lithic technology and typology (Fig. 7) show a break-off with regard to the Mesolithic Complex. I consider this Neolithic Complex the result of agrarian colonisation.

Both complexes show a clear territorial pattern, the limits of which, furthermore, can be traced through ceramic decorations. Figure 8a-c shows how settlements were distributed within the analysed area during phases 0 and 1 in the model.

During phase 0, the only existing settlements belong to the pre-ceramic phase of the Geometric Complex. Of course, there are no domestic resources and no pottery. Group 1 and at least part of group 2 can be included here.

During model phase 1 (ca. 6800-5800 bp) two territories are clearly distinguished:

- one is occupied by group 5, belonging to the Neolithic Complex. Most of the cardial pottery of the whole area is concentrated in this territory (Fig. 9).

- the other territory, occupied by groups 2-3, dates to the ceramic phases of the Mesolithic Complex. *Cardial* pottery is rare (even non-existent), the *epicardial* decoration, particularly incised and impressed decorations which are mixed in the same vase, being a characteristic of this territory (Fig.10).

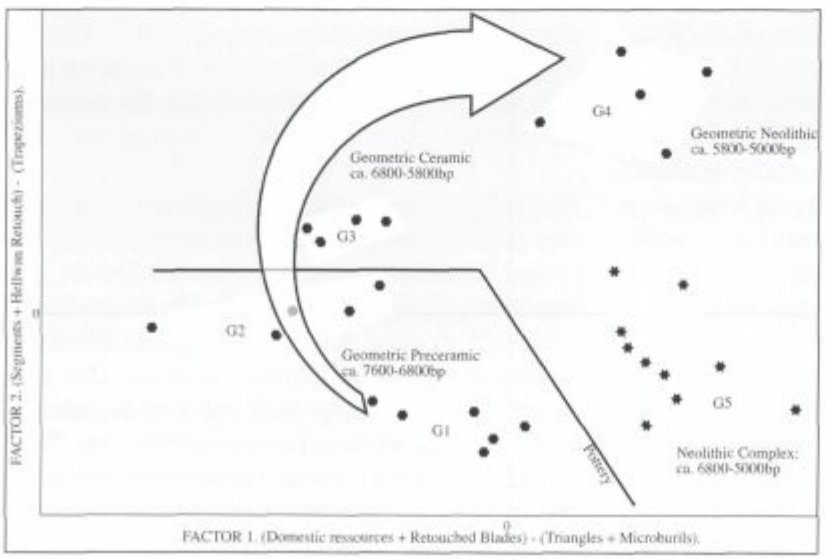

Fig. 4. Results of the PCA analysis.
Dots represent sites and layers belonging to the Geometric Complex. Stars represent sites and layers belonging to the Neolithic Complex. The line represents the rise of pottery, leaving on the left all pre-ceramic sites. Arrowheads represent time: thus, Groups 1 to 4 are successive, and Group 5 is contemporaneous with Groups 3-4 (see text for explanations).

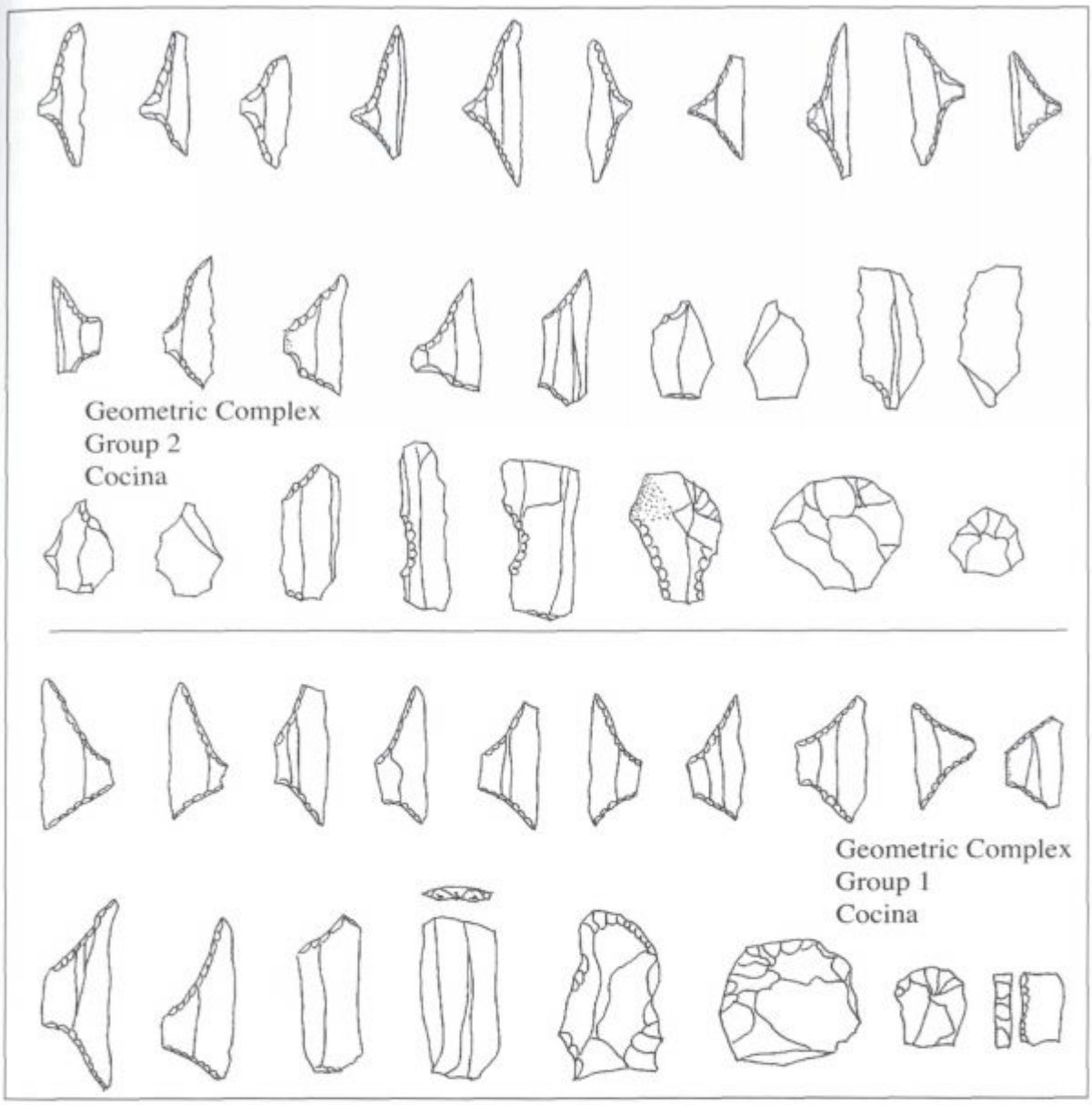

Fig. 5. Lithics of Groups 1–2. Geometric Complex. Pre-ceramic phases (the Cocina cave, Valencia).

In phase 2 (ca 5800–5000 bp) all settlements show a subsistence systems based on domestic means. This, however, does not change the spatial variability already observed, which matches exactly the pattern in phase 1.

- The Neolithic territory, still occupied by Group 5-related settlements. Now, ceramics decorative styles already belong to the horizon of post-impressed ware, with a predominance of carved decorations and simpler motifs and styles (Fig.11).

- On the other hand, the territory belonging to the Geometric Complex is now occupied by Group 4 settlements. Their subsistence already rests on domestic resources; but their pottery shows an original decorative system (Fig. 12). This is the Late *Epicardial* Phase.

4. THE SYMBOLIC DIMENSIONS OF THE NEOLITHISATION PROCESS

In conclusion, both the territorial behaviour of groups, as determined by multivariable analysis, and their subsistence and cultural features demonstrate the basic assumptions of the dual model, i.e. neolithisation was a mixed result of

4.1 The expansion of farming, through colonisation *(Neolithic Complex)*

The territorial component of this colonisation was limited, and its demographic power was seemingly

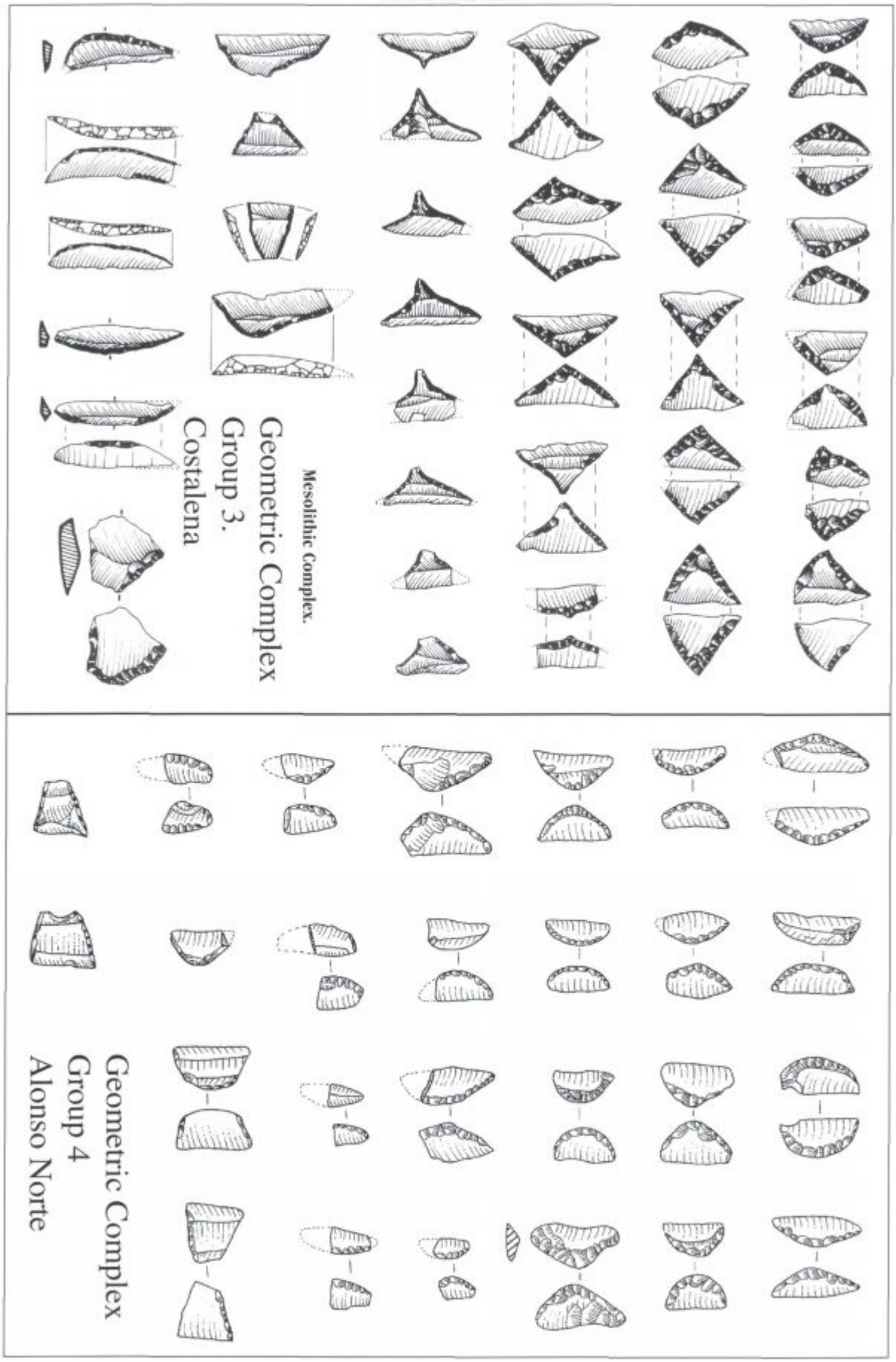

Fig. 6. Lithics of G3 (Costalena cave, Teruel) and G4 (Alonso Norte, Teruel).

poor. Only the coastal valleys of the River Llobregat, in the north, and of the River Serpis, in the south, have some significance. In the inner regions, only one settlement (the Chaves cave, in Huesca) can be related to this movement. Throughout the remainder of the Iberian Peninsula, only the sites in the Granada group (*Navarrete 1976; Bernabeu 1986*) and those at the Portuguese coast (*Zilhão 1993; 1997*) can be related to cardial expansion. The absolute dates available (Fig. 13) prove that it was a rapid movement, which reached northern Portugal in about 500 years. This situation seems to fulfil the

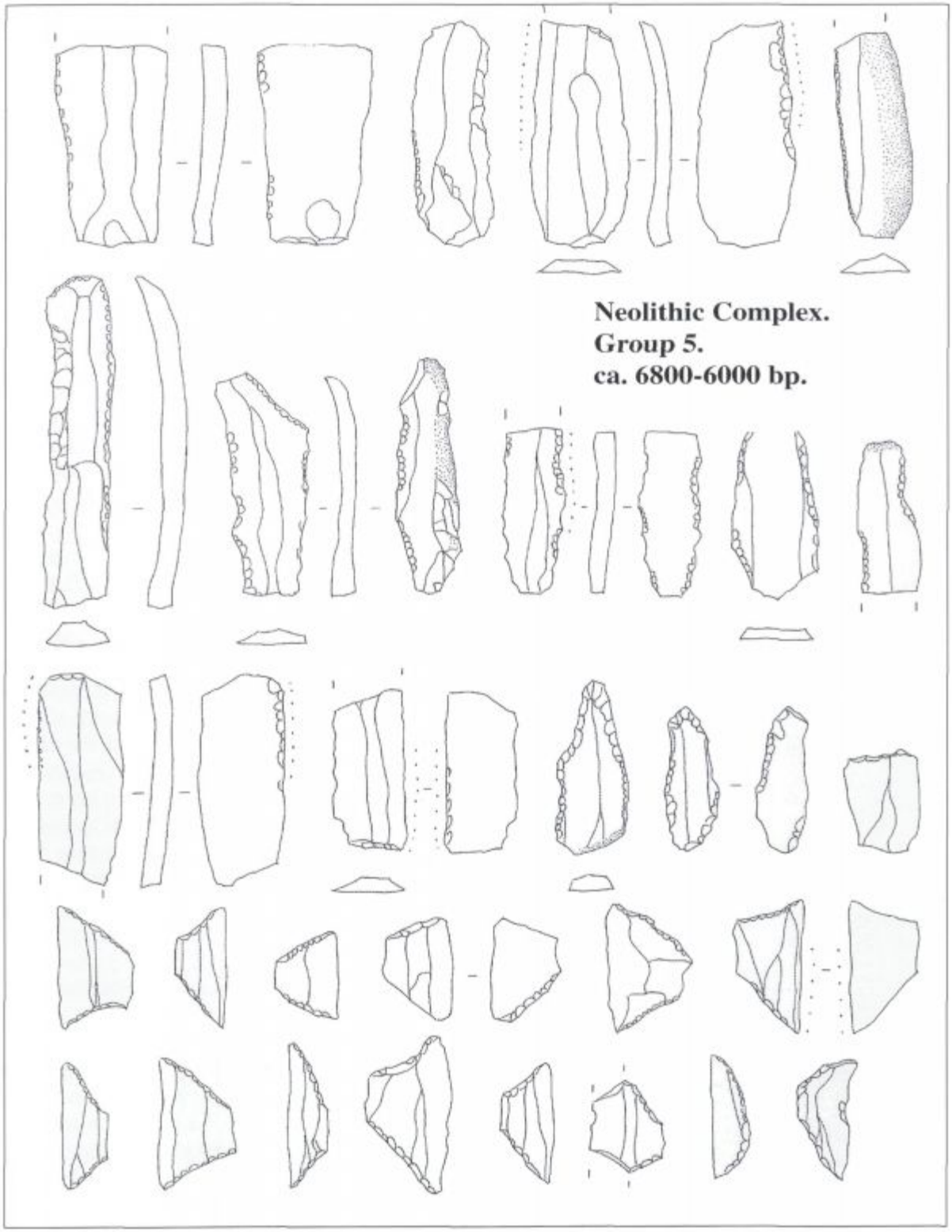

Fig. 7. Lithics of Group 5. Neolithic Complex. Or cave (Alicante).

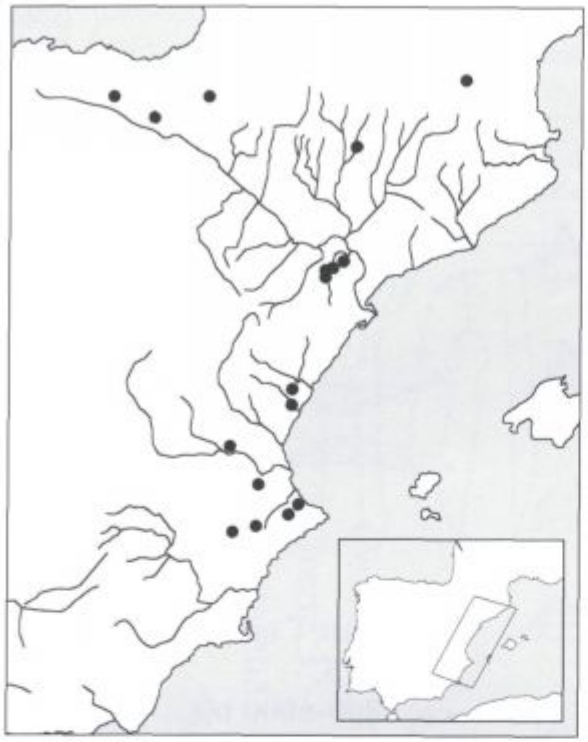

Fig. 8a. Spatial distribution of Pre-ceramic Mesolithic (Model Phase 0). Geometric Complex; group 1; preceramic; 7600–7100 bp.

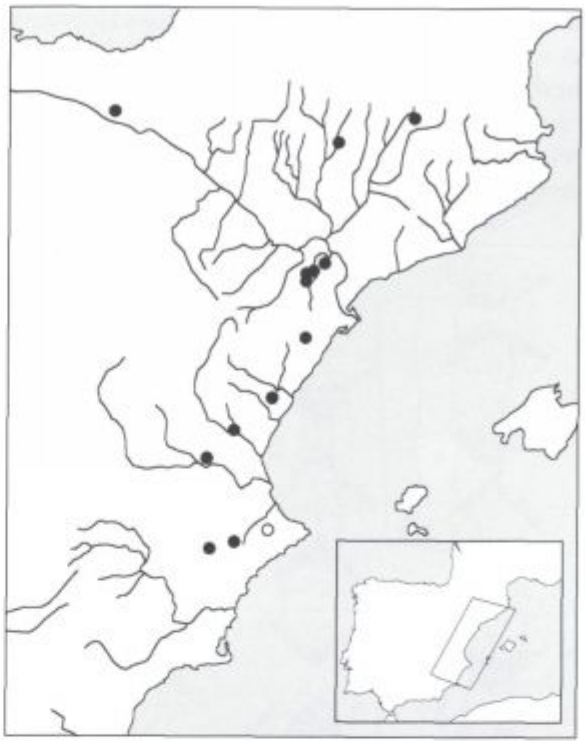

Fig. 8b. Spatial distribution of Ceramic Mesolithic (Cardial and Ancient Epicardial; Model Phase 1). Geometric Complex; groups 2–3; Cardial and Early Epicardial; 6800–5800 bp.

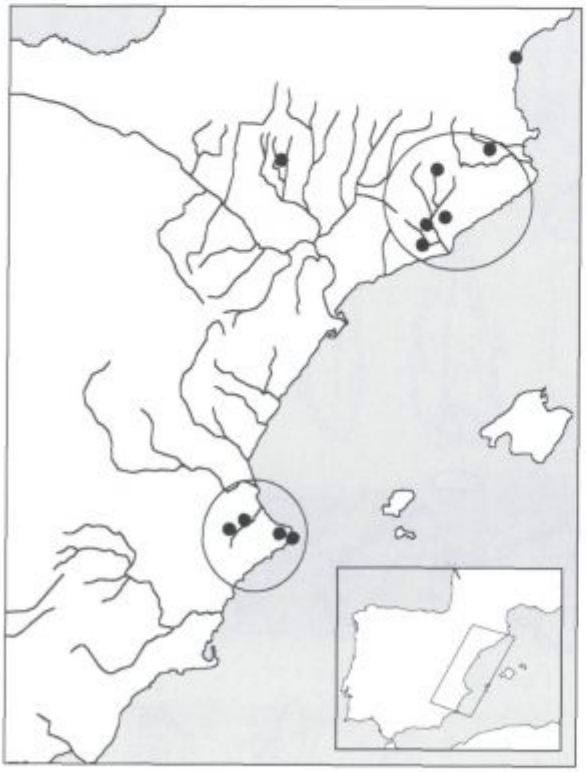

Fig. 8c. Spatial distribution of Neolithic Complex (Cardial and Early Epicardial; Model Phase 1). Circles show the Llobregat (north) and Serpis valleys (south), the two regions with a higher concentration of cardial sites. Neolithic Complex; group 5; Cardial and Early Epicardial; 6800–5800 bp.

expectations of the maritime colonisation model (*Zilhão 1993; 1997*) better than the model of the Advancing Front. Such a fast process can not be explained on the basis of a progression of 1 km per year, although the process developed a little faster along the margins of dissemination (as happened in the Iberian Peninsula), as was recently noted (*Cavalli-Sforza 1996*). On the other hand, a simulation study based on modern genetic data (*Calafell and Bertranpetit 1993*) indicates that if the interpretation of the second Principal Component as a consequence of Neolithic expansion is correct, then its simulated distribution did not correlate well with actual gene frequencies, as has been pointed by Zilhão (*1997.20*).

There are two important questions to be answered:

1. What is the reason for this rapid movement? Given the demographic potential of these Neolithic groups and the availability of natural resources, it is unlikely that this movement could be explained by economics. It is beyond the scope of the present paper to explore this topic in depth, but I think the main reason must be sought in some social imperatives: e.g. as a reaction against social circumscription and the concentration of power. Of course, it is a

highly speculative hypothesis, which needs considerable additional support; however, what is important is to retain the idea that it is such a situation which could explain the forces behind the Martime Pioneer Colonisation model.

2. Why is it associated with decorated pottery? One of the most striking features in this process may be its association with impressed pottery. The most likely reason must lie in the fact that these ceramics are a basic element in the social network of these groups. Acting either as a vehicle or a symbol of this network, decorated pottery spread together with domesticated resources, lending the entire territory of early neolithisation an aspect of cultural homogeneity. *Cardial* decorations and, particularly, symbolic styles are its most outstanding signs, shaping a symbolic system belonging to the *Cardial* Territory. Figure 14 shows various representations of one of these motifs, the so called M or W sign, which, in different forms, can be found throughout this territory.

4.2 The neolithisation of the substratum *(Geometric Complex)*

Analysis has shown that pre-existent Mesolithic groups adopted Neolithic technology (ceramics) first, and then they adopted domestic resources. Although the chronology of the process is still inaccurate, we can definitely state that:

a. Assimilation played a limited role. Actually, considering that assimilation developed very rapidly (*Dennell 1985*), it could not be a very visible process in the archaeological record.

Considering the available data, an assimilation process in the peninsular Mediterranean could only have developed around the region of the River Serpis, the only area which is occupied by group 1 sites (preceramic Mesolithic). Once early ceramics emerge, sequences in the sites in the littoral and pre-littoral areas cease, and thus the subsequent evolution of the Geometric Complex is visible only in the inner regions. Unless the interruption of these sequences derives from an actual gap, which implies that preceramic Mesolithic groups abandoned the coastal region, this is the most acceptable explanation.

b. Thenceforth, once the border was fixed, interaction between both groups eventually results in the neolithisation of the Mesolithic Complex. Ironically, the reason lies in the threat of assimilation. The important question about assimilation was not whether it would eventually happen, but rather the obvious,

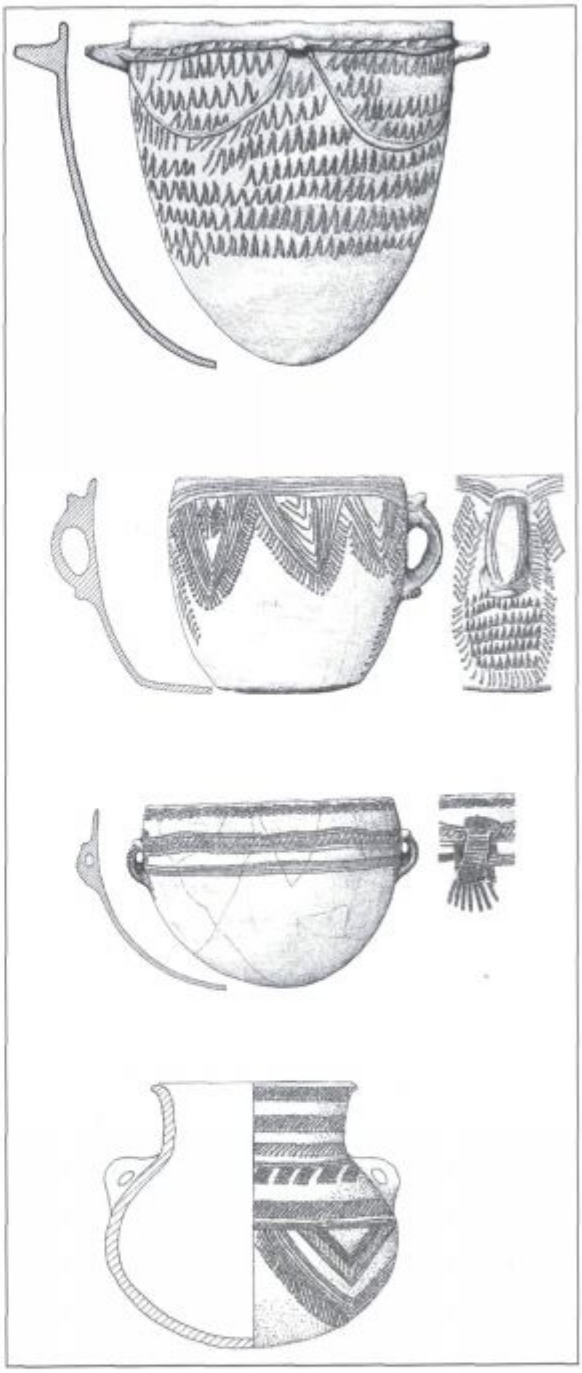

Fig. 9. Cardial and Gradine decorations from the Neolithic Complex, Group 5. (Or cave). Cardial Phase.

dangerous possibility that it could actually happen, which would definitely imply the disappearance of the assimilated group (in this case, the Mesolithic group). This possibility could only be faced if the response of the Mesolithic group included an imitation of some practise of the Neolithic groups, e.g. adopting domesticated resources and, consequently, transforming the mode of production. This decision, however, means a highly dramatic change in the life-style and subsistence of Mesolithic groups in the

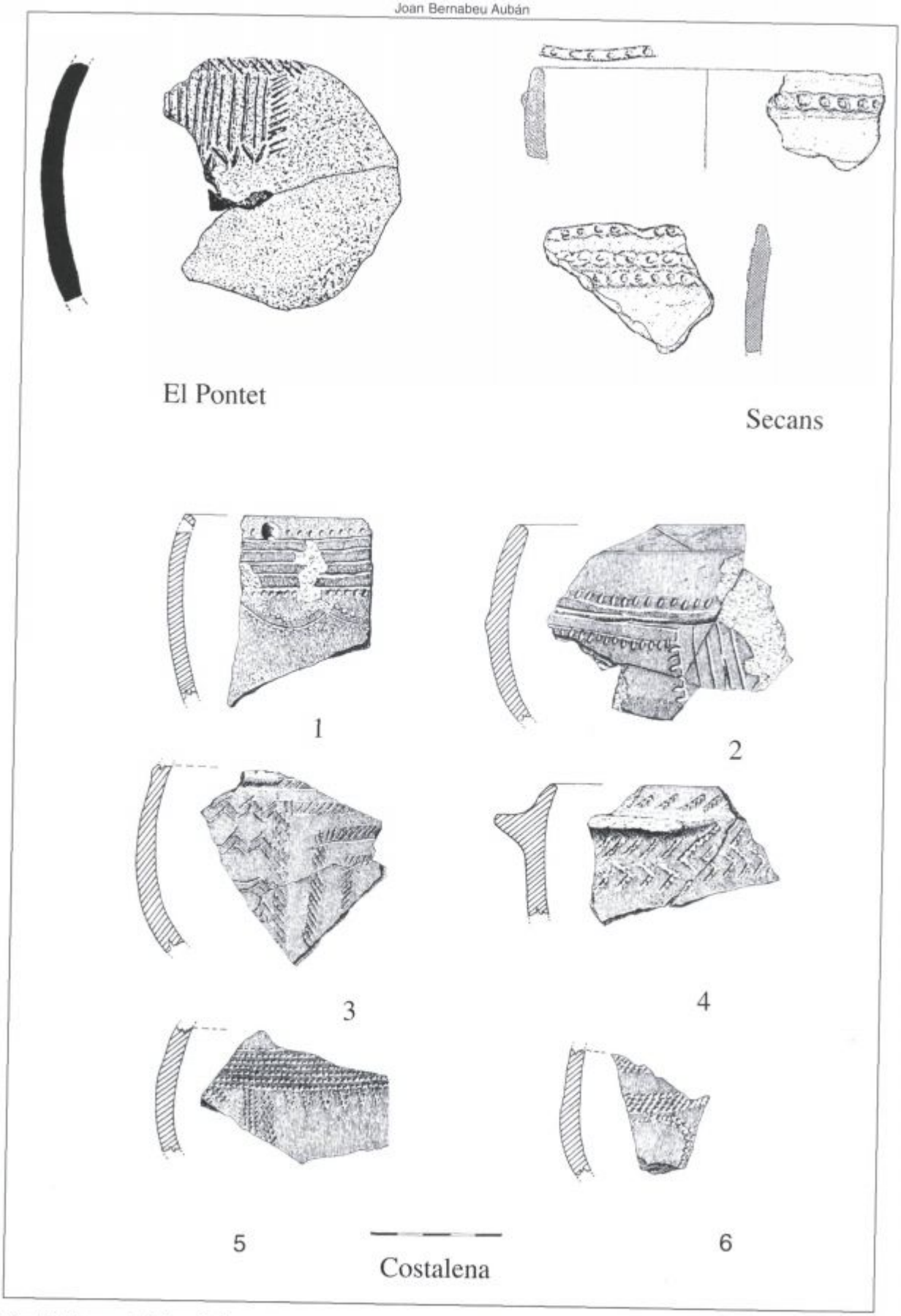

Fig. 10. Decorated sherds from Geometric ceramic sites. Cardial and Early Epicardial phases. Cardial (Costalena cave 1). Gradine (Costalena cave 3, 5, 6). Incised and impressed (Costalena cave 1, 2; El Pontet). Reliefs (Secans).

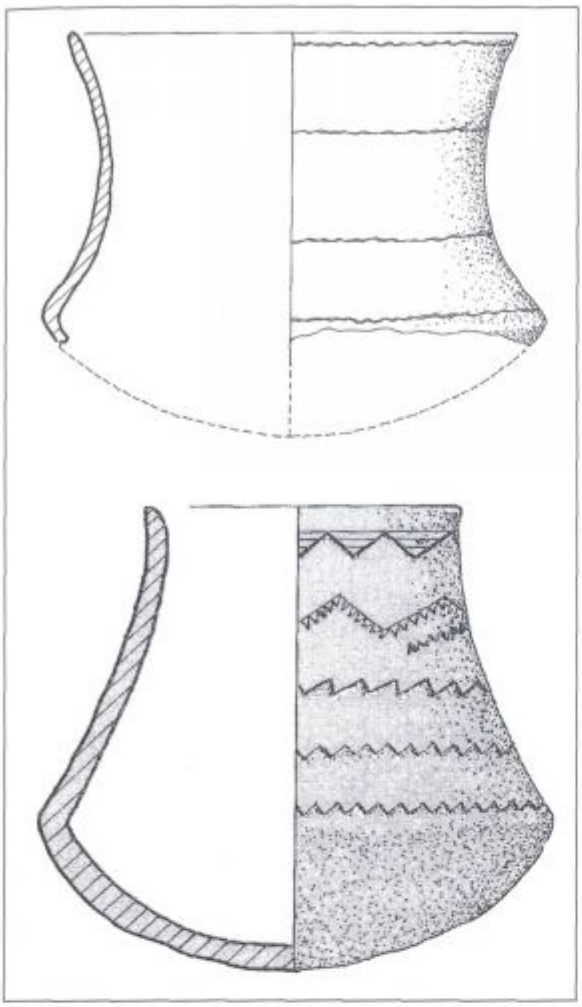

Fig. 11. Carved decorations of the Post-impresso phase. Neolithic Complex, Group 5. En Pardo Cave (up) and Ampla Cave (down), Alicante.

Spanish Mediterranean, one of whose main characteristics is the important residential mobility of their foraging system, the deferred use of resources being unverified (*Aura and Pérez Ripoll 1995*).

Consequently, it seems difficult to assume that actions aimed at modifying subsistence systems, if they appear, are selected in the beginning. It is more likely that those decisions are taken (or eventually certain practises are chosen) which tend to preserve, apparently at least, traditional life styles. The above analysis suggests that this was what happened, and so domestic resources would have been adopted about 800 years later, while other techniques, e.g. ceramics, would have been accepted earlier.

Contacts between groups could possibly have been co-operative at first, as Zvelebil suggests (*1996*), but they had to be competitive earlier rather than later. The opportunist use of land, the free access to sources of raw materials and the unidirectional movement of women - from Mesolithic to Neolithic groups - (*Zvelebil 1996; Cavalli-Sforza 1996*) would make initial co-operation a threat to the long-term subsistence of Mesolithic groups. Consequently, we may reasonably suppose that competitive behaviours appear between these groups. On the other hand, this is the only possible response to the pressure of farmers, if one wants to avoid the threat of increasing marginalisation and/or assimilation. Assuming that, at first, this competitiveness does not affect the economic domain, one may expect it to influence the social and symbolic, promoting the development of prestige items as a means of avoiding disruptive tendencies. Decorated pottery could play this role. At a

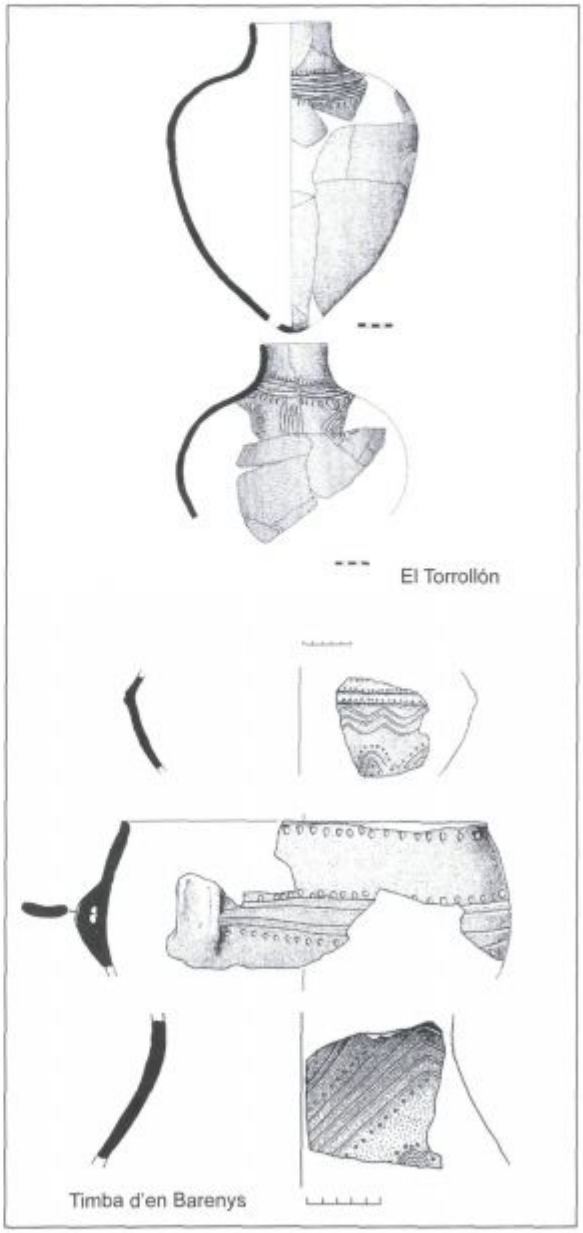

Fig. 12. Pottery decorations of the Late Epicardial Phase. Geometric Complex, Group 4.

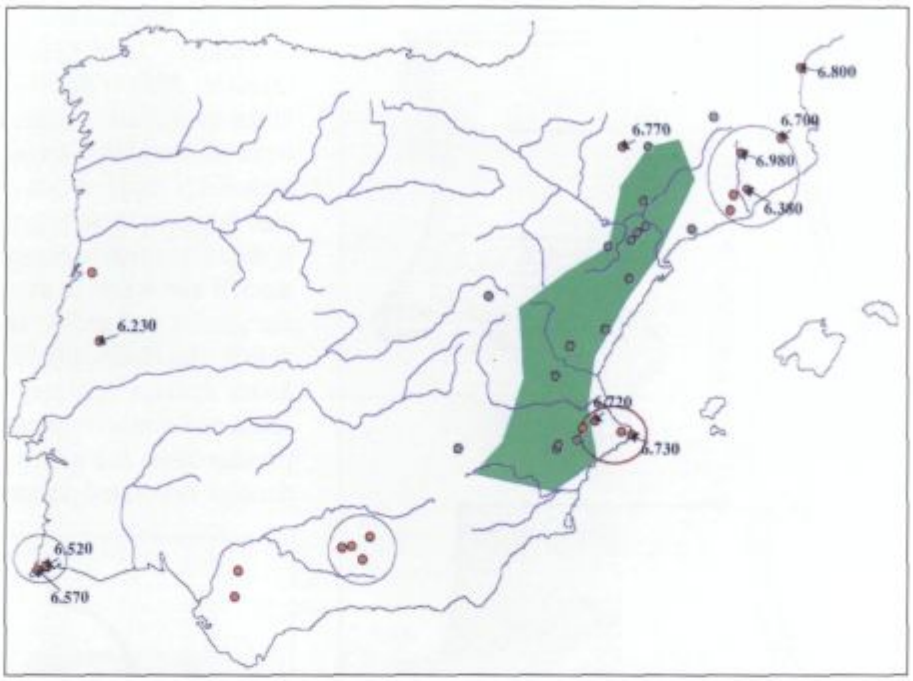

Fig. 13. The Cardial Territory in the Iberian Peninsula.
The circles show the cardial groups (the Cataluña-Llobregat group, Valencia-Serpis group, Granada-Carigüela group and Southern Portugal group). Red dots represent Neolithic Complex sites, with radiocarbon dates if available; grey dots represent Mesolithic ceramic sites; green area represents approximate dispersion of Levantine rock art shelters.
Most of the shelters with Macro-schematic Art are from the Serpis group (red circle). This is the only one region where a possible assimilation process could have happened at the time of first contact; thereafter, interaction between farmers and hunters – located at some distance – will result in the neolithization of the latter.

first stage, while the relationships between both groups are dominated by co-operation, cardial pottery flows from the Neolithic Complex to the Mesolithic. From this perspective, we may assume that its spatial variability will follow a declining pattern, starting in the Neolithic Complex centres where this pottery was made. It is not a progressive decline, and thus the reduction of cardial pottery inside the borders is dramatic. Actually, in lower Aragón, not far from the probable agricultural boundary, cardial pottery is usually rare in quantitative terms in the first layers where pottery appears, and sometimes does not appear at all, e.g. in the Secans shelter (*Rodanés et al. 1996*).

This is the most evident effect of the filter: cardial pottery and domestic resources do not pass into the hinterland. The reason for this is that people were exchanging objects only between Neolithic and Mesolithic groups at the farming border, and did not become incorporated into the production of Mesolithic groups' material culture. Interestingly enough, a petrologic analysis of pottery fragments from the Balma Margineda (Andorra) – a site which can be ascribed to the Geometric Complex – suggests that the only cardial vase found here was probably made outside the area (*Barnett 1995.197, 207*). Undoubtedly, if such a situation were common to all the sites of the Geometric Complex, it would lend considerable support to the hypothesis above.

Given the poor influence of cardial pottery within the Mesolithic Complex, we may assume that it was a rapid phase, although it is impossible to establish how long it lasted. In this phase, ceramics technology is disseminated, and decorative patterns show obvious similarities to those of the *Cardial* phase of the Neolithic Complex. From this moment on, and as ceramics became a part of the material production of these groups, decorative patterns tended to be different. This is because pottery within the Mesolithic groups played a role similar to that of pottery in the Neolithic groups, namely, it became the bearer of certain codes and symbols expressed through decoration and conferred, among other things, individual prestige or status and social cohesion.

An analysis of the spatial variability of decorative motifs and styles similar to those carried out in other regions (*Barnett 1990; Malone 1985*) would show that this pottery is associated with the territories belonging to the Mesolithic and Neolithic Complexes mentioned above, within which there would have been differing exchange and information networks. The information available suggests, indeed, that the decorative patterns of ceramics associated with the Mesolithic Complex tended to diversify very quickly during the Early *Epicardial*. The Late *Epicardial* Phase is the most outstanding example of this phenomenon. The differences between the style and designs of this pottery are self-evident

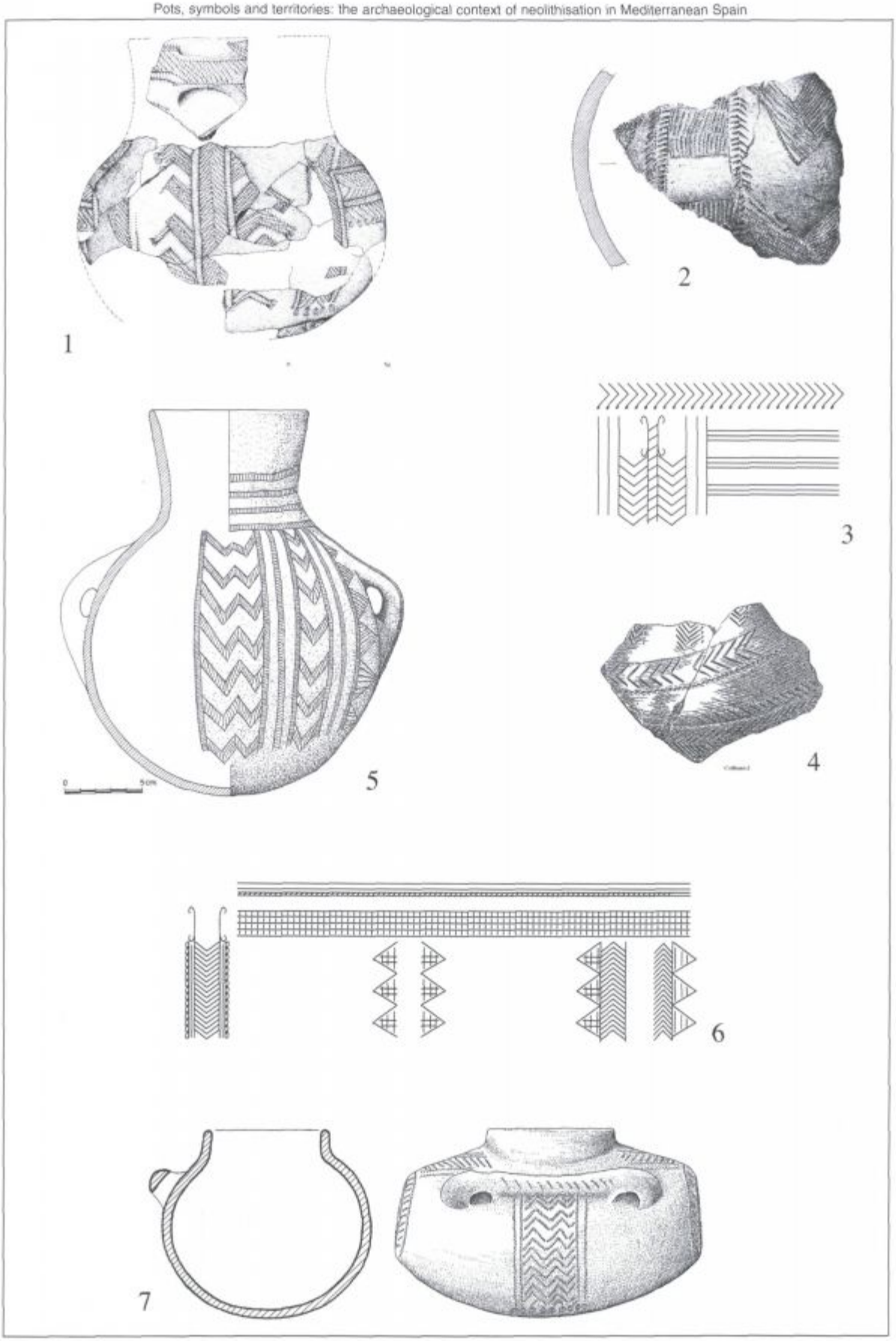

Fig. 14. Symbolic pottery of the Neolithic Complex. Collbató Cave, Barcelona (4); Or cave, Alicante (1, 7); the Ventana cave (2); the Cariguela cave, Granada, (drawn from original photographs) (3, 6); the Niño cave, Albacete (5). Cardial decoration (1, 2, 3, 4, 7); Gradine decoration (5); incised and impressed decoration (6).

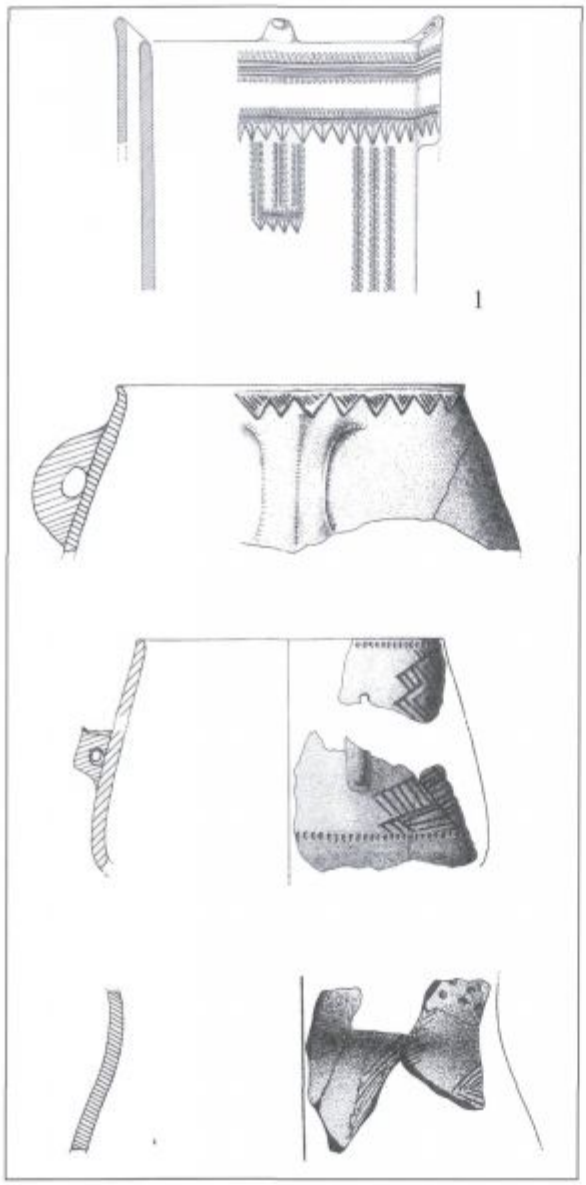

Fig. 15.* Epicardial *decorations. Neolithic Complex, Group 5. Or cave (1) and Cendres cave (all the others). Early* Epicardial *Phase.

when compared with those common in the Neolithic complex during the Early *Epicardial* (Fig.15). This is why the geometric territory appears, in its ceramic phases, as an area where the development of the *Epicardial* reaches its highest level (*Van Willingen 1999; Mestres 1991*). The extraordinary development of Levantine rock art may be better understood within this context. As other researchers have suggested, Levantine art seems to be the symbolic referent of a changing world, the world of the ceramic phases of the geometric complex (*Hernández and Martí 1994*).

I will not analyse the meaning of these symbolic referents in depth, but it is worth noting that the Neolithic symbolism focuses on the human figure, with representations which are deprived of individual attributes, in a non-naturalistic style, and with a certain aversion to descriptive content. The Levantine art, however, is naturalistic and scenic; it is interested in human figures, but also includes animals, which are often depicted as part of the same scenes. We should not forget, however, that the Levantine art in its origins is closely related to the Macro-schematic, which is presented as the symbolism of the cardial territory and, consequently, of the Neolithic Complex, by ceramic parallels. There are four outstanding points in this discussion:

1. Schematic styles are older. Both the ceramic sequence in Cova de l'Or, and the chromatic superimpositions seem to suggest this.

Fig. 16. Levantine scene superimposed on a symbolic motif close to the M symbols of figure 14 (compare with vase number 1). Los Chaparros (Teruel).

2. The Levantine style shows a higher spatial correlation with Mesolithic territory (Fig. 13).

3. Some macro-schematic representations are found in shelters within the geometric territory or within its limits.

4. The Levantine style, when it is found in the same shelter, is placed on top of the macro-schematic (Fig. 16), which seems to happen only within the limits of both territories, geometric and cardial.

Interestingly enough, developments in rock art seem to be very similar to those described for ceramic decorations: after an imitation phase, where some patterns deriving from Neolithic symbolism are found, another phase follows, where an original style develops (the Levantine style), which is seemingly interested in eliminating the previous symbolic referent (super-impositions) and is located outside rocky shelters, in open places, which seems to be a way of sign-posting the territory (*Bradley 1997*). Does this situation result from the emergence of competitive behaviours within the geometric groups, as a way of facing the risk of assimilation, as occurs in ceramics? I suggest that in both cases, pottery and rock art, the original symbolism which is associated with the Mesolithic world in its ceramic phases is a response to the threat of assimilation or marginalisation. This response, in turn, is a way of resisting economic change and limiting transformations to the ideological domain. A similar understanding has been suggested for other European regions (*Whittle 1998*), which seems to show a historical scenario with differences, but also with some common characteristics. All these symbolic phenomena, on the other hand, are associated with a higher degree of territoriality and an increase in social identity, two features which bring the world of the Mesolithic foragers closer to that of the Neolithic farmers.

No doubt we must undertake an analysis of the various symbolic components which appear systematically associated within the context of neolithisation. The understanding of their inner structure and of their movement may help us evaluate the particular historical setting in which this process took place. My sole aim in this paper was to draw attention to the potential of this line of analysis which, necessarily, will have to be developed in the future.

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REFERENCES

AURA J. E. and PÉREZ RIPOLL M. 1995. El Holoceno incial en el Mediterráneo español (11 000–7000 bp). Características culturales y económicas. In V. Villaverde (ed.), *Los últimos cazadores. Transformaciones culturales y económicas durante el Tardiglaciar y el inicio del Holoceno en el ámbito mediterráneo: 119–146.*

AMMERMAN A. J. and CAVALLI-SFORZA L. L. 1984. *The Neolithic Transition and the Genetics of population in Europe*. Princeton.

BARNETT W. K. 1990. Small-scale transport of Early Neolithic pottery in the West Mediterranean. *Antiquity, 64: 859–863.*

1995. The petrographic analysis of Early Neolithic pottery from the Balma Margineda. In J. Guilaine (dir.), *Les excavacions a la Balma Margineda (1979–1991). Vol. III*. Andorra.

BERNABEU J. 1989. *La tradición cultural de las cerámicas impresas en la zona oriental de la Península Ibérica.* Trabajos Varios del Servicio de Investigación Prehistórica, 86. Valencia.

1997. Indigenism and migrationism. The neolithisation of the Iberian Peninsula. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji, XXIV: 1–17.*

BRADLEY R. 1997. *Rock Art and the Prehistory of Atlantic Europe. Signing the land*. London.

DENNELL R. 1985. The hunter-gatherer/agricultural frontier in temperate Europe. In S. W. Green and S. M. Perlman (eds.), *The archaeology of frontiers and boundaries: 113–140.*

ESTREMERA PORTELA M. S. 1999. Sobre la trayectoria del Neolítico Interior. Precisiones a la secuencia de la cueva de La Vaquera (Torreiglesias, Segovia).

In *II Congrés del Neolític a la Península Ibèrica. Saguntum, Extra 2: 245.*

GUSI F. and OLARIA C. 1979. El yacimiento prehistórico de Can Ballester (Vall de Uxó, Castellón). *Cuadernos de Prehistoria y Arqueología Castellonense, 6: 39-96.*

HERNÁNDEZ M. and MARTÍ B. 1994. Art rupestre et processus de néolithisation sur la façade orientale de l'Espagne méditerranéenne. In J. Vaquer (ed.), *Le Néolithique du nord-ouest méditerranéen. Actes du XXIV Congrès Préhistorique de France: 257-266.*

JACKES M., LUBELL D. and MEIKLEJOHN C. 1997. Healthy but mortal: human biology and the first farmers of western Europe. *Antiquity, 71: 639-658.*

KUNST M. and ROJO GUERRA M. !!!!! El Valle de Ambrona: un ejemplo de la primera colonización neolítica de las tierras del interior peninsular. In *II Congrés del Neolític a la Península Ibèrica. Saguntum, Extra 2: 259-270.*

LUBELL D., JACKES M., SCHWARCZ H., KNYF M. and MEIKLEJOHN C. 1994. The Mesolithic-Neolithic transition in Portugal: Isotopic and dental evidence of diet. *Journal of Archaeological Science, 21: 201-206.*

MALONE C. 1985. Pots, prestige and ritual in Neolithic Southern Italy. In C. Malone and S. Stoddart (eds.), *Papers in Italian Archaeology. BAR-IS, 244: 118-151.*

MARTÍ B. 1989. Impressed cardial decoration and rock shelter art in eastern Spain. In D. Cahen and M. Otte (eds.), *Rubané&Cardial. Eraul, 39: 405-415.*

MARTÍ B. and HERNÁNDEZ M. S. 1988. *El Neolitic Valencià. Art rupestre i cultura material.* Servicio de Investigación Prehistórica. Valencia.

MESTRES J. 1991. Neolitització i Territori. *Estat de la Investigació del Neolític a Catalunya: 72-75.*

RODANÉS J. M., TILO M. A. and RAMÓN N. 1996. El abrigo de Els Secans (Mazaleón, Teruel). La ocupación del Valle del Matarraña durante el Epipaleolítico y el Neolítico Antiguo. *Al-Qannis, 6.*

STARK M. T. (ed). 1998. *The Archaeology of Social Boundaries.* Smithsonian Institution Press.

UTRILLA P. and MAZO C. 1994. El poblamiento prehistórico del rio Ésera (Ribagorza, Huesca). *Bolskan, 11: 53-67.*

VAN WILLIGEN S. 1999. L'*Epicardial* et la Néolithisation de la France Méditerranéenne. *II Congrés del Neolític a la Península Ibérica. Saguntum-Extra 2: 571-582.*

VICENT J. M. 1997. The Island Filter Model Revisited. In M. S. Balmuth, A. Gilman and L. Prados-Torreira (eds), *Encounters and Transformations. The Archaeology of Iberia in Transition: 1-13.*

WHITTLE A. 1998. Fish, faces and fingers: presences and symbolic identities in the Mesolithic. Neolithic transition in the Carpathian basin. In Budja M. (ed.), *Documenta Praehistorica, XXV: 133-150.*

ZILHÃO J. 1993. The spread of agro-pastoral economies across Mediterranean Europe. A view from the Far West. *Journal of Mediterranean Archaeology, 6 (1): 5-63.*

1997. Maritime pioneer colonisation in the Early Neolithic of the West Mediterranean. Testing the model against the evidence. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji, XXIV: 19-43.*

ZVELEBIL M. 1996. The agricultural frontier and the transition to farming in the circum-Baltic region. In D. R. Harris (ed.), *The origins and spread of agriculture and pastoralism in Eurasia: 232-345.*

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Documenta Praehistorica XXVI

The transition to farming in Mediterranean Europe – an indigenous response

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ABSTRACT – Abstract. The transition to farming in Mediterranean Europe is discussed in the contexts of the DNA analysis of male chromosomes, female mitochondrial genetic gradients, the maritime pioneer colonisation model, the Mediterranean sea voyages in Mesolithic and Neolithic, the "PPNB Exodus" in Near East and the colonisation of southeastern Europe. It was argued that the hunters and gatherers at Ilipinar, in Franchthi and Theopetra caves, at Lepenski Vir and Padina were capable and ready to serve as a promoters of agro-pastoral farming in the course of which these communities could be expected to develop or to adopt and to modify agro-pastoral practices and pottery production and integrate them with existing subsistence strategies.

IZVLEČEK – *Prehod na kmetovanje v sredozemski Evropi obravnavamo v kontekstu DNK analiz moških kromosov in ženskega mitohondrijskega zapisa, morske pionirske kolonizacije, plovbe po Sredozemskem morju v mezolitiku in neolitiku, "PPNB eksodusa" na Bližnjem vzhodu in kolonizacije jugovzhodne Evrope. Ocenjujemo, da so lovci in nabiralci v Ilinira(ju), v jamah Franchthi in Theopetra ter na Lepenskem Viru in Padini sami razvili ali pa prevzeli, priredili in nato vključili posamezne dele kmetovanja in lončarstva v obstoječa gospodarstva.*

KEY WORDS – *Mediterranean; transition to farming; demic diffusion; migration; colonisation; DNA analysis*

INTRODUCTION

Despite many years of modern investigation into the transition from mainly hunter-gatherer Mesolithic to predominantly farming Neolithic societies, there remains a major unresolved problem in European prehistory, with the reasons for the transition and manner, rate and mechanism of this transformation all being subject to debate and controversy.

The very recent debate still underlines the importance of the issue, which has historical and anthropological, as well as political, implications. Historically, the transition to the Neolithic addresses the origin and constituent elements of the Neolithic and subsequent cultures in Europe. Anthropologically, it addresses the transformation of material cultures, processes of diffusion, interaction and adoption and their recognition in the archaeological record. Politically, it raises the question of European cultural identity, and of the genetic and linguistic roots of most present-day Europeans (*Zvelebil 1994(1995). 107*).

INTERPRETATIVE BACKGROUNDS OF FORAGER-FARMER INTERACTIONS

Embedded within the problem of the transition to the Neolithic lies the special issue of the mechanism of the spread of farming, which has often been polarised into a debate between the "diffusionists" and "indigenists". This aspect of the debate has particularly strong political connotations, as it addresses the relationship between the gene pools, language, material culture and ethnicity of present-day Europeans. Ever since Childe's seminal publication (The

Dawn of European Civilisation), it has become an established view to regard the adoption of farming in Europe as a case of the replacement of indigenous hunter-gatherers by farmers migrating from the Near East and colonising uncultivated areas in Europe.

Using the paradigm of the *Neolithic revolution* and diffusionistic assumptions, which claimed that Europe could not have achieved the transition from nomadic foraging to sedentary farming, Childe introduce *"oriental view"* of European cultural development, which also included an evaluation of European Prehistory *"as a story of imitation"* or *"at best an adaptation of Middle Eastern achievements"* and hypotheses that *"Mesolithic microliths in Europe are an expression of the stagnation of groups which were incapable of coming to terms with the difficulties of the natural environment"* (*Trigger 1980.66-67*).

A similar minimisation of the meaning of the European Mesolithic can also be recognised much later in other authors who formulated the complex cultural and historical picture of European prehistory. Thus Müller-Karpe treated Mesolithic cultures as a *"a microlithic cultural phenomenon"* lagging behind in cultural development (*Müller-Karpe 1976.19*). The diminution of the role played by Mesolithic groups in the neolithisation processes in Europe is still current. It is particularly evident in authors who formulate a holistic image of European prehistory on the basis of a linear cultural development and a succession of periods which linked mobile hunter-gatherer groups with the Mesolithic, and sedentary farmers with the Neolithic. This paradigm still maintains that Mesolithic and Neolithic artefact sets are culturally, chronologically and spatially mutually exclusive.

It is interesting to note also that in the context of the humanistic evaluation of the development of European civilisation in the 18th century, Rousseau was sceptical about the appearance of agriculture. It was his view that agriculture was a discovery that caused the first revolution, the civilisation of man, but destroyed humanity (*Harris 1981.3*). Unfortunately, the surviving historical records for the relations between foragers and farmers illustrated the destructive examples in the agricultural frontier zone. Herodotos, Strabo and Diodorus in 5th century BC describe hatred and destruction. The case of the Aithiopi and Garamanti is instructive. The former, hunters and gatherers living in caves, were hunted and killed in their territory by the latter, who were farmers (*Vencl 1982.662-670*).

There is some indirect evidence of inter-group and intra-group violence in European Late Mesolithic and Early Neolithic settlement contexts. First comes from the Große Ofnet (Fig. 1) and Hohlestein rock-shelters in southern Central Europe where human skulls were placed in shallow pits, often described as nets. At Ofnet, 34 skulls were found deposited in two "nests" and, it became clear from the very beginning that some of the skulls show definite signs of violence, indicating a violent death and beheading inflicted by polished stone axes (*Orschiedt 1998. 153,157*). The skulls seem to belong to a group deposited in a single event radiocarbon dated between c. 6400 and 6150 BC (*Hedges et al. 1989.224- 226*). At Hohlestein a child and an adult male and female were deposited after being killed and decapitated as attested by cut marks on the remaining cervical vertebra (*Orschiedt 1998.157; Gronenborn 1999.134-135*).

Fig. 1. Ofnet "skull nest" (After* Schulting 1998a. Figure 12.4*).

Violence in the Early Neolithic has been identified at Vaihingen, a fortified Neolithic settlement, where human bones from disarticulated skeletons in refuse pits were assessed to be more robust that those from ordinary burials in the refilled ditch surrounding the settlement (*Krause 1997, online*). It was suggested that the sturdier skeletons deposited in the disarticulated burials could be the remains of local hunter-gatherers leading a marginalized life within societies and having no rights to a proper burial (*Veit 1993.107-140; Gronenborn 1998*). It seems also that the transition to farming in the Lepenski Vir cultural context in the Danube region was not a peaceful process. Evidence of possible violence has been noted in the burial remains and has been

interpreted as resulting from violent confrontations between the indigenous and intrusive populations (*Voytek & Tringham, 1990.495*), although the traces of violence could likewise be explained by internal conflicts (*Radovanović 1996.42*). And we can not avoid the fact that a high proportion of apparent violence is reflected in human remains in Lithuania which were buried in the period of transition to farming in the Baltic region (*Antanaitis 1999.97*). These records are not in accordance with Zvelebil's model of forager-farmer interactions, suggesting that in the early phase of forager-farmer contact, cooperation would prevail *(Zvelebil 1994(1995).114–116; 1998. 16–21)*.

It has already been pointed out that in spite of the unavoidable fact that Herodotos and Childe are separated by two and half millennia, their ideological perceptions of farming and foraging societies are very similar (*Budja 1996a.69–71*). This perception maintains a cultural and ethnic zoning, with farmers linked to a civilised centre and foragers to the barbaric periphery of Eurasia. The frontier between civilisation and barbarism was defined as an agricultural frontier.

The agricultural frontier zone and the genetic palimpsest: the male and female stories

Perhaps the most popular version of the agricultural frontier is represented recently in the work of Ammerman and Cavalli-Sforza (*1984; 1995; 1996*). They determine the frontier as an "isochronic line of agricultural expansion in Europe" (*Ammerman, Cavalli-Sforza 1984.58–62, fig. 4.5*). Using the concepts of "demic diffusion" and "wave of advance" they anticipate a slow expansion of people into Europe that is driven by population growth resulting from agricultural surpluses, and either the displacement or absorption of the less numerous hunter-gatherer populations. They hypothesise that the rate of advance of agriculture into Europe is compatible with the estimation that the farmers, not farming, spread (i.e. by demic diffusion as opposed to cultural diffusion), assuming rates of fertility and mobility of early farmers comparable to those observed in ethnographically similar situations. In correspondence with the relocation of the agricultural frontier, shifting at a rate of 1km per year across the continent, demic diffusion is supposed to have had a dramatic effect on the European gene pool. The most important consequence is that the major component of the modern European gene pool derives from Near-Eastern Neolithic farmers rather than indigenous Mesolithic foragers. In other words, the European neolithisation process in the period 7500–5500 BP was exclusively the domain of Near-Eastern farmers who were allowed to plant their genes and farming practices across Europe and preserve their ethnic, cultural and social identity.

Ammerman and Cavalli-Sforza introduced into archaeology the principle of syntethic genetic maps, geographical maps of lines of equal value of the interpolated principal component values of gene frequencies of modern European populations. The overall topological similarity between one of these maps, the map of the first principal component (genetic landscape of Europe based on the distribution of the first principal component of the frequencies of 95 genes) and an archaeological map of radiocarbon dates of the earliest Neolithic settlement deposits in Europe leads to the conclusion that modern European populations as a "Neolithic package", arrived in Europe at 7500 BP, the beginning of the Neolithic (*Ammerman, Cavalli-Sforza 1984; Cavalli-Sforza, Cavalli-Sforza 1995.147–153, fig. 6.10; Cavalli-Sforza 1996.53, 57–65, fig. 4.1a*). The indigenous hunter-gatherer communities were deleted or absorbed, and their contribution to the subsequent development of the genetic and cultural history of Europe was insignificant. However, they believe in the story which was recorded in the genetic pattern produced by DNA from the Y (male) chromosomes (*Cavalli-Sforza, Minch 1997.274–251)*.

A different story is found in the pattern of mitochondrial DNA genetic gradients, giving us the female picture. An analysis of five major lineage groups with different internal diversities and divergence times in the European mitochondrial gene pool, which is based on phylogenetic and diversity analysis of the mitochondrial DNA sequence variations in the control region of Europe and the Middle East leads to the conclusion that the ancestors of the great majority of modern, extant lineages entered Europe much earlier, in the Upper Palaeolithic (*Richards et al. 1996.185–203*). On the other hand, geneticists strongly suggest that the spread of agriculture was a substantially "indigenous development, accompanied by only a relatively minor component of contemporary the Middle Eastern agriculturalist". However, they determine the pattern of lineages group (2A) originated in the Middle East and that several different lineages migrated into Europe, dividing into the western (2A–W, halotype 54) and central European (2A–C, halotype 52) clusters, but having little impact on the extant lineage. The ances-

tral halotypes of both groups reach back to Anatolia and the Middle East, implying at least two distinct founding lineages, and it is worth noting that these clusters in Europe do not overlap geographically or chronologically, in spite of being very widespread (Fig. 2). The age of the western lineage was estimated "in minimum age ~12 500 years" and "only 6000" years in central and northern Europe, although estimating the dates of origin of the observed patterns is admittedly difficult (*Richards et al. 1996.185–203; Chikhi et al. 1998.654*). The migration of lineages has been linked to the pioneer colonisation model, whereby there was "selective penetration by fairly small groups of Middle Eastern agriculturalists of a Europe numerically dominated by the descendants of the original Palaeolithic settlements." (*Richards et al. 1996.196,197*). The very well known Neolithic colonisation routes from the Near East through Europe, one through the Balkans to central Europe, and another across the Mediterranean to the Iberian Peninsula, have also been taken up to correlate the two halotype clusters with the process of neolithisation. Halotype 52 has to be linked to the genesis of the LBK culture in Central Europe, and halotype 54 to the cardial ware cultural complexes of the Mediterranean coastline and Atlantic west.

It is suggested, then, that in the 13 millennium BP the small group of middle Eastern farmers (west European lineages) migrated to the Iberian Peninsula. Although having little impact on the extant foraging lineages, they alone initiated the genesis of the west Mediterranean Neolithic cardial cultural complex and farming economy in the region. This interpretation fits almost perfectly with Zilahao's maritime pioneer colonisation model, which assumed that the spread of the Neolithic around the northern coasts of the Mediterranean had involved not just the circulation of ideas, artefacts and resources but also people, if we exclude from consideration the calendriacal time as the first variable (*Zilhão 1997.19– 42*).

Archaeological upgrade: "*maritime pioneer colonisation*" and "*the dual model*"

The maritime pioneer colonisation model demonstrates that Neolithic farmers and herders reached the Mediterranean and Atlantic coast of the Iberian Peninsula in the 7th millennium BP. At the level of radiocarbon dating resolution the process was described as a punctuated event, objectified in the mutually exclusive settlement patterns of an early Neolithic Cardial culture and late Mesolithic shell mid-

Fig. 2. Two currents of movement characterise the colonisation routes of Middle Eastern agriculturalist into the Central Europe (halotype 52 cluster) and Iberian Peninsula (halotype 54 cluster). Source: **Richards et al. 1996.185–203.**

dens. The settlement distributions, although contemporary, were geographically segregated, the former being concentrated in the interior limestone massifs, where no signs of putative late Mesolithic ancestor groups were known, and the latter around the large estuaries of the Rivers Tagus, Sado and Mira. In other words, the earliest Neolithic settlements occur in areas, or "enclaves", between the nuclei of late Mesolithic catchments (Fig. 3). The interpretation of the pattern suggests that the initial settlement had been established by small Neolithic seafaring groups in areas that were not (or were being marginally) exploited by local hunter-gatherers, followed by a more or less delayed assimilation of the latter into the new economic system (*Zilhão 1993.50; 1997. 19–42*). It was also assumed that these colonists "brought their own language with them" which could be placed in the Indo-European language group, and could be developmentally linked to the Levantine pre-Neolithic "Proto-Nostratic" linguistic core and Late Natufian culture (*Renfrew 1996.79–82; Harris 1996.557*).

It was hypothesised that the most westerly colonies appeared at the same time in geographically distinct, but environmentally similar regions in the Algarve to the south, and Estremadura on the north of Atlantic coast of the Iberian Peninsula. The cardial settlements of Cabranosa and Padrão in the Algarve, located only on the south-western end of the European continent, are dated in 6500 ± 70 BP and 6540 ± 70 BP (*Zilhão 1997.36*). In Estremadura there are few ^{14}C dates available within the range of 6870 ± 210 BP (*Zilhão 1992.152*) and 6130 ± 90 uncal BP *(Rowley-Conwy 1992.237*) from Caldeirão. However, it is suggested that a farming economy was present in Estremadura "since at least 6300 BP... and probably as early as 6700 BP" (*Zilhão 1997.19*).

A similar situation has been identified in the Mediterranean region of the Iberian Peninsula. The "*dual model* " of the transition to farming in Spain available recently proposes that there were "external" farming groups involved in the process of neolithisation in the region (*Bernabeu Aubán 1996.37–54; 1997.1–17; 1999.101–118*). Two primary centres of colonisation, located around the mid-low course of the River Llobregat in Catalonia, and along the Alcoi and Serpis river courses in Valencia have been recognised in the region. Using the available radiocarbon dates, Bernabeu Aubán dated the beginning of colonisation to the period within 6820 ± 70 uncal BP

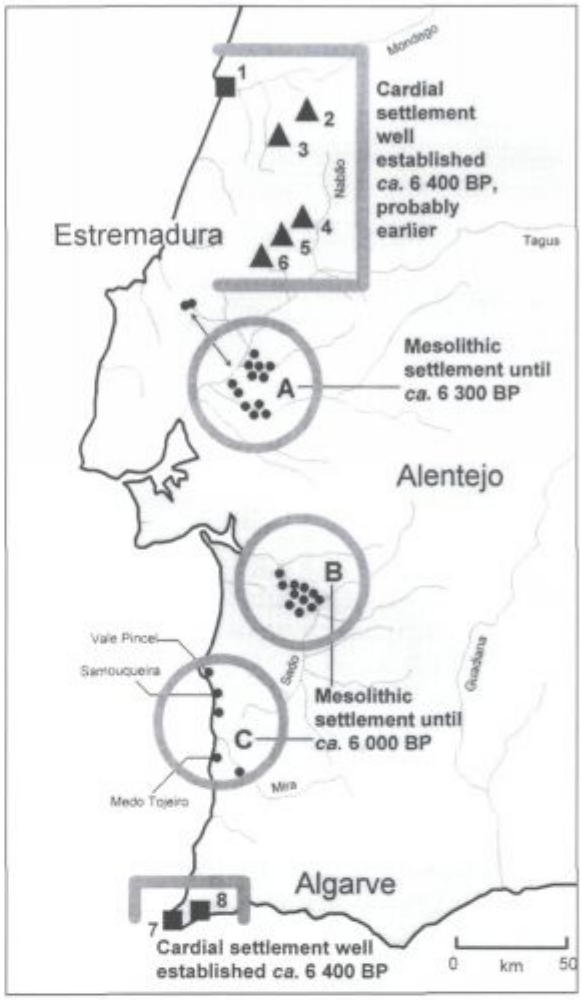

Fig. 3. Settlement clusters of indigenous forager's settlements and logistic camps and contemporaneous farmer's colonies on the Atlantic coast of the Iberian Peninsula. (after* Zilhão 1997.Fig 1*)

and 6680 ± 290 uncal BP (*Bernabeu Aubán 1997. 10; 1999.107–110, Fig. 13*)). The colonisation was spatially and demographically limited to coastal areas (*Bernabeu Aubán 1999.107–111.Fig. 8c*). Forager's settlements of the "Geometric Complex" are randomly dispersed in the region, whilst the contemporaneous "Cardial Complex" of farmers settled niches with highly productive soils and optimal climatic conditions (*Bernabeu Aubán 1997.13, Fig. 10)*. A similar pattern has been recognised in pottery distribution. There were two pottery groups identified in the region within the time span of ca. 6800 bp to 5800 bp. The first was identified as the Neolithic Cardial Complex and linked to the farmer's settlement pattern. The distribution of the later group overlapping with the forager's settlement pattern has been correlated to "the ceramic phases of the Mesolithic Complex" [1] (*Bernabeu Aubán 1999.106*).

1 The pottery group is identified as epicardial. Analysis has shown that pre-existent Mesolithic groups (Geometric Complex) adopted Neolithic pottery technology first, and then adopted domesticated resources (*Bernabeu Aubán 1999.106–111*).

The models suggest that the circulation of people in the western Mediterranean have resulted in a punctuated colonisation of the Iberian Peninsula and, that the spread of agro-pastoral economies along the northern Mediterranean shores had been much faster than was predicted by Ammerman's and Cavalli-Sforza's wave of advance. Despite some doubts (*e.g. Dennell 1983; Lewthwaite 1990.541–542*) there is general agreement that Neolithic farming, as a system, was introduced to the west Mediterranean from the Near East, and that the Neolithic had indeed appeared as a complete package with cardial decorated pottery as its most emblematic feature.

On the Atlantic coast of the peninsula, settlement patterns indicate that the settlement clusters of farmer's colonies were isolated from each other by the contemporaneous logistic sites (shell middens) used in the indigenous framework of hunter-gatherer settlement subsistence systems. There are two alternative interpretations as to what happened in the epicardial period, around 6000 BP, after four hundred years of coexistence and interaction between the systems. The first is recognised as the slow, gradual, piecemeal adoption of several elements of the "Neolithic package" by local hunter-gatherer groups. The second hypothesises an expansion of farmer groups and/or the assimilation of local hunter-gatherer groups due to the superior demographic potential of agricultural societies.

The hypothesis of the neolithisation processes on the Mediterranean coast of the Iberian Peninsula is slightly different. Farming groups that had been introducing agriculture and establishing "primary centres of colonisation" continued to integrate into the settlement subsistence network the most favourable lands. The interaction between the expanding farmers and the indigenous foragers has been described as an adoption of "more technological than economic innovations". Hunters and gatherers are supposed to have accepted and distributed pottery from the very beginning, but domesticates were not adopted before 6000 uncal BP – 5500 uncal BP (*Bernabeu Aubán 1997.14; 1999.111*). Late subsistence changes have also been identified in Brittany much further north along the Atlantic coast, where the stable isotope data suggest the continuation of a Mesolithic economy into the period traditionally seen as the middle Neolithic (*Schulting 1998.211–212*).

However, we have to point out the facts that the large majority of known early Neolithic sites on the Iberian Peninsula are caves or rock-shelters, and that villages became the norm only from the middle Neolithic onwards. With all due respect to the motto "absence of evidence is not evidence of absence", it has to be pointed out that no direct evidence of agriculture has yet been found on the Iberian Peninsula that could have correlated with the initial colonisation. Cereal agriculture appeared a few hundred years later, but as far as pastoral economies are concerned, analysis has revealed a high proportion of domesticated ovicaprines from the beginning of colonisation onwards (*Zilhão 1997.23–26; Bernabeu Aubán 1997.11–12*).

MEDITERRANEAN SEA VOYAGES IN THE MESOLITHIC AND NEOLITHIC

For the Mediterranean no direct evidence has survived, either in the form of actual boat remains or of artistic representations to indicate the size and nature of the craft that carried the first farmers across the Mediterranean, although the odds are that up to the early Holocene, Mediterranean increasingly represented less of a barrier and more of a bridge (*Lewthwaite 1990.541–555; Binder 1989. 199–226; Guilaine 1994; Masseti and Darlas 1999, online*). The prehistoric sea-going craft of the Mediterranean and the Near East have received considerable attention recently. The evidence from Franchthi Cave demonstrates that the island of Melos (in the Aegean Cyclades) was exploited as a source of obsidian in early Mesolithic times (*Perlés 1990.48–49*), although there is no evidence of permanent settlement on the island before the Neolithic. Obsidian, however, occurs at only two localities on a single island in the Aegean archipelago and it is reasonable to assume that the finding of obsidian on Melos was merely a chance by-product of a widespread pattern of movement and exploration throughout the island; the distance travelled is estimated to have been up to 19 nautical miles (*Cherry 1985.15*).

The same pattern of seafaring movement, identified in the Mesolithic colonisation of the island prior to 9000 BP has been documented on the Hebrides in the Atlantic (*Edwards and Mithen 1995.348–365*). On Cyprus, in the eastern Mediterranean, short-term hunting camps of the Akrotiri culture have been connected with hunts for endemic mammals at the end of the 10th and the beginning of the 11th millennium BP (*Cherry 1990. 149–157; Simmons 1991. 857–869; Lax and Strasser 1992.209 Masseti and Darlas 1999. online*). It is interesting that the assemblages of chipped stone artefacts found together with

a huge quantity of bone of extinct endemic fauna were similar to Natufian and early pre-pottery Neolithic artefact sets from the Levant (*Simmons 1991*). Moreover, the island was colonised a millennium later (Khirokitia culture), and there is certainly no evidence of continuity in settlement or coexistence between the hunter-gatherer and farmer communities (*Cherry 1990.149–157; Simmons 1991.857–867; Rizopoulou-Egoumenidou 1996.183–187*). It seems therefore reasonable to actualise the idea of the "*PPNB exodus*", which may not be an isolated event, but an extension of a process of colonisation already attested in Near East (*Perlès 1994.648–49; Cauvin 1989.14–24*), and to link it to the hypothesis that migrant farmers were capable of undertaking sea voyages (*Broodbank & Strasser 1991.233–245*).

The Maritime Colonisation of Mediterranean Islands

However, that the colonisation did take place by sea is amply documented on Crete. Colonising farmers entered the island where no earlier occupation is known close to 8050 ± 180 uncal BP (*Demoule and Perlès 1993.364–365)* or 7910 ± 140 uncal BP (*Bloedow 1991.39–43; Broodbank & Strasser 1991.233–245*). The arrival was linked to the "aceramic deposit" in Knossos, where a complete "Anatolian-Balkan Neolithic faunal and floral" package, with no indication of filtering, and the indirect evidence of a high level of clay technology have been found. After this initial phase of an estimated 140 years, the evidence of permanent architecture and intensive pottery production similar to those found in Asia Minor or even the Syro-Palestinian coast come to light (*Bloedow 1991.43; Davaras 1996.92*). It is possible, therefore, to speculate that one of those regions was the point of origin from which farmers reached Crete. Even more, it is hypothetically possible to link the colonisation of Crete with the "general collapse of the cultural system" and the depopulation of the intensively inhabited regions in South-eastern Anatolia and the Near East which happened during the final stage of the pre-pottery period (PPNC) (*Özdoğan 1998. 35*). It is broadly accepted that the migrations did not take place simultaneously all over the Near East and that the primary groups must have been few, but with enough impact to stimulate a chain reaction. However, most settlements were abandoned, and in those that continued shrank in size, public buildings were abandoned etc. (*Cauvin 1990.191–204*). It is interesting that this depopulation of the Near East and South-eastern Anatolia corresponds to a period of rapid colonisation in Central and Western Anatolia. The similarities in the assemblages indicate the presence of an endemic movement from East to West, which must be understood as a continuous infiltration of groups originating from various parts of the Near East (*Özdoğan 1997.13–17; 1997.35; Özdoğan and Gatsov 1998.223*). There is considerable discussion as to what led to the circulation of the Neolithic population. Were they social tensions and economic changes or climatic fluctuation? An interesting idea was advanced recently by Özdoğan. He speculates that the reason for the migration "...was a social turbulence that took place by the end of the PPNB in the Near East that stimulated an influx of people in small groups to the West. They carried on almost all aspects of their culture with the exception of centralised authority." And in consequence "...throughout the Neolithic of Anatolia and South East Europe, a much more egalitarian rural economy seems to have been implemented than the centralised system of Syro-Mesopotamia." (*Özdoğan 1997. 16–17*). There are indeed clear indications of social stratification and hierarchy available in PPNB settlement palimpsests. At Çayönü "...within the immediate periphery of the specifically reserved cultic areas, there are living quarters which were separated from the rest of the community; there the buildings are bigger, better built and possess what can be called status objects." (*O.c. 10*) These objects were linked to an elite group, evidently in control of spiritual and probably other aspects of the community. Dominance in the community is reflected in the rigid order of the settlement organisation, deliberately designed burial houses and in the construction of plaster floors that evidently needed the extensive organisation of labour.

The maritime colonisation of Cyprus and Crete in the Aegean archipelago was an isolated process, but if we look for Mediterranean island colonisation broadly contemporary with that of Crete and Cyprus, examples are found far to the west on Sicily, Corsica and Sardinia. Whether the farmers brought their social elite with them or not, Neolithic island colonisation involved not only a conceptual shift from the Mesolithic usage of the sea, but also a distinct shift in nautical technology and in the design of boats. It was hypothesised that the total scale of transportation for a mere 40 human colonists and their accompanying cargo, including grains and animal package was 15 400–18 900 kg (*Broodbank & Strasser 1991. 240*). The cargo makes it necessary to imagine a flotilla of 10–15 boats carrying one or two tonnes of cargo each for a relatively small-scale colonisation

Fig. 4. Mediterranean Sea Voyages and accompanying cargo (after* Broodbank & Strasser 1991.240*), including colonists and "Neolithic package".

(Fig. 4). For the East Mediterranean no evidence has survived, either in the form of actual Neolithic boat remains or artistic representations to indicate the size and nature of the craft that carried farmers and "Neolithic package" on the islands. The earliest rock carving of a longboat on Naxos is dated to the Aegean Cycladic Early Bronze age (Fig. 5) (*Cherry 1985.22–23, Fig.2–6*). In modelling the process of colonisation, Williamson & Sabath made the important point that human groups are well aware of the demographic instability of small populations. If the colonisation is intentional and voluntary, a decision concerning group size is taken less with a view to the hypothetical minimum that might succeed, than to the larger number of individuals that the colonising society considers will succeed. Deliberate colonists set out in groups that expect to make it, rather than ones that might or even might not be successful (cfr. *Broodbank & Strasser 1991.240*). The "safe size" on Crete is speculative, but has been estimated that the basic settlement unit appears to be between 40–200 inhabitants (l.c.). Little is known with any certainty about their behavioural and logistic patterns, which hypothetically could have altered the Cretan landscape to the point at which they caused the extinction of the island's endemic fauna (*Lax and Strasser 1992.203–224*).

Whilst the Neolithic settlement's palimpsests, which are clearly connected with the beginnings of farming on Cyprus and Crete, show the movement of farmers, the evidence on Sicily, Sardinia and Corsica, the central and western Mediterranean islands fits far better with the prediction of a long period of acquaintance and experimentation with the new resources by the indigenous hunter-fisher-gatherers before farming became the dominant mode of subsistence.

A model of the slow transition to farming was originally proposed by M. Zvelebil and P. Rowly-Conwy fifteen years ago (*Zvelebil 1990.10–13*).[2] On Sardinia and Corsica, central and western Mediterranean islands, the spread of agro-pastoral economies and the transition to farming began with the piecemeal introduction of pottery and some domesticates, par-

2 The model distinguishes an availability phase, when foraging is the principal means of subsistence, and domesticates and cultigens constitute less than 5% of total remains; a substitution phase, when farming strategies develop, but foraging strategies are retained, and domesticates and cultigens comprise about 5–50% of total remains; and a consolidation phase, when farming is the principal mode of subsistence and domesticates and cultigens comprise more than 50% of total remains (*Zvelebil 1990.12*).

ticularly sheep, and their adoption as prestige items of exchange amongst the hunter-fisher-gatherers' social elite, having been acquired through a long-distance exchange network (*Halstead 1989.23–53; Barker 1996.109*). In conformity with the "island filter model" it was hypothesised that the paucity of large mammals on the Tyrrhenian islands stimulated the rapid adoption of animal husbandry as the major subsistence strategy before the acceptance of crop cultivation. (*Lewthwaite 1990.543–545,547–549*).

On Sicily, a "faunal and floral" package without any indication of filtering was identified in the context of an "aceramic occupation phase" in the Uzzo cave on the northwest coast of the island. Costantini pointed out the close chronological concordance and similarity in the appearance of species of cultivated plants in "an aceramic occupation phase" in the Uzzo cave (7910±70 BP) on Sicily and the Franchthi cave (7980±110 BP) on Peloponnese (*Costantini 1989.202*)[3]. It is interesting that the only difference documented in both deposits is in the type of wheat cultivated: *Triticum monococcum* in Uzzo and *Triticum dicoccum* in Franchthi. The remainder of the "Neolithic package": *Hordeum vulgare and Lens culinaris, Ovis/Capra, Bos taurus* and *Sus domesticus* was the same. The transition to farming at the Uzzo site is supposed to have been a gradual process, with no marked traumatic changes in subsistence; in other words, there was no change during the Neolithic either in the continuation of marine resource exploitation, or in the gathering of wild plants. The only exception was the appearance of the wild olive and fig (*Costantini 1989.202–203; Grifoni Cremonesi 1996.72*).

In contrast to the eastern Mediterranean the appearance and distribution of obsidian tools on Sicily, Sardinia and Corsica correlates strictly with the appearance of Cardial pottery and with the expansion of village-based farming. It is interesting that in the central and western Mediterranean, obsidian was not used before the Neolithic, although Tykot hypothesises that the sources must have been known to the hunters and foragers on the Aeolian Islands and, that virtually all obsidian artefacts found in the central and western Mediterranean come from sources located on four of those islands: Lipari, Palmarola, Pantelleira and Sardinia (*Tykot 1996.46,65*). If we accept the idea that obsidian signified social importance and prestige values in the context of exchange networks and long-distance connections in the eastern Mediterranean even before the Neolithic and the hypothesis of a seafaring farming colonisation from the East, it is extremely surprising that obsidian from Melos should have been found at only a single site in the central and western Mediterranean (*O.c. 42*). Moreover, we should not overlook the broadly accepted fact that the Aegean and Thyrrenian obsidian distributions have been exclusive from the very beginning (*Renfrew 1977.71–90; Perlès 1992; Tykot 1996.fig.10*).

The Sicilian obsidian artefacts were presumed to have originated on Lipari Island, 10 nautical miles

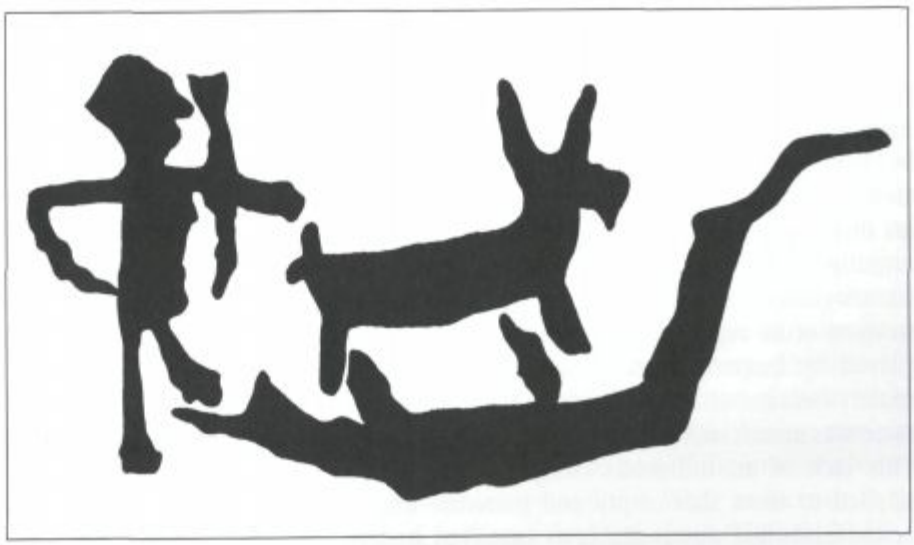

Fig. 5. Rock carving from the site of Korphi t'Aroniou in southeast Naxos, dates to the Early Cycladic period, provides illustration of Mediterranean Sea Voyages and accompanying cargo (after* Cherry 1985.Figure 2–6*).

3 Costantini believed he correlated uncalibrated dates 7981±105 bp in Franchthi and 7910±70 bp in Uzzo (*Costantini 1989.202*; see also the notion in *Harris & Hillman (eds.) 1989.xxxiii-1*). However, the correct chronological positions for both deposits are as follows: in Uzzo 7910±70 BP (*Grifoni Cremonesi 1996.72*); and in Franchthi: 7980±110 BP, calibrated to 2σ 7210 – c.6500 BC (*Jacobsen, Farrand 1987.Plate 71; Vitelli 1993.Table 13*).

away. Surprisingly, more then 40% of the obsidian artefacts found in the Uzzo cave came from Pantelleria Island, which is close to the African mainland, almost 60 nautical miles away. Pantelleria is presumed to have been the source of most of the obsidian artefacts found in North Africa, and it is reasonable to suggest a correlation between Pantellerian obsidian distribution and continual sea voyages and the spread of domesticates from the North Africa to Sicily (*Tykot 1996.58–59*). On the other hand, the high rate of obsidian artefacts in Uzzo allows us to hypothesise that the farmers from Sicily had direct access to the obsidian source on Pantelleria, and their own local production of obsidian tools; that is, there is no straightforward link in principle between the distribution of sources and that of production centres (*Perlès 1992.125–130*). It must be noted that the local, Sicilian domestication of cattle and pig was recently confirmed (*Grifoni Cremonesi 1996.73; cfr. Bökönyi 1988–1989.371–385*). It fits perfectly with Bökönyi's evaluation that "...complete Neolithic domestic fauna containing all five domestic species appeared in southeast Europe some 500 years earlier, around 8500 years ago..." than in southeast Asia (*Bökönyi 1994.393*).

The "PPNB Exodus" in Near East and the Colonisation of South-eastern Europe

In tracing the transition to farming at the regional and continental level it is broadly accepted that the Peloponnese and the tip of the Balkan Peninsula constitutes the contact zone between south-eastern Europe, Anatolia and the Middle East. And, there seems to be broad agreement that in this zone, whether through demic diffusion or migration, farmers entered primarily into the Europe. Although it has become an established view to regard the adoption of farming in Europe as a case of colonisation, an increasing number of "indigenists" have been arguing for the local adoption of farming by local hunter-gatherer communities throughout Europe or in most of its regions. The diminution of the role played by hunter-gatherer groups is still current mainly because of the assumption that the contact zone was almost uninhabited in the early Holocene. This lack of an indigenist component has been applied to show that empty and therefore uncontested landscape was available to Anatolian settlers. It is worth remembering the taphonomic filter – the lack of research thorough enough to justify the inference that the zone was actually uninhabited (*Andreou, Fotiadis, Kotsakis 1996.596–597*).

However, the neolithisation of the contact zone was described as "a fully exogenous process" linked to the "PPNB exodus" in the Near East (*Perlès 1994. 646–649*). A new model of demic diffusion into Europe has recently been published by van Andel and Runnels (*1995.481–500*). The model was based on four basic assumptions: (1) that the Neolithic advance in the southern Balkans proceeded mainly in areas not occupied by an indigenous population; (2) that the migrating farmers preferred to occupy the flood plains of rivers and lakes, as in the environment in the Konya Basin in central Anatolian; (3) it was not only population growth immediately behind the front of "the wave of advance" that drove demic diffusion, but environments – fertile floodplains large enough and available at a considerable distance from each other, supporting populations ultimately large enough to start the next migratory move, and (4) it was the Larissa plain in Thessaly, the only region in Greece that provided a reasonably assured harvest and was large enough for significant population growth. All these assumptions have been already criticised (*Andreou, Fotiadis, Kotsakis 1996.596–597; Wilkie & Savina 1997. 201–207*) the third one the most sharply, as "...their own calculations fail to substantiate the population growth rates necessary for such a model to operate." (*Zvelebil 1998.412*). That is to say that, even in the Larissa plain, it took too long, some 1500 years, to reach "saturation" and demic diffusion into the nearest floodplains large enough in Macedonia and Thrace. The initial demic diffusion into the Larissa plain has been correlated with the "preceramic" level in Argissa (*Demoule and Perlès 1993.365–366*), although a re-examination of the "Preceramic Neolithic" sites in the region clearly shows that the pottery was found and documented in all the "aceramic strata" (*Bloedow 1991.1–143; Gallis 1996. 61*).

The concept of an "aceramic Neolithic cultural phase" in Europe similar to those in the Near East was introduced V. Milojčić in the 'sixties to support idea that all the inventions took place in the Orient and the domesticates and pots came to Europe as part of an already developed tradition. An aceramic phase implies the introduction of farming and herding at the beginning, and the later introduction of pottery as a second influx of "influence" (*Milojčić 1952. 313–318; 1956.208–210; 1960.320–335*). Milojčić identified an "aceramic stratum" in Argissa Magoula and his results were soon followed by the identification of a similar phase at other sites in the region, so that in the 'seventies Theocharis could claim five

aceramic sites: Argissa, Sesklo, Soufli, Achilleion and Gediki (*Theocharis 1973.35*). As far as pottery production is concerned, Bloedow believes that there is no evidence available of any incipient experimentation in pottery making in the region, and when pottery containers appear, the technology is already advanced. We have mentioned already that, "absence of evidence is not evidence of absence", but this does not necessarily disprove the idea that at least the knowledge of clay technology came from outside Europe. At the same time, cultural discontinuity between Mesolithic hunter-gatherers and Neolithic farmers is broadly accepted. On the basis of the standardised production of blades in Argisa, most probably produced by using the complex pressure-flaking method of debitage, it was concluded that there is no argument for the local evolution of lithic production (*Perlès 1990.130–136; Bloedow 1991.18*). And it is almost a matter of course that the complete "Anatolian faunal and floral" package, without any indication of filtering has been found (*Demoule and Perlès 1993.362,365–366*).

However, it is worth remembering that van Andel & Runnels have been dealing with non-representative settlement patterns[4] and that the settlement tells in the Larissa floodplain were temporary and not permanent, being occupied only outside of the flood seasons. The analysis of soil history shows that floods in the region were quite frequent during the period of incoming demic diffusion from Anatolia. The choice of site for repeated occupation and the permanence and continuity of that occupation has already been discussed, and doubt about year-round occupation has been shown very clearly (*van Andel et al. 1995.131–144; Whittle 1996.49–54*). The "preceramic levels" on all the sites were thin, with no definite structures other than ditches and pits, and there were sterile layers separating these levels from the Early Neolithic ones. Extrapolation from the radiocarbon dates has suggested a maximum duration of 200 years (*Bloedow 1992/93.56*). We would speculate that the initial agriculture was not so intensive as it is hypothesised in the estimation that "...the Thessalian floodplains as floodplains have done elsewhere, offered Neolithic farmers dry dwelling places and much arable land on abandoned levee/channel systems..." (*van Andel & Runnels 1995.490*). Our speculation is in complete agreement with the recent work carried out by Willis and Bennett (*1994.327; Willis 1995.9–24*) suggests that the archaeobotanical evidence is recording early farming communities that were small in size, and occupied sites on a short-term basis without a significant impact upon the landscape. The impact of agriculture is not in evidence until ca 6000 BP, which is not to say that farming did not occur earlier, but that it had a negligible impact on the landscape.

AN INDIGENOUS RESPONSE (Fig. 6)

Alternative data are still available in the cave deposits in the Theopetra cave in eastern Thessaly. In the Mesolithic deposit, which has been chronologically fixed by seven radiocarbon dates as ranging from ca. 9780–6700 BC, *Horedum vulgare*, *Triticum boeticum*, wild goat, pig and "primitive pottery" have also been found. It should be pointed out that the Mesolithic has been dated for the first time in Thessaly and stratigraphically separated from both Neolithic and Paleolithic deposits. Interestingly, the lithic industry does not seem to be typical of the Mesolithic as known from other European or Greek littoral sites. The assemblage consists of a large number of flakes but no baked bladelets or geometric microliths, and no evidence of the microburin technique (*Kyparissi-Apostolika 1998.247,249; 1999. 237–238*).

The interpretation of the process of transition to farming in the Argolide on Peloponnese was based on the decoded palimpsest of Mesolithic/Neolithic transition in the Franchthi cave. In contrast to Thessaly, an indigenous hunter-gatherer tradition in flint working techniques is clearly presented (*Perlès 1990. 135; Demoule and Perlès 1993; 365,368*). Pottery appeared beside the complete faunal and floral package in the initial, "aceramic" Neolithic. However, here it is interesting to note that "...the abrupt increase in quantity and varieties of pottery..." in the following phase "...points to abrupt change in cultural practices and possibly to a hiatus in site use." (*Vitelli 1993.39*). In other words, abrupt changes happened 200 years after the initial introduction of the farming economy and pottery production if Bloedow's (*1992/93.56*) calculation of the available radiocarbon data is correct. Wild barley, oats and lentils were adopted as part of the subsistence strategy in the late Palaeolithic. While an increase in the use of both was detected about 9300–9100 BP, a "sickle-gloss" on a stone tool that could relate to har-

4 258 Neolithic settlements have been identified in the eastern Thessalian plain and both the hilly and mountainous regions surrounding it. During the Early Neolithic 35–50% of settlements were located in a hilly or mountainous region (*Gallis 1996.64*).

Fig. 6. Cluster of indigenous forager's settlements in south-eastern Europe and north-western Anatolia capable and ready to serve as a promotion centres of agro-pastoral farming in the course of which process these communities could be expected to develop or to adopt and to modify agro-pastoral practices and pottery production and integrate them with existing subsistence strategies.

vesting was identified after about 8700 BP in botanical zone V, corresponding to the later part of the upper and the final Mesolithic lithic phase from about 9000 BP to 8000 BP as defined by Perlès (*Hansen 1991.135,161,169; cfr. Perlès 1990*). The paucity of botanical remains in the Late Mesolithic has been interpreted as a decrease in intensity of occupation of the cave that may have been the results of either a seasonal pattern or periodic longer abandonment. In the following, early Neolithic sequence (i.e. zone VI) an abrupt change in the botanical record was identified. The hypothetical absence of wild oats and barley on the one hand, and the appearance of emmer wheat and two-row hulled barley, along with domestic ovicaprids on the other, have been interpreted as proof of the sudden appearance and external origin of the Neolithic agricultural system at the Franchthi cave and in northern Greece (*Hansen 1991.161,169–170,182–183*). Whereas a hypothetical discontinuity between the Mesolithic and the Neolithic is seen in the fact that the wild cereals, oats and barley completely disappear from the botanical record before the appearance of domesticated cereals, while other species previously present, such as lentils, pistachio, almond and pear continue to be exploited. In addition, it was emphasised that "...there is no positive evidence of cultivation prior to the sudden appearance of domesticated emmer wheat and two-row barley." and that the increase in lentil size apparently coincides with these domesticates (*O.c. 163*).

Although the idea of an abrupt change in the botanical record was broadly accepted (*Halstead 1996. 299*), and the "indigenists" in debate with "diffusionists" have already been labelled as "reactionist" (*Özdoğan 1997.2),* some further thoughts on the restrictions connected with the definition of artefact and ecofacts sets in Franchthi cave should be considered. The taphonomic filter can be traced at the documentary and interpretative levels, primarily in connection with inadequate sampling, (mis)understanding of the formation processes of the deposits, and stratigraphic contexts, etc. Hansen herself has pointed out very clearly that the absence of wild oats and barley in the Neolithic botanical sequence "...could be the result of a sampling problem, in that the final sieving and cleaning of the plants to remove the larger weeds may not have taken place in an area that has not been excavated, or in the Neo-

lithic village on Paralia, where plant remains have not been preserved." (*Hansen 1991.142*). Sampling and water sieving had been limited to two small excavation units located beside one another (FAS and FAN). We believe that the interpretative relevance is weak beside the unrepresentative sampling pattern mostly because of the exclusive results of the sampled units. Namely, in the FAN interzone V/VI (i.e. Mesolithic /aceramic Neolithic interzone) "...several units contain both oats and emmer wheat (*Triticum turgidum ssp. dicoccum*), while in the same interzone FAS the first appearance of emmer wheat is in the unit above that containing the last appearance of oats." (*O.c. 24–5,138*). Inconsistency in determining the chronological and cultural context of "an abrupt" change is also intriguing. While the abrupt change in the botanical record has been embedded within the discontinuity between the Mesolithic and the Neolithic and linked to the sudden appearance of Neolithic farming and herding, there was no discontinuity in flint working techniques (*Perlès 1990. 135; Demoule and Perlès 1993.365*). It appears later, parallel with the abrupt change in pottery technology, which was identified 200 years after the initial introduction of the farming economy to the "ceramic" Neolithic (*Vitelli 1993.39; Bloedow 1992/ 93.56*). Changes have more in common with Neolithic open settlements in Thessaly than with Mesolithic Franchthi. The same pictures emerge from the study of marine molluscs from the cave, which exhibit continuity in the mollusc assemblage dominated by *Cerithium vulgatum*. A change to a more mixed assemblage occurs in the "ceramic" Neolithic. It was suggested that these changes correlate with the founding of the open settlement at Paralia outside the cave, based on a sedentary, mixed farming economy (*Halstead 1996.300*). However, it might be realistic to link the change to a corresponding rise in sea level, when the transgression reached a short distance to the settlement (*van Andel and Sutton 1987.44*).

The long-term cultural continuity in the Mesolithic and the initial Neolithic in Franchthi has been interpreted as an expression of cultural identity (*Perlès 1990.135; Demoule and Perlès 1993.365,368*), and it is reasonable to hypothesise that the transition to farming in Argolide was an autochthonous process, although the introduction of at least some domesticates has been thought suggestive of immigrant farmers. However, plant remains, harvesting and plant processing, as well cattle and pig hunting, hint at Mesolithic pre-adaptation to the use of cultigens. Moreover, it is no coincidence that in Franchthi before 9000 BP, lentils were roasted prior to being ground or pounded into a coarse flour, and they are wide enough in diameter to be identified as domesticated (*Hansen 1991.124,138*).

In the case of barley the genetic data indicate that the domestication event was polyphylethic, which means that the crop has been taken into cultivation more than once and in different places (*Zohary 1996.155*). And, it is important to know that the detection of the start of cultivation is problematic and that cultivation prior the domestication can be recognised only from indirect evidence, not from the remains of the crops themselves. The experimentally-based model of Hillman and Davies (*1990.157–222*) suggests that, once the wild types of cereals were under cultivation, morphologically altered domestic forms could have "taken over" the crops within two centuries if the cultivators used harvesting methods favouring the domestic mutants and, while these methods would have offered the cultivators some immediate advantages, some groups may well have used methods which left their crops in the wild species state for centuries or millennia. In addition, even when domestication-inducing methods were applied, the harvesting of genetic infiltration of wild type genes from nearby populations of wild cereals, could have caused domestication to take many centuries. It is inevitable even with the most rapid domestication that these genes would have ensured that the crops continued to contain an admixture of wild forms. This "genetic contamination" resulted in a correspondingly protracted period of "pre-domestication cultivation". This effect, combined with the inherent problems of distinguishing wild and domestic cereals from charred remains, ensures that the detection of continuing domestication in the archaeological record is extremely difficult (*Hillman 1996.194, see also Hansen 1991.173*). While it is possible, therefore, that barley and lentils had reached at least the level of "pre-domestication cultivation" in Franchthi and in Argolide (*Zohary 1996.145,155*), there is no evidence for local wild progenitors of emmer and einkorn wheat (*Hansen 1991.138,145*), which means that *Triticum turgidum subsp. dicoccum* (*T. dicoccum*) and *Triticum monococcum subsp. monococcum* (*T. monococcum*) must have been introduced from Anatolia or the Near East. There is also no evidence for *Triticum monococcum ssp. aegilopoides* (*T. aegilopoides*), another einkorn wheat which occurs in the wild mainly in the Balkans and Western Anatolia, where it occupies marginal habitats. It is of interest because it shows domestication traits similar

to those of *T. monococcum*, although the genetic data "...seem to be compatibile with the notion of single origin." (*Zohary 1996.155*) and, "...that *T. aegilopoides* is probably a feral form of the cultivated types which reached the Balkans as a result of the spread of agriculture." (*Heun et al. 1998.67*). However, the situation has become even more complicated since the appearance of wild progenitors of einkorn wheat, *Triticum boeoticum* in Mesolithic context in Theopetra cave allow us to hypothesise the autochthonous process of plant cultivation in eastern Thessaly.

It is necessary to incorporate all these fragmentary data into the interpretative context of an indigenous adoption of agriculture, which has had nothing directly in common with the "PPNB exodus" we mentioned before. In eastern Thessaly the wild progenitors of barley and einkorn wheat, as well as wild goat and pig, suggest local processes of plant cultivation and animal domestication. It is reasonable, therefore, to accept the idea that the transition to farming was an autochthonous process there, and that the adoption of domesticates took place piecemeal over a period of several centuries (*Halstead 1996.297*). In Argolide barley and lentils were locally adopted. Emmer, sheep and goat were introduced in the initial "aceramic" Neolithic. Einkorn wheat and cattle are first documented in the "ceramic" Neolithic, although it is not clear if the earliest specimens of cattle and pig (from the end of the "aceramic" Neolithic) were domesticated or not (*O.c. 297*). In this way we can really "...envisage the transition as an enhancement of the existing social system, rather than as the kind of radical break which is often proposed." (*Whittle 1996.43*). The system seems to collapse after 5000 BP, when the site and the site catchment area, located on a terrace, were flooded in the process of marine transgression (*van Andel and Sutton 1987.44; Lambeck 1996.597–610*). But before being flooded, these people were takers of opportunities and, on voyages by sea for the acquisition of obsidian and tunny fishing, could have been involved in the Aegean Mesolithic and Neolithic forager-farmer exchange network, where they could have been moved to adopt pottery, as well the chance to collect some domesticates and cultigens. There is indirect evidence of Neolithic exchange in the Franchthi cave. Statuette-like artefacts have been interpreted as tokens designed either as contractual devices or as identifying tokens between individuals or groups, symbolising the obligations of an agreement, friendship or common bond. It is hypothesised that in the context of inter-settlement contact in the region, various types of bonds between communities would have been beneficial during the Neolithic, and that contractual devices or identifying tokens could have been used in a variety of contexts. They may have been used as tokens in a "down the line" mode of exchange or, perhaps, to identify messengers between villages, particularly in times of crisis, or even as markers of inter-village marital connections (*Talalay 1993.45–46; Budja 1998.222–223*).

It is much more difficult to decode the late foraging and early farming palimpsest in the Marmara area, although the north-western part of Anatolia, comprising of the littoral areas around the Sea of Marmara and the Black Sea, has always been considered a cultural bridge between Europe and the Near East. It is well known that the region underwent a series of environmental pressures due to drastic changes in the marine conditions of Marmara. The Sea of Marmara in the Holocene was subject to alternating brief episodes of more saline or brackish periods. At first there was an overflow of cold and fresh water from the Black Sea, soon to be followed by the resumption of lacustrine conditions. The first intrusion of warm and saline waters from the Aegean had taken place by 6500 BC, and was soon followed by the establishment of a link with the Black Sea. The radiocarbon dating of the death of freshwater molluscs in the Black Sea, and therefore the ingression of the saltwater from the Marmara is around 5600 BC. It is suggested that the Black Sea did not assume its present form immediately after the breakthrough. As late as the end of the third millennium BC, people were able to live in settlements along the western Black Sea coast, all of which are now about 8–10 meters underwater (*Özdoğan 1998.29; Kuniholm 1999.on line*)

However, in the context of neolithisation there are three different processes identified in the Marmara area (*Özdoğan 1997.3–33; Özdoğan and Gatsov 1998.209–232*). The first was linked to an endemic movement from central Anatolia which took place by the end of PPNB. The migration was identified by the sites indicated in the mound formations in Çalca, Musluçeşme, Kabakli, Keçiçayi, Ağaçli Anzavurtepe, Gavurtarla (*Özdoğan and Gatsov 1998.214,223; Thissen 1999.Fig. 1*) and by the lithic assemblages, which are distinctively different from those of the local Epi-Palaeolithic. The most specific aspect of these assemblages is the presence of technologies of "large blades with occasional ventral retouch" and "bifacially pressure-flaked points". It was hypoth-

esised that because the sites are located in a mountainous region, far from the alluvial plains, subsistence "depended more on hunting than farming" (*Özdoğan 1997.18; Özdoğan and Gatsov 1998. 214–223*).

The second was linked to permanent fishing sites at Fikirtepe, Pendik, İçerenköy and Tuzla on the Marmara coast which were settled by "a direct offspring of the Epi-Palaeolithic industries of the region" (*Özdoğan 1983.409; Thissen 1999.34*). Subsistence was based on hunting, fishing and mollusc collecting. The buildings are oval wattle and daub hut-like structures.

The third has been identified in Ilıpınar (phase X), the earliest farming village site settled by farmers migrating from central Anatolia around 6000 BC (*Roodenberg 1993.251–267; 1995.171–174*). The founding of the village was linked up with the genesis of the Fikirtepe culture (*Özdoğan 1997.19–23*). The contrast in settlement location, house structure and subsistence with the Ilıpınar phase is evident. The Ilıpınar and Menteşe dwellings were built of *pisé* with wood reinforcement (*Roodenberg 1993. 253–254,264, Fig. 3*).

There are some interesting details that should be pointed out if the Özdoğan palimpsest reading was correct. It seems that the first wave of an endemic movement originated in the Konya plain in the "later phases of the pre-pottery Neolithic", although during what has been determined as the "initial phase of neolithisation" (*Özdoğan 1997.18*) it had no impact on stimulating the process of adopting agriculture in the region. There was a second, much more intrusive wave, directly linked to "late Çatal Höyük" (*O. c. 22*). The area around Lake İznik was directly colonised by setting up the primary centre of farming colonisation in Ilipinar[5]. Although the complete Neolithic subsistence package was available, local fishers and foragers living in permanent villages at Fikirtepe, Pendik, İçerenköy and Tuzla on the Marmara coast were much more interested in pottery than domesticates and cultigens. Comparative analyses of dominant vessel categories between the farmers' and fishers' pottery assemblages show that the introduction must have been selective. Differences in the quantitative ratio of "open vessels" in farmers' (> 5 %) and fisher's (27.7 %) settlements have led to the conclusion that the pottery was introduced selectively according to subsistence strategies (*Thissen 1999.32*).

In the scenario of endemic movement the beginning of colonisation of northern Aegean was linked up with the foundation of a farmers' colony at Hoca Çesme in Eastern Thrace[6]. The small colonial settlement by the estuary of the Maritza River was heavily fortified with a massive stone wall (*Özdoğan 1997.23–27*). Perhaps it would be too simplistic to correlate the fortification at Hoca Çesme and "aceramic" walls at the colony at Knossos with the structures of power and the agricultural frontier. However, we believe that Özdoğan's scenario of endemic movement is highly compatible with van Andel's and Runnel's demic diffusion – the modified version of wave of advance model, where the idea of an agricultural frontier has usually been associated with models of colonisation analogous to farmer colonisation in the colonial period of recent centuries. On the other hand, permanent and fortified communities might reflect a new ideology of social order and control over social and natural resources. It was hypothesised that the underlying basis for greater social domination was domestic production, and productive activities were couched within the ideology of *domus* as the guarantor of social life against the wild (*Hodder 1990*). A fortified *domus* as a structure of power and signification located on the agricultural frontier could have been provided a new and powerful way in which social relationships between farmers and foragers at the local level could be created and manipulated.

5 Analysing the colonisation route from the Konya plain to the northern Marmara region, Thissen suggested recently that the clusters of sites at Menteşe, Marmaracık, Yenişehir and Demircihüyük, which are located more to the south, were settled a few centuries earlier than Ilıpınar (phase X). Using morphological similarities in pottery production, he hypothesised the beginning of colonisation in the period of Çatalhöyük East levels VIA–III as being "anywhere between 6500/6400–6300/6200 cal BC" (*Thissen 1999.37*).

6 There is chronological inconsistency in Özdoğan's scenario of endemic movement. That is, there should have been a farmer's settlement colony in Ilipinar in the Marmara region established first, followed after a few centuries by Hoca Çesme in the north Aegean (*Özdoğan 1997.19–27*). In the available ^{14}C sequence the later settlement predates the former. It is worth noting that the founding of Hoca Çesme (6400-6100 cal BC) fits with the "exodus" in the Konya plain in the period "anywhere between 6500/6400–6300/6200 cal BC" (cf. supra 2) on the one hand, and the "ceramic" early Neolithic in Thessaly on the other. Bloedow has proposed 6438–6221 cal BC for Argissa, 6489–6406 cal BC for Sesklo, 6469–6373 cal BC for Nea Nikomedeia and 6481–6216 cal BC for Achilleion. The proposition was based on the selection of calibrated (1σ) dates (*Bloedow 1992/1993.56*).

Despite the strong evidence for forager-farmer interaction and their coexistence for certain period of time, little attention has been paid to the existence of farming-foraging frontiers and forager-farmer interaction in western Anatolia and Balkan. The agriculture frontier and principles of forager-farmer interactions are conceptualised in Zvelebil's model of agricultural transition, describing the process in three stages: availability, substitution and consolidation (*Zvelebil 1990; Zvelebil and Rowley-Conwy 1990*). Each is defined by the economic evidence, which is considered at a regional scale in order to interpret the traditional notion of a rapid transition to farming by colonisation (*supra 1*). It is suggested that in the early phase of forager-farmer contact the effect of the frontier would have been largely supportive and that co-operation would prevail. The exchange of foodstuffs across the frontier would reduce the stochastic variation in food supply and the risk of failure for both the hunting and farming communities. This would have been especially true for farmers who had recently adopted farming, or recently moved into a new area. With the increasing duration of the agricultural frontier, disruptive effects gained the upper hand. This may have been marked mainly by increased social competition, the opportunistic use of hunter-gatherer lands by farmers through the establishment by the farmers of "hunting lands" in hunter-gatherer territories as part of a secondary agricultural expansion, and by the increased exploitation of export commodities by hunter-gatherers to the long-term detriment of the forager economy (*Zvelebil 1994(1995).107–127; Zvelebil 1998.9–27*). Inter-group violence, the presence of fortified farming villages, and the existence of a "no-man's land" in the north European plain, could have also been interpreted as indicators of conflict and competition within the agricultural frontier (*Zvelebil 1998.21*).

It is broadly accepted that contacts between foragers and farmers, occurring within an agricultural frontier zone must have had a direct effect on the nature an the rate of the transition, and may have acted as a delaying mechanism in the process of the transition in north-western and eastern Europe (*Dergachev et al. 1991.1–16; Zvelebil 1996.341; Zvelebil 1998.23*). However, one of the most important points is that playing an active part as individuals and as communities, hunters and gatherers contributed to the generation of a different kind of Neolithic through their own communities and their influence on the established farming settlement (*Zvelebil 1998.21; cf. Bogucki 1988; Whittle 1996*).

IN PLACE OF CONCLUDING REMARKS

There are not very many Mesolithic-Neolithic palimpsests available in south-eastern Europe which can be used to decode the hunter-gathers' and farmers' interactions. It is not because they do not exist, but because of taphonomic filters which operate in the context of unsystematic and inconsistent research procedures, and interpretative postulates which maintain that Mesolithic and Neolithic artefact sets are culturally, chronologically and spatially mutually exclusive. Many of these have been successfully erased from the archaeological records in the last few decades (*Budja 1996a.61–76; Budja 1996b. 323–329).*

However, one of the best-documented examples of long-term forager-farmer interactions in south-east Europe is embedded in the Lepenski Vir culture in the Danube Gorges region. Mesolithic communities continued to reside in the region for several hundred years after the appearance of the local Early Neolithic and did not adopt available farming practices. But they did adopt pottery, which was buried within the multi-layered Mesolithic sites of Lepenski Vir and Padina. There could be several reasons for resistance and the refusal to accept the complete "Neolithic package". The geographical isolation of the deep Danube gorges is one of the frequently stated explanations, implying that the Mesolithic population lived in a "dead end", off the beaten tack of the "neolithisation process" and indifferent to it. However, Radovanović, Voytek and Tringham have suggested recently that the reasons seem to be decoded in another aspect of the Iron Gates Mesolithic – its intensive contact with neighbouring, as well as more distant communities. It was hypothesised that there were groups undertaking "expeditions" to acquire particular goods in distant areas, skipping the "down-the-line" mode of exchange. Evidence comes in the form of lithic resources and ceramics (*Voytek & Tringham 1990; Radovanović 1996. 39–43; Radovanović & Voytek 1997.21*).

Unfortunately, most of the pottery assemblages are still scantily published and there is no direct evidence of any incipient pottery available, and one might speculate that the pots appear as prestige items or as containers for plant foods, which were the real items of barter. However, pottery has been reported in the contexts of Mesolithic trapezoidal houses at Lepenski Vir and Padina. Interpreting the Mesolithic cultural phase Lepenski Vir I and II D, the excavator pointed out that the houses "contained

some sherds of monochrome ware" (*Srejović 1968.24; 1969.153–154;*). He was very precise in locating the pottery distribution, mentioning that pottery fragments had been lying on the floor in the houses "Am Fußboden der Häuser 19, 24, 26, 28, 35, 47, 48, und 54 wurden auch vereinzelt Tonscherben gehoben. Die erwähnten Bauten sind der Endstufe von Lepenski Vir I zuzuweisen." (*Srejović 1971.5*) (Fig. 7)[7]. A similar pattern has been recorded at Padina, where whole pots were deposited in trapezoidal houses 7 and 15 (or 18) (*Jovanović 1969.30; 1987.1–16*).

Srejović has proposed the idea of post-depositional processes that caused the infiltration of pottery fragments from the upper Early Neolithic layer into the lower Mesolithic one. It is worth remembering that a recent analysis did not confirm the hypothesis "of intrusion" (*Radovanović 1996.39–43; Borić 1999.47–53*). They show, on the contrary, that the pottery deposition in Lepenski Vir I and II was not a matter of a taphonomic filter – stratigraphic problems of vertical displacement and post-depositional disturbance. It is hard to believe, indeed, that complete pots found *in situ* on the house floors at Padina were infiltrated through the superposed layers. On the other hand, there is "one almost metaphorical piece of evidence" available. We believe that a fragment of monochrome pottery was not firmly embedded by coincidence between the red deer's teeth and the floor of house 28 at Lepenski Vir I (*Borić 1999.52*). In interpreting the pottery's appearance in the foraging context of Lepenski Vir I and II the correlation between the pottery distribution and the distribution of sculptures and "altars" should be pointed out very clearly (Table 1). There are houses: 1, 16, 19, 20, 24, 26, 28, 32, 35, 37, 46, 47 and 54, where pottery fragments, "stone heads" and other decorated sculptures, "altars" and artefacts ornamented by motifs that perhaps represent various symbols have been found (*Срејовић 1969; 1971. 1–39; Srejović, Babović 1983*).

It is not our intention to enter into the discussion of the cognitive principles operating at Lepenski Vir (*Hodder 1990.20–31*) or to contextualise the symbolic structure and social power in the Djerdap Mesolithic (*Chapman 1993.71–121*). And, whether Chapman's principal conclusion "that the social transformations in the gorge moved largely parallel to those of farming cultures outside the gorge but that increased interaction between the two social networks led to the collapse of one without any significant change in the other" (*Chapman 1993.115*) is

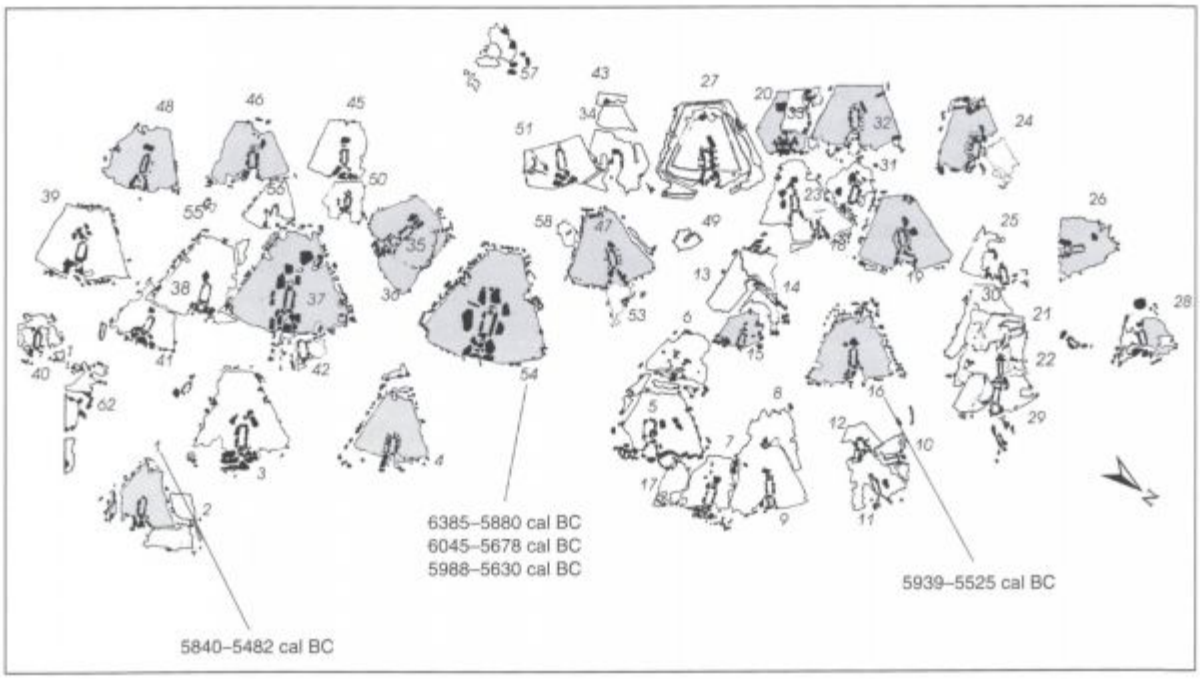

Fig. 7. Lepenski Vir, phases I and II. Pottery distribution, marked with shaded house plans (after* Срејовић 1969; Srejović 1971; Srejović, Babović 1983*) and ^{14}C dates calibrated on 2σ (after* Bonsall et al. 1997.Table 1*).

7 Two years before Srejović published a slightly different list of houses of Lepenski Vir I and II: 1, 4, 15, 16, 19, 20, 24, 26, 28, 32, 35, 37, 46, 47 and 54 (*Срејовић 1969.153,154*).

House No.	Pottery	Stone sculptures	Stone "shrines"
1	●		
4	●		
15	●		
16	●	▲	
19	●	▲	■
20	●		■■
24	●	▲	■
26	●		■
28	●	▲▲	
32	●		■
35	●		■
37	●	▲	■■
46	●	▲	■
47	●	▲	
48	●		
54	●	▲▲	■

Tab. 1. Lepenski Vir, phases I and II. Correlation between the houses, pottery distribution and the distribution of sculptures and "altars". Sources: **Срејовић 1969; 1971; Srejović, Babović 1983*).**

correct or not, the presence of features bearing witness to participation in regional exchange networks within both Mesolithic and Early Neolithic contemporary settlements, speaks in favour of a process in which a sedentary hunter-gatherer community in the Djerdap was first "neolithicised" – in all aspects except the essential one (*Radovanović 1996.43*). It is worth remembering that pottery appears to have been adopted before the full adoption of cultigens and domesticates, and that the areas where the pots occur are marked by a continuity between the Mesolithic and the Neolithic in settlement location and material remains, especially in burial procedures and architectural elements, including the famous sculptures.

We may hypothesise that the pottery was introduced selectively, related to changes in subsistence strategies, which are a far cry from the "Neolithic package", and did not coincide with a wholesale shift in subsistence from foraging to farming. A shift in dietary patterns, identifiable within the variability of stable isotopic values of $\delta^{15}N$ and $\delta^{13}C$ in collagen samples occurred at Lepenski Vir (phases I and II) between 7600 and 7300 BP. The dietary shift has been interpreting as a change in foraging subsistence patterns from an economy based on the exploitation of aquatic (riverine) resources to a more broadly-based economy in which traditional food resources were supplemented to a much greater degree by terrestrial resources in theform of herbivores and/or protein-rich plants (*Bonsall et al. 1997.50–91*). In this interpretative context it seems reasonable to relate the pots at Lepenski Vir and the Padina settlement to the beginning of local pottery production and to processes of food preparation and serving dishes, whether to alive or in sacrificial rituals to dead ancestors buried beneath the houses. It is worth remembering that pounders and mortars, although variously interpreted as shrines and altars, have been recently interpreted on the basis of wear patterns as grinding and/or pounding stones (*Radovanović & Voytek 1997.21*).

All of this points to the conclusion that in many parts of south-eastern Europe, there were clusters of Mesolithic settlements (Fig. 6) capable and ready to serve as a promotion centres of agro-pastoral farming in the course of which process these communities could be expected to develop or to adopt and to modify agro-pastoral practices and pottery production and integrate them with existing subsistence strategies.

REFERENCES

AMMERMAN A. J. and CAVALLI-SFORZA L. L. 1984. *The Neolithic Transition and the Genetics of Populations in Europe.* Princeton University Press. Princeton.

ANDREOU S., FOTIADIS M., KOTSAKIS K. 1996. Review of Aegean Prehistory V: The Neolithic and Bronze Age in Northern Greece. *American Journal of Archaeology 100: 537–597.*

ANTANAITIS I. 1999. Concerning the transition to farming in the East Baltic. In Budja M. (ed.), *Documenta Praehistorica XXVI, 6th Neolithic Studies: 89–100.*

BARKER G. 1996. Early Holocene environments and subsistence strategies in the Mediterranean basin. In *The Colloquia of the XIII International Congress of Prehistoric and Protohistoric Sciences. Forli (Italia) 8–14 September 1996. The Mesolithic. Section 7. Adaptations to Postglacial Environments. Colloquim XIV: 105–112.*

BERNABEU AUBÁN J. 1996. Indigenismo y migracionismo. Aspectos de la neolitización en la fachada oriental de la Pennninsula Ibérica (Indigenism and migrationism. Aspects of the Neolitization in the East of the Iberian Peninsula). *Trabajos de Prehistoria 53/2: 37–54.*

1997. Indigenism and Migrationism. The Neolithization of the Iberian Peninsula. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXXIV: 1–18.*

1999. Pots, symbols and territories: the archaeological context of neolithisation in Mediterranean Spain. In Budja M. (ed.), *Documenta Praehistorica XXVI, 6th Neolithic Studies: 101–118.*

BINDER D. (1989). "Aspects de la néolithisation dans les aires padane, provençale et ligure". In Aurenche O. and Cauvin J. (eds), *Néolithisation. British Archaeological Reports International Series 516. Oxford: 199–226.*

BLOEDOW F. E. 1991. The "Aceramic" Neolithic Phase in Greece Reconsidered. *Mediterranean Archaeology 4: 1–143.*

1992/93. The dates of the Earliest phase at Argissa Magouls in Thessaly and other Neolithic sites in Greece. *Mediterranean Archaeology 5–6: 49–57.*

BOGUCKI P. I. 1988. *Forest Farmers and Stockherders: Early Agriculture and its Consequences in North-Central Europe.* Cambridge: Cambridge University Press.

BÖKÖNYI S. 1988–1989. Take-over and local domestication: the double faced nature of early animal husbandry in South Italy. *Origini XIV: 371–385.*

1994. Domestication of animals from the beginning of food production up to about 5,000 xears ago. An overview. In S. J. De Laet (ed.), *History of Humanity, Vol.1: 389–397.*

BONSALL C., LENNON R., McSWEENEY K., STEWART C., HARKNESS D., BORONEANT V., BARTOSIEWICZ L., PAYTON R. and CHAPMAN J. 1997. Mesolithic and Early Neolithic in Iron Gates: A Palaeodietary Perspective. *Journal of European Archaeology 5: 50– 92.*

BROODBANK C. & STRASSER F. T. 1991. Migrant farmers and the Neolithic colonization of Crete. *Antiquity 65/247: 233–245.*

BUDJA M. 1996a. Neolithisation in the Caput Adriae region: between Herodotus and Cavalli-Sforza. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXXIII: 61–76.*

1996b. Neolithisation of Europe: the Slovene Aspect. Contribution to the Discussion. *Arheološki vestnik 47: 323–329.*

1998. Clay tokens – accounting before writing in Eurasia. In Budja M. (ed.), *Documenta Praehistorica XXVI, 5th Neolithic Studies: 219– 235.*

CAUVIN J. 1989. La néolithisation au Levant et sa première diffusion. In Aurenche O., Cauvin J. (eds.), *Néolithisation BAR IS 516.*

1990. *Naissance des divinités. Naissance de l'agriculture.* Paris: CNRS Editions.

CAVALLI-SFORZA L. L. and CAVALLI-SFORZA F. 1995. *The Great Human Diasporas. The History of Diversity and Evolution.* Addisson – Wesley Publishing Company. Reading.

CAVALLI-SFORZA L. L. 1996. The spread of agriculture and nomadic pastoralism: insights from genetics, linguistics and archaeology. In D. R. Harris (ed.), *The Spread of Agriculture and Pastoralism in Eurasia: 51–69.*

CAVALLI-SFORZA L. L. AND MINCH E. 1997. Paleolithic and Neolithic Lineages in the European Mitochondrial Gene Pool. *American Journal of Human Genetics 61: 247–251.*

CHAPMAN J. 1993. Social Power in the Iron Gates Mesolithic. In J. Chapman and P. Dolukhanov (eds.), *Cultural Transformations and Interactions in Eastern Europe. Worldwide Archaeology Series 6. Centre for Archaeology of central and Eastern Europe. Monograph 1: 71–121.*

CHERRY J. 1985. Islands out of Stream: Isolation and Interaction in Early East Mediterranean Insular Prehistory In Knapp, T. Stech (eds.), *Prehistoric Production and Exchange. Monograph XXV.*

1990. The first colonization of the Mediterranean islands: a review of recent research. *Journal of Mediterranean Archaeology, 3: 145–221.*

CHIKHI L. et al. 1998. Clinical Variation in the Nuclear DNA of Europeans. *Human Biology 70/4: 643–657.*

COSTANTINI L. 1989. Plant exploitation at Grotta dell'Uzzo, Sicily: new evidence for the transition from Mesolithic to Neolithic subsistence in Southern Europe. In D. R. Harris, G. C. Hillman (eds.), *Foraging and Farming. One World Archaeology 13: 197–206.*

DAVARAS C. 1996. Crete. In G. A. Papathanassopoulos (ed.), *Neolithic Culture in Greece: 92–93.*

DEMOULE J. P. and PERLES C. 1993. The Greek Neolithic: A New Review. *Journal of World Prehistory 7/4: 355–416.*

DENNELL R. 1983. *European Economic Prehistory.* New York: Academic Press.

DERGACHEV V., SHERRATT A. and LARINA O. 1991. Recent results of Neolithic research in Moldavia. *Oxford Journal of Archaeology 10: 1–16.*

EDWARDS J. K. AND MITHEN S. 1995. The Colonization of the Hebridean Islands of Western Scotland: evidence from the palynological and archaeological records. *World Archaeology 26/3: 348– 365.*

GALLIS K. 1996. Neolithic habitation in central and western Thessaly. In G. A. Papathanassopoulos (ed.), *Neolithic culture in Greece: 61–66.*

GRIFONI CREMONESI R. 1996. La Neolitizzazione dell'Italia: I – L'Italia centro meridionale. In *The Colloquia of the XIII International Congress of Prehistoric and Protohistoric Sciences. Forli (Italia) 8–14 September 1996. The Neolithic in the Near East and Europe. Section 9. The Processes of Neolithisation and the Development of Neolithic Cultures in Large Geographical Areas. Colloqium XVII: 69–80.*

GRONENBORN D. 1998. Ältestebandkeramische Kultur, La Hoguette, Limburg and ... What Else? – Contemplating the Mesolithic-Neolithic Transition in southern Central Europe. In Budja M. (ed.), *Documenta Praehistorica XXVI, 5th Neolithic Studies: 189–202.*

GUILAINE J. (1994). *La Mer Partagée. La Méditerranée Avant l'Écriture (7000–2000 avant Jesus-Christ).* Hachette. Paris.

HALSTEAD P. 1989. Like rising damp? An ecological approach to the spread of farming in southeast and central Europe. In A. Milles, D. Williams, N. Gardner (eds.), *The beginning of agriculture BAR IS 496: 23–53.*

1996. The development of agriculture and pastoralism in Greece: when, how, who and what. In D. R. Harris (ed.), *The Spread of Agriculture and Pastoralism in Eurasia: 296–309.*

HANSEN M. J. 1991. *The Palaethnobotany of Franchthi Cave. Excavations at Franchthi Cave, Greece. Fascicle 7.* Indiana University Press. Bloomington and Indianapolis.

HARRIS D. R. 1981. Breaking Ground: Agricultural Origins and Archaeological Explanations. *Institute of Archaeology Bulletin 18: 2–19.*

1996. The origins and spread of agriculture and pastoralism in Eurasia: an overview. In D. R. Harris (ed.), *The Spread of Agriculture and Pastoralism in Eurasia: 552–574.*

HEDGES R. E. M., HOUSLEY R. A., LAW I. A., BRONK C. R. 1989. Radiocarbon dates from the AMS system, datelist 9. *Archaeometry 31: 224–226.*

HEUN M., BORGHI B. and SALAMINI F. 1998. Einkorn wheat domestication site mapped by DNA fin-

gerprinting. In Budja M. (ed.), *Documenta Praehistorica XXVI, 5th Neolithic Studies: 65–69.*

HILLMAN C. G., DAVIES M. S. 1990. Measured Domestication Rates in Wild Wheats and Barley Under Primitive Cultivation, and Their Archaeological Implications. *Journal of World Prehistory 4/2: 157– 222.*

HILLMAN G. 1996. Late Pleistocene changes in wild plant-food available to hunter-gatherers of northern Fertile Crescent: possible preludes to cereal cultivation. In D. R. Harris (ed.), *The Spread of Agriculture and Pastoralism in Eurasia: 159–203.*

HODDER I. 1990. *The domestication of Europe.* Blackwell. Oxford

JACOBSEN W. T. & FARRAND R. W. 1987. Franchthi Cave and Paralia. Excavations at Franchthi Cave, Greece. Fascicle 1. Bloomington & Indianapolis

JOVANOVIĆ B. 1969. Chronological Frames of the Iron Gate Group of the Early Neolithic Period. *Archaeologica Iugoslavica X: 23–38.*

1987. Die Architektur und Keramik der Siedlung Padina B am Eisernen Tor, Jugoslawien. *Germania 65(1): 1–16.*

KRAUSE R. Online. Bandkeramische Siedlung in Vaihingen/Enz. http://www.bawue.de/~wmwerner/grabung/vaih.html

KUNIHOLM I. P. 1999. Aegean Dendrochronology Project December 1998 Progress Report. http://www.arts.cornell.edu/dendro/98news/98adplet.html

KYPARISI-APOSTOLIKA N. 1998. The Significance of Theopetra cave for Greek Prehistory. Préhistoire d'Anatolie. Genèse de deux mondes, *ERAUL 85: 241–152.*

1999. The Palaeolithic deposits of Theopetra Cave in Thessaly (Greece). In Bailey G. et al. (eds.), *The Palaeolithic Archaeology of Greece and Adjacent Areas British School at Athens. Studies 3: 241–252.*

LAMBECK K. 1996. Sea-level change and shore-line evolution in Aegean Greece since Upper Paleolithic time. *Antiquity 70/269: 588–611.*

LAX E. AND STRASSER F. 1992. Early Holocene Extinctions on Crete: The Serach for the Cause. *Journal of Mediterranean Archaeology 5/2: 203–224.*

LEWTHWAITE J. 1990. Isolating the Residuals: the Mesolithic Basis of Man-Animal Relationships on the Mediterranean Islands. In C. Bonsall (ed.), *The Mesolithic in Europe. Papers Presented at the Third International Symposium Edinburgh 1985: 541–555.*

MASSETI M. and DARLAS A. 1999. Pre-Neolithic man and other mammals on the Eastern Mediterranean islands. In A. R. Cruz, S. Milliken, L. Oosterbeek & C. Peretto (eds.), *Results from the Human Population Origins in the Circum-Mediterranean Area: Adaptations of the Hunter-Gatherer Groups to Environmental Modifications. Mediterranean Prehistory Online.* http://www.med.abaco-mac.it/home.htm

MILOJČIĆ V. 1952. Die frühesten Ackerbauer in Mitteleuropa. *Germania 30, 3/4: 313–318.*

1956. Die erste praekeramische baeuerliche Siedlung der Jungstenzeit in Europa. *Germania 34, 3/4: 208–210.*

1960. Praekeramisches Neolithikum auf der Balkanhalbinsel. *Germania 38, 3/4: 320–335.*

MÜLLER-KARPE H. 1976. *Geschichte der Steinzeit.* 2. Aufl. München.

ORSCHIEDT J. 1998. Ergebnisse einer neuen Untersuchung der spätmesolithischen Kopfbestatungen aus Süddeutschland. In N. J. Conard and C. J. Kind (eds.), *Aktuelle Forschungen zum Mesolithikum. Urgeschichtliche Materialhefte 12: 147–160.*

ÖZDOĞAN M. 1983. Pendik: a neolithic site of Fikirtepe culture in the Marmara region. In Boehmer R., Hauptmann H. (eds.), *Beiträge zur Altertumskunde Kleinasiens. Festschrift für Kurt Bittel: 401–411.*

1997. The beginning of Neolithic economies in Southeastern Europe: an Anatolian perspective. *Journal of European Archaeology 5.2: 1–33.*

1998. Anatolia from the last glacial maximum to the Holocene climatic optimum: cultural formations and the impact of the environmental setting. *Paléorient 23/2: 25–38.*

ÖZDOĞAN M., GATSOV I. 1998. The Aceramic neolithic Period in Western Turkey and the aegean. *Anatolica XXIV: 209–232.*

PERLÈS C. 1990. Les industries lithiques taillées de Franchthi. Tome II: Les industries du Mésolithique et

du Néolithique. In T. W. Jacobsen (ed.), *Excavations at Franchthi Cave, Greece. Fascicle 5: 47–279.*

1992. Systems of Exchange and Organisation of Production in Neolithic Greece. *Journal of Mediterranean Archaeology 5/2: 115–164.*

1994. Les débuts du Néolithique en Grèce. *La Recherche 25: 641–669.*

RADOVANOVIĆ I. 1996. Mesolithic/Neolithic Contacts – The case of the Iron Gates Region. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXIII: 39–43.*

RADOVANOVIĆ I. & VOYTEK B. 1997. Hunters, fishers or farmers: sedentism, subsistence and social complexity in the Djerdap Mesolithic. *Analecta Praehistorica Leidensia 29: 19–32.*

RENFREW C. 1977. Alternative models for exchange and spatial distribution. In T. K. Earle, J. E. Ericson (eds.), *Exchange Systems in Prehistory: 71–90.*

1996. Language families and the spread of farming. In D. R. Harris (ed.), *The Spread of Agriculture and Pastoralism in Eurasia: 70–92.*

RICHARDS M., CÔRTE-REAL H., FORSTER P., MACAULAY V., WILKINSON-HERBOTS H., DEMAINE A., PAPIHA S., HEDGES R., BANDELT H.-J., SYKES B. 1996. Paleolithic and Neolithic Linages in the European Mitochondrial Gene Pool. *American Journal of Human genetics 59: 185–198.*

RIZOPOULOU-EGOUMENIDOU F. 1996. Cyprus. In G. A. Papathanassopoulos (ed.), *Neolithic Culture in Greece: 183–190.*

ROODENBERG J. 1993. Ilıpınar X to VI: links and chronology. *Anatolica 19: 251–267.*

1995. Chronologies and conclusions. In J. Roodenberg (ed.), *The Ilıpınar excavations I. Five seasons of fieldwork in NW Anatolia, 1987–91: 167–174.*

ROWLEY-CONWY P. 1992. The Early Neolithic animal bones from Gruta do Caldeirão. In J. ZILHÃO (ed.), *Gruta do Caldeirão. O Neolítico Antigo. Trabalhos de Arqueologia 6: 231–257.*

SCHULTING R. J. 1998. Slighting the sea: stable isotope evidence for the transition to farming in northwestern Europe. In Budja M. (ed.), *Documenta Praehistorica XXVI, 5th Neolithic Studies: 203–218.*

1998a. Creativity's coffin: innovation in the burial record of Mesolithic Europe. In Mithen S. (ed.), *Creativity in Human Evolution and Prehistory: 203–226.*

SIMMONS A. H. 1991. Humans, island colonisation and Pleistocene extinctions in the Mediterranean: the view from Akrotiri-Aetokremnos, Cyprus. *Antiquity, 65: 857–869.*

SREJOVIĆ D. 1968. Lepenski Vir 7000 Years Ago. *The Illustrated London News. January 20: 23–25.*

СРЕЈОВИЋ Д. 1969. Лепенски Вир. Нова праисторијска култура у Подунављу. Београд.

1971. Die Lepenski Vir – Kultur und der Beginn der Jungsteinzeit an der mittleren Donau. In H. Schwabedissen (ed.), *Die Anfänge des Neolithikums vom Orient bis NordEuropa. Teil II. Östliches Mitteleuropa. Fundamenta. Reihe A. Band 3: 1–39.*

SREJOVIĆ D., BABOVIĆ L. 1983. *Umetnost Lepenskog Vira*. Beograd.

TALALAY E. T. 1993. Deities, Dolls, and Devices. In T. W. Jacobsen (ed.), *Excavation at Franchthi Cave, Greece.* Fasc. 9. Indiana University Press. Bloomington & Indianapolis.

THISSEN L. 1999. Trajectories towards the neolithisation of NW Turkey. In Budja M. (ed.), *Documenta Praehistorica XXVI, 6th Neolithic Studies: 29–39.*

THEOCHARIS R. D. 1973. *Neolithic Greece.*

TRIGGER B. 1980. *Gordon Childe. Revolutions in Archaeololgy*. London.

TYKOT H. R. 1996. Obsidian Procurement and Distribution in the Central and Western Mediterranean. *Journal of Mediterranean Archaeology 9/1: 39–82.*

VAN ANDEL H. T. AND SUTTON S. B. 1987. Landscape and Peple of the Franchthi Region. In T. W. Jacobsen (ed.), *Excavations at Franchthi Cave, Greece. Fascicle 2.* Indiana University Press. Bloomington and Indianapolis.

VAN ANDEL T. H., GALLIS K AND TOUFEXIS G. 1995. Early Neolithic farming in a Thessalian river landscape. In L. Lewin, M. G. Macklin and J. C. Woodward (eds.), *Mediterranean Quaternary River Environments: 131–144.*

VAN ANDEL H. T., RUNNELS N. C. 1995. The earliest farmers in Europe. *Antiquity 69/264: 481–500.*

VEIT U. 1993. Burials within settlements of the Linienbandkeramik and Stichbandkeramik cultures of Central Europe. On the social construction of death in early-Neolithic society. *Journal European Archaeology 1: 107–140.*

VENCL S. 1982. K otázce zániku sběraèsko-loveckých kultur. *Archeologické rozhledy XXXIV/6: 648–694.*

VITELLI D. K. 1993. Franchthi Neolithic Pottery. Volume 1: Classification and Ceramic Phases 1 and 2. In T. W. Jacobsen (ed.), *Excavations in Franchthi Cave, Greece. Fascicle 8.* Indiana University Press. Bloomington & Indianapolis.

VOYTEK B. A. and TRINGHAM R. 1990. Rethinking the Mesolithic: the Case of South-East Europe. In C. Bonsall (ed.), *The Mesolithic in Europe. Papers Presented at the Third International Symposium Edinburgh 1985: 492–499.*

WILKIE C. N. & SAVINA E. M. 1977. The earliest farmers in Macedonia. *Antiquity 71/271: 201–207.*

WILLIS K. J. AND BENNETT K. D. 1994 The Neolithic transition – fact or fiction? Palaeoecological evidence from the Balkans. *The Holocene 4: 326–330.*

WILLIS K. 1995. The Pollen-Sedimentological Evidence for the Beginning of Agriculture in Southeastern Europe and Anatolia. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji XXII: 9–24.*

WHITTLE A. 1996. *Europe in the Neolithic.* Cambridge.

ZILHÃO J. 1992. Conclusão: a Gruta do Caldeirão e neolização do território português. In J. Zilhão (ed.), *Gruta do Caldeirão. O Neolítico Antigo. Trabalhos de Arqueologia 6: 144–162.*

1993. The Spread of Agro-Pastoral Economies across Mediterranean Europe: A View from the Far West. *Journal of Mediterranean Archaeology 6/1: 5–63.*

1997. Maritime pioneer colonisation in the early Neolithic of the west Mediterranean. Testing the model against the evidence. *Poročilo o raziskovanju paleolitika neolitika in eneolitika v Sloveniji XXXIV: 19–42.*

ZOHARY D. 1996. The mode of domestication of the founder crops of Southwest Asian agriculture. In D. R. Harris (ed.), *The Spread of Agriculture and Pastoralism in Eurasia: 142–158.*

ZVELEBIL M. 1990. Mesolithic Prelude and Neolithic Revolution. In Zvelebil M. (ed.), *Hunters in Transition: 5–15.*

1998. Genetic and cultural diversity of Europe: a comment on Cavalli-Sforza. *Journal of Anthropological research 54: 411–417.*

ZVELEBIL M., ROWLEY-CONWY P. 1990. Foragers and Farmers in Atlantic Europe. In Zvelebil M. (ed.), *Hunters in Transition:* 67–93.

1994(1995). Neolithisation In Eastern Europe: A View From The Frontier. *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji XXII: 107–127.*

1996. The agricultural frontier and the transition to farming an the circum-Baltic region. In D. R. Harris (ed.), *The Spread of Agriculture and Pastoralism in Eurasia: 323–345.*

1998. Agricultural frontiers. Neolithic Origins, and the Transition to farming in the Baltic Basin. In M. Zvelebil, L. Domanska and R. Dennell (eds.), *Harvesting the Sea, Farming the Forest. The Emergence of Neoltihic Societies in the Baltic Region: 9–27.*

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Documenta Praehistorica XXVI

Pattern and mobility in the prehistoric settlements of the Edirne region, Eastern Thrace

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ABSTRACT - *This paper is a study of prehistoric settlement patterns and mobility in the Edirne Region, the north western part of Eastern Thrace. As a result of surface surveys of the region in 1995 and 1997, I was able to propose two different models of settlement mobility from the Neolithic to the Bronze Age. I have termed these the 'Extensive Mobility' and the 'Restricted Mobility' models. In this paper, I explain these two models in terms of the relationship between landscape and mobility in the region and discuss the wider question of sedentism in southeastern Europe. The results presented here should not be regarded as final, but as the basis for a future, more intensive survey in other parts of Eastern Thrace which, when combined with geomorphological studies, will allow the reconstruction of settlement patterns and help us to understand the mobility of prehistoric populations in Eastern Thrace.*

IZVLEČEK - *V članku predstavljamo prazgodovinske vzorce naselitve in mobilnost prebivalstva v regiji Edirne, ki leži na severozahodnem delu Vzhodne Trakije. Na podlagi terenskih pregledov regije v letih 1995 in 1996 smo predlagali dva modela poselitvene mobilnosti od neolitika do bronaste dobe. Imenovali smo ju model "ekstenzivne mobilnosti" in model "omejene mobilnosti". V članku oba modela razložimo v kontekstu regionalne mobilnosti in njene vezanosti na krajinske značilnosti. Analiziramo vprašanje sedentizma v jugovzhodni Evropi. Čeprav predstavljeni rezultati niso dokončni, lahko služijo kot osnova za bodoče intenzivnejše terenske preglede v drugih delih Vzhodne Trakije. Šele ko bomo rezultate povezali z geomorfološkimi raziskavami, bo mogoče rekonstruirati poselitvene vzorce in bolje razumeti mobilnost prazgodovinskega prebivalstva v Vzhodni Trakiji.*

KEY WORDS - *Thrace; Neolithic; Eneolithic; Early Bronze Age; settlement mobility; settlement patterns*

INTRODUCTION

Eastern Thrace is bordered by the Maritsa (Meriç) River to the west, by the Istranca Mountains, the Black Sea and the Bosphorus to the north and east, and by the Sea of Marmara and the Dardanelles to the south. The Ergene River, which is a tributary of the Maritsa River, runs from east to west across the centre of Eastern Thrace. The Ergene River and its tributaries constitute the main central plain of Eastern Thrace. The region of Edirne is a part of the upper Ergene basin. This region lies at a crucial point on the important land route linking the Balkans not only to the region of Marmara, but also to the Aegean.

The following discussions are based on result of a surface survey carried out by the author in 1995 in the province of Edirne (*Erdogu 1997; 1999a*). The aim of this survey was to identify new prehistoric sites, to refine the database of known sites and to identify the distributions of types. The survey interest expanded to cover the Neolithic to the Early Bronze Age periods only. Certain sections within the study area were chosen for original fieldwork where a gap in previous research was particularly apparent. The lands are known geographically as the basins of Tunca, Süloglu and the area along the southern

fringes of the Istranca Mountains. The decision to conduct fieldwork in these areas was determined by the need to lay some sort of foundation for the study of local prehistory. The study areas were selected to ensure as much coverage of different altitudinal and contrasting environments as possible.

MODELS OF MOBILITY

Are Early and Mature agricultural and Copper Age tell settlements in Southeast Europe signs of permanent residence? Planned tell settlements with developed houses and a large quantity of artefacts have generally been accepted as evidence for long-term permanent habitation. However, the concept of long-term permanent occupation has come under criticism due to re-examined tell settlements, studies of hunter-gatherer complexity and recent research on the relations between the settlements and their landscapes. The study of sedentism in non-Neolithic and early Neolithic societies and social anthropological studies of complex hunter-gatherers indicate that a sedentary lifestyle cannot be used as a hallmark of the Neolithic. If such forms of sedentary life are used as signifiers of especially the earliest Neolithic, then Neolithic society began developing in the Mesolithic. The study of pre and/or proto-Neolithic groups of the Iron Gate suggest that Iron Gate communities lived in permanent houses, subsisting without dependence on agriculture and stock breeding (*Srejović 1972; Chapman 1993*). A large number of burials have been recorded within the nine Mesolithic sites of the Iron Gates, such as Lepenski Vir, Vlasac, Padina, Schela Cladovei (*Radovanović 1996.161*). Important work on hunter-gatherer social complexity in the Denmark-Ertebølle Culture, suggests that some of the sites, such as Skateholm I, were seasonal campsites, but the dead were buried in a cemetery (*Rowley-Conwy 1992.1*). The seasonal occupation of Skateholm I was very large and the adjacent cemetery contains some 50 inhumations. In the other areas of northern and western Europe, Mesolithic cemeteries associated with semi-sedentary and/or semi-nomadic (?) groups were also found e.g. Moita do Sebastiao (*Roche 1989*), Amoreiras (*Arnaud 1989*) in Portugal and Vedbæk in Denmark (*Price 1985*). We might suggest that the cemeteries could have been a very important factor for occupation by some hunter-gatherers. Some hunter-gatherer communities occupied fixed settlements in different seasons, and cemeteries mark these fixed settlements. Ancestors probably play an important role in sedentism. For the early Neolithic we have seen that burials are rare, but they occur in some tells, such as Anza, Nea Nikomedia and Azmak (*Whittle 1996.59*). At Anza, most of the burials were found in the earliest level (*Nemeskeri and Lengyel 1976.376*). We should consider that the broader elements of the ideology of the Neolithic, such as ancestor cults, or permanent houses can already be found in the Mesolithic. The more established social anthropological studies of complex hunter gatherers also show that non-sedentary complex communities engaged in activities, ideologies and belief systems little different from those of settled communities (*Bailey 1997.44-45*). Zvelebil has recently argued that there seems to be a considerable continuity in social organisation across the economically defined Mesolithic-Neolithic transition (*Zvelebil 1998.23*)

Now I turn to the question of whether the Early and Mature agricultural and Copper Age tell settlements in Southeast Europe are signs of permanent residence. Recent archaeo-geological research in Northern Greece shows that the settlements of the flood plain early agricultural tells was temporary and not permanent (*van Andel et al. 1995*). The research suggests that the flood plain tells, such as Platia Magoula Zarkou and Koutsaki Magoula, were occupied only outside the flood season. Research on the soil history shows that the early Neolithic activity at both sites occurred when flooding was frequent. Runnels and van Andel note that many early farming flood plain sites exist in Southeast Europe, at the Körös settlements in Hungary, for example (*van Andel and Runnels 1995.494*). However, more recent investigations in the Tisza region in Hungary have shown that only a few Neolithic sites lie on tiny elevations on the flood plain. Most of the sites are set back from the edge of the flood plain (*Chapman 1994.81*). In addition, about 10 tells were investigated by Todorova in Northeast Bulgaria, and only one of them can be described as a flood plain tell (*personal communication from Chapman*). Last, but not least, at Anza in Macedonia, no break is known in the early agricultural layers (*Gimbutas 1976*). Similarly, the cultural sequence at the tell of Achilleion, Thessaly, was divided into four main phases, covering without interruption most of the Early and Middle Neolithic (*Gimbutas, Winn and Shimabuku 1989*). We should consider that two types of early tell settlement might be characteristic of south eastern Europe: seasonal tells, such as Platia Magoula Zarkou, and permanent tells, such as Anza. I believe that there are still gaps in our knowledge of the early tell settlements in south eastern Europe.

Tell settlements of the 5th millennium BC such as Ovcharovo in north eastern Bulgaria are marked by

a long series of abandonments and re-occupations, and not by continuous settlements (*Bailey 1996; 1997*). According to more recent excavations, the Karanovo tell is also not a continuous settlement (*Hiller and Nikolov 1997*). I can now raise some questions, such as what length and period could be accepted as permanent occupation. If a re-occupied tell shows interruption levels in some periods, can we call it permanent? For myself, at least, it is difficult to answer these questions. It seems that in south east Europe three types of site may be recognised: permanent and seasonal tells, re-occupied tells and flat settlements. During our surface survey in the Edirne region, almost all the settlements we found are flat, rather than tells.

Several differences between the spatial organisation of tells and flat settlements were outlined by Chapman: "...different locations for communal activity (focal points outdoors for flat settlements, indoor or off-tell for tells), different potential for settlement expansion (greater for flat settlements, less for tells), a different degree of tolerance of dimensional variability (greater for flat settlements, less for tells), and different attitudes to the maintence of tradition in the landscape (more stability on tells, less stability flat settlements)." (*Chapman 1989.39*). Settlements from the Edirne region can be described as mobile, re-occupied flat settlements. With the results of a surface survey, two models of settlement mobility in the Edirne region can be introduced. The first I call 'Extensive Mobility'. This model may explain the series of abandonments and re-occupation dispersed over a single wide landscape unit or community area (*Neustupny 1991.324*) such as a permanent stream, highland, coastline etc. The second model is 'Restricted Mobility', explaining abandonments and re-occupations of settlements dispersed over small, almost the same landscape unit. The size range of 'Extensive Mobility' is larger than of 'Restricted Mobility'. In 'Restricted Mobility' settlements are dispersed over an area of no more than 1 kilometre in radius. However, in 'Extensive Mobility' settlements are dispersed over an area of 10–20 km in radius in one community area.

Before testing our models, I describe the survey area and settlement pattern in the Edirne region.

DESCRIPTION OF THE AREA SURVEYED

The Tunca Basin

The Tunca River is a tributary of the Maritsa (Meriç) River, which rises in the Balkan Mountains, descends southwards, and joins the Maritsa River below the town of Edirne. The Tunca Basin was partly investigated by the University of Istanbul in 1982 and 1986 (*Özdoğan 1983.66; 1987.159*). During our survey in 1995 six prehistoric sites were visited in the basin (*Erdogu 1997.274*). No uplands and tributaries have been investigated. The Tunca Basin consists mainly of a flood plain. The settlements are found on the lower or higher river terraces, which are now intensively cultivated.

The Süloglu Basin

The Süloglu Stream is a tributary of the Ergene River which rises near the village of Vaysal and runs from north to south. The Suloglu Basin was investigated by the University of Istanbul in 1982 (*Özdoğan 1983.66; 1985.532*). During our survey in 1995, six prehistoric sites were visited between the district centres of Havsa and Suloglu (*Erdogu 1997.278*). Both sides of the Süloglu Stream are flanked by high and low terraces that are suitable for settlement and agriculture. The survey was carried out by walking along only these stream terraces. With the exception of one site, most settlements are situated on the lower stream terraces, close to the stream.

The area along the southern fringes of the Istranca Mountains

The Istranca Mountain range is composed principally of schist, gneiss, limestone, flysch and some granite pockets which were considerably eroded in later periods. The southern foothills are usually gentle and, compared to other parts of the region, this area is abundant in water and other natural resources. This area was chosen as the focus of the survey project in 1995 because it was a fertile area, previously unsurveyed (*Erdogu 1997.277*). The survey was mainly carried out by walking in directions suggested by local residents. Five prehistoric settlements have been recorded in the area. The settlements are concentrated along small streams or perennial tributaries, natural lines of communication and are generally close to natural water sources.

DESCRIPTION OF THE SETTLEMENT PATTERN

The siting of settlements in the Edirne region is linked to a number of predictable factors, such as locational preference for riverine environments, the selection of fertile soils for agricultural exploitation, and proximity to water sources and natural lines of communication. In the course of our survey, there was no evidence of early Neolithic settlement. Allu-

Fig. 1. Distribution of Prehistoric settlements in the Edirne Region: 1. Çardakalti; 2. Çardakli; 3. Kumocagi/Avariz; 4. Köprubasi; 5. Dustubakyamasi; 6. Kaldirim; 7. Kavakli; 8. Ortakçi; 9. Kaynaklar/Sulecik; 10. Kaynaklar/Yagcili; 11. Kocahöyuk; 12. Karabas; 13. Kocatepe; 14. Tepeyani; 15. Kaynaklar/Arpaç; 16. Yumurta Tepe; 17. Cevizlik; 18. Degirmen Çesme

vial deposits probably cover the early occupations of sites in the Edirne region. The earliest pottery found in the survey was Balkan Karanovo III.

Karanovo III and Early IV

Karanovo III and Early IV assemblages are found at five settlements, all of which are located on the lower terrace of the Tunca and Süloglu basin, some 10–20 m above the flood plain. The settlements occur on the gentle slopes of small streams or perennial tributaries in the area along the southern fringes of the Istranca Mountains. Karanovo III and Early IV pottery is particularly common in Eastern Thrace.

Kalojanovec-Çardakalti

A total of five Kalojanovec-Çardakalti settlements are represented. This period displays a major change in the location of settlements in the Tunca Basin. In comparison with the Karanovo III and Early IV settlements, there was a tendency to locate settlements more frequently on the upper river terraces, some 50–60 m above the flood plain. The settlement of Çardakalti is the only excavated site in the Tunca Basin (*Kansu 1963*). It revealed only a single cultural phase, containing Kalojanovec material with some local variations. During our survey, the settlement of Kumocagi/Avariz in the Tunca Basin was also investigated (*Erdogu 1995*). This settlement was damaged by a large trench dug for the quarrying of sand. However, on the eastern side of the settlement we were able to locate a single stratum in the profile cut by bulldozers which seems to bear some of the characteristic elements of Kalojanovec culture.

There is no evidence of Kalojanovec-Çardakalti settlements in the Süloglu basin. However, three settlements were found on the slopes of small streams and gulches in other parts of the surveyed areas, two of which are on settlements previously occupied during the Karanovo III and early IV periods.

Marica/Pre-Cucuteni and Karanovo VI

These periods are marked by a decrease in the number of settlements in Eastern Thrace. However, in the course of our survey, five settlements were found in the Süloglu Basin and one in the area along the southern fringes of the Istranca Mountains. The settlements are generally situated on the lower terraces. Only one settlement, Yumurta Tepe, is located on the edge of the upland, some 120–140 m above the flood plain. Much to our suprise, we found an absence of material dating to this period (the 4th millennium BC) in the Tunca Basin. It is an important point that the settlements occupied during the earlier periods were not settled during this period.

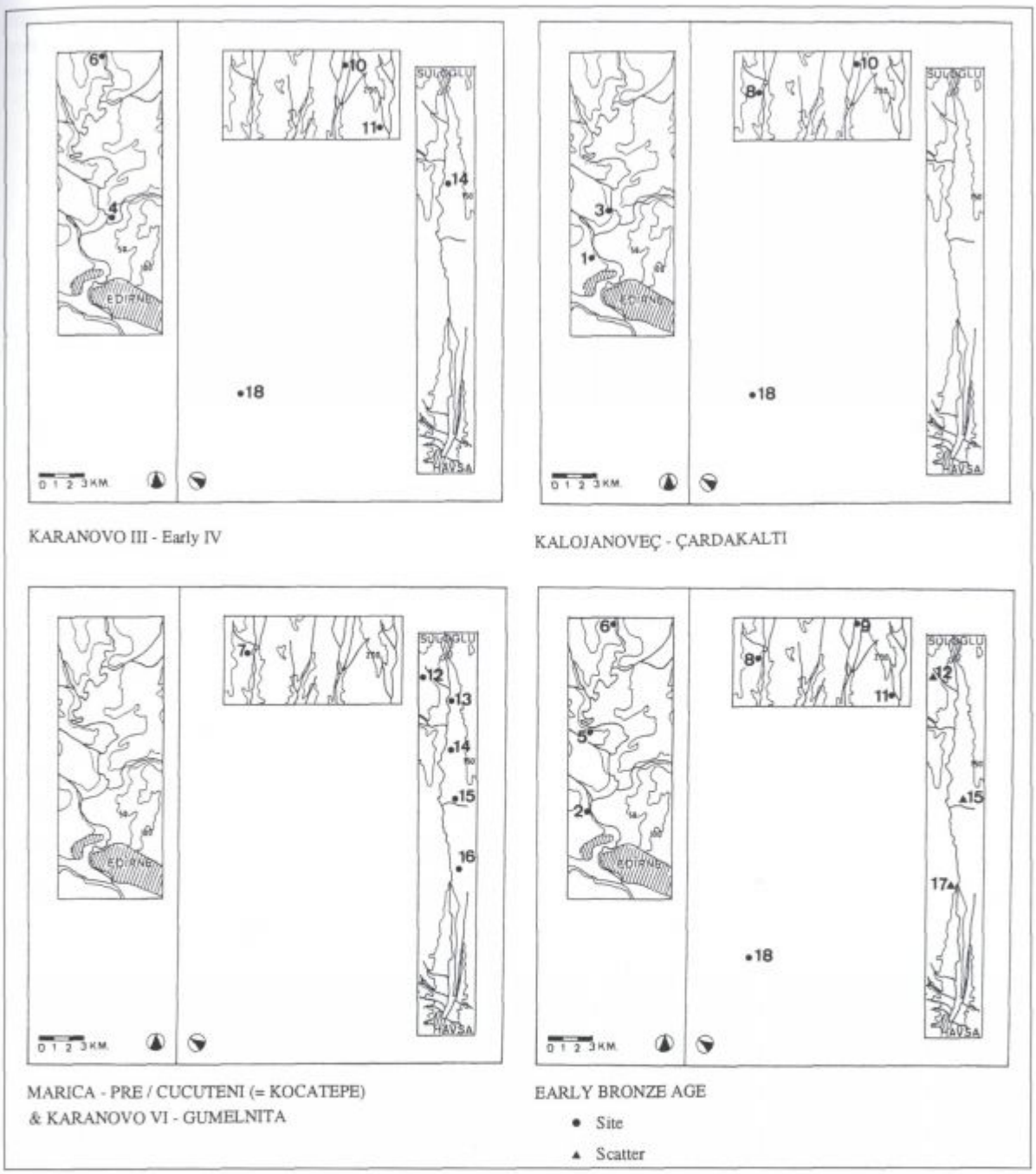

Fig. 2. Prehistoric settlements in the Survey Area.

The Early Bronze Age

During the Early Bronze Age there was an increase in the number of settlements in the Erdine region. With the exceptions of the Tunca Basin, the Early Bronze Age settlements are often situated on settlements previously occupied during earlier periods. The settlements are situated on the lower and upper river terraces, and the slopes of small streams. Most are large-scale sites. There are also small settlements associated with larger settlements. In the Süloglu Basin were found only single finds from the Early Bronze Age.

SETTLEMENT MOBILITY: A CASE STUDY IN THE EDIRNE REGION

Occupation at the settlements of the Edirne region was marked by a series of abandonments and re-occupations. The settlements are often situated on sites previously occupied during earlier periods. However, later arrivals (?) settled not on the top of the early settlements, but always nearby. This pattern fits our 'Restricted Mobility' model. A number of settlements comprise a similar pattern, especially in the Süloglu basin and the area along the south-

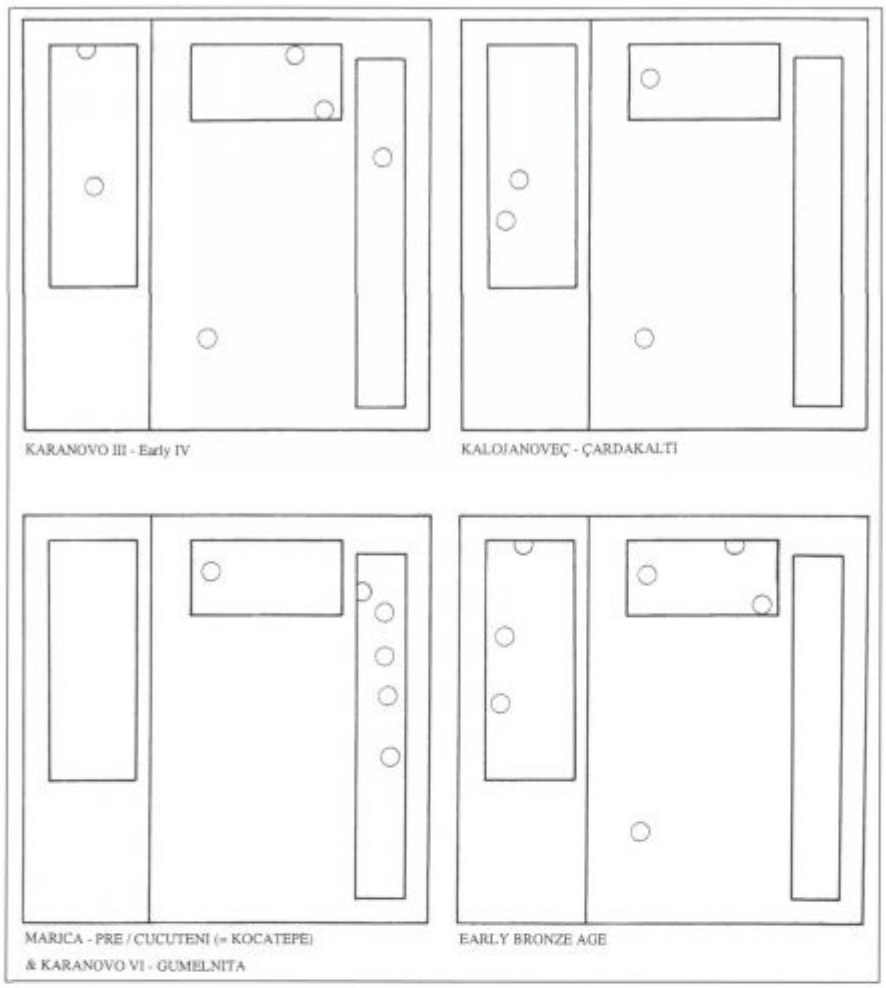

Fig. 3. Prehistoric settlements focis in the Survey Area.

ern foothills of the Istranca Mountain. Noteworthy among these settlements is Kavakli-Ortakçi, some 20 km northeast of the town of Edirne, south of the village of Kavakli, just to the south of the road leading to the village of Yagcili. Kavakli-Ortakçi is situated on the west bank of Çiftlik (or Ortakçi) Stream, which is a tributary of the Iskenderköy. On the west bank of the stream, there is a small narrow gulch. The settlements were found on both sides of the gulch. In Kavakli-Ortakçi, settlement history dates back to the end of the 5th millennium BC. Kalojanovec pottery is the earliest find from the south of the gulch. We suggest that, during this period, the settlement was small. The 4th millennium settlements were situated on the north of the gulch and are marked by Pre-Cucuteni/Marica and Karanovo VI assemblages. A Pre-Cucuteni/Marica (= Kocatepe) settlement was found just south of the village, far from the stream and the gulch. It is approximately 100 m in diameter. A Karanovo VI settlement is located roughly 120–150 m southwest of the Pre-Cucuteni/Marica (i.e. Kocatepe) settlement, close to the gulch. It is about 100 m in width and less than 1 m in height (*Erdogu 1999b*). Material density is high in an area of 50 square metres. According to surface finds, the early stage of the Early Bronze Age settlements is missing in this area. The Early Bronze Age II settlement was found on the south side of the gulch which is considerably larger than the earliest settlements. It is some 250 m in diameter and 5–6 m high. There is a hiatus in settlement between the Early Bronze Age II and the Late Bronze Age period. A small settlement of the Late Bronze Age-Early Iron Age was found at the confluence of the stream and gulch.

The Yumurta Tepe site is also particularly noteworthy for our 'Restricted Mobility' model. It is located some 12 km north of the district centre of Havsa and about 1 km east of the village of Haskõy. It is situated on the east bank of the Suloglu stream. To the east of the stream is a high terrace with an elevation of about 120–140 m, on which the site has formed. A natural spring was found nearby. Yumurta Tepe is dated to the 4th millennium BC; the Pre-Cucuteni/Marica (i.e Kocatepe) and Karanovo VI settlements were found side by side. The Karanovo VI settlement is about 60 m in diameter, and perhaps

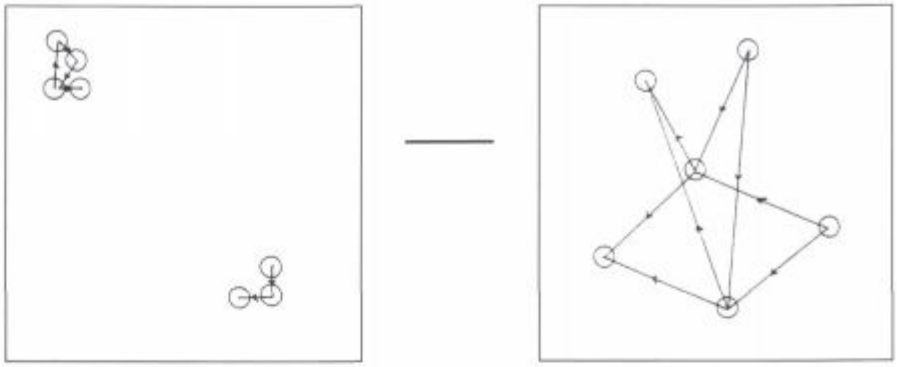

Fig. 4. Models of 'Restricted Mobility' (left) and 'Extensive Mobility' (right).

1 m in height. The settlement is dated to the latest stage of the Karanovo VI Culture. The Pre-Cucuteni/ Marica (Kocatepe) settlement is located to the southeast of the Karanovo VI settlement. It is around 100–150 m in width (*Erdogu 1999b*). We suppose that the Early Bronze Age settlement lies under the modern village of Hasköy, to the east of the stream.

The settlements of the Sülogu Basin and the area along the southern foothills of the Istranca Mountains have patterns comparable to those of Asagipinar-Kanligeçit, near the town of Kirklareli, around 40 km east of Edirne (*Özdoğan et al. 1997*), and Drama in southern Bulgaria, some 60 km northwest of Edirne (*Fol et al. 1989.81*). However, settlement mobility in the Tunca Basin is significantly different, and it can serve as an example of our 'Extensive Mobility' model. In the Tunca Basin, Karanovo III/early IV settlements were found on the lower terraces. At the end of the 5th millennium BC, all settlements were abandoned. The Kalojanovec-Çardakalti assemblage is marked by a shift from lower terrace to upper terrace settlement. At the beginning of the 4th millennium, the new settlements were also abandoned, and no evidence of 4th millennium settlement in the Tunca Basin has been found. During the Early Bronze Age, the settlements were situated on the lower and upper river terraces, and with one exception, there is no evidence of overlapping settlements.

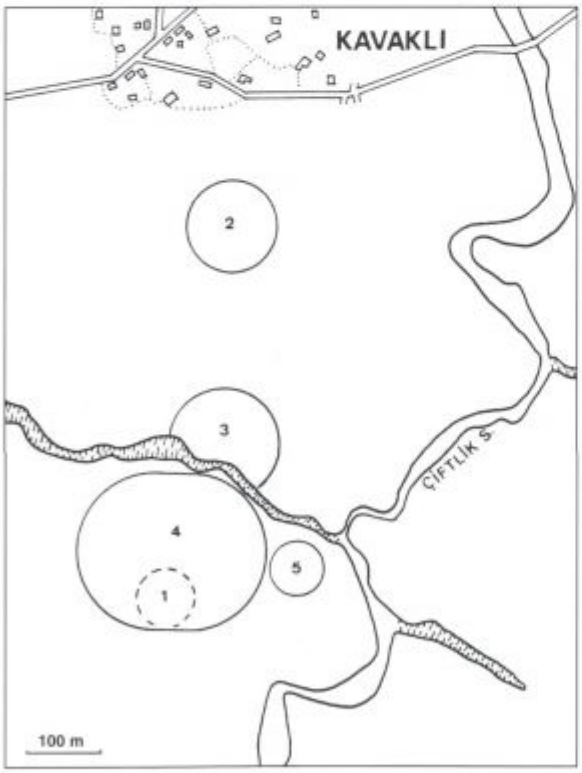

Fig. 5. Location map of Kavakli–Ortakçi: 1. Kalojanoveç – Çardakalti settlement; 2. Marica – Pre / Cucuteni (=Kocatepe) settlement; 3. Karanovo VI – Gumelnita settlement; 4. Early Bronze Age II settlement; 5. Late Bronze – Early Iron Age settlement.

It seems evident that the movement of settlements through the different periods occured in different parts of the landscapes in the Edirne region. Reoccupations always occurred close to earlier, abandoned settlements, not on top of them. The apparent non-existence of tell settlements in the Edirne region may be explained in this way.

CONCLUSIONS

A study of settlement pattern and mobility in the prehistoric settlements of the Edirne region is outlined above. The results are inferences based on a surface survey which are not yet confirmed by systematic excavation. It seems evident that the prehistoric settlements in the Edirne region were not long-term permanent. The abandonment and reoccupation of settlements are dispersed either over one large landscape unit (Extensive Mobility), such as the Tunca River, or over small and almost identical landscape units (Restricted Mobility), such as the sites of Ortakçi-Kavakli and Yumurta Tepe, but are not overlapping settlements. There are, as yet, no geomorphological studies, no detailed soil analyses and no pollen diagrams of Eastern Thrace. Hence, we

can only speculate for the time being on what factors contributed to settlement change in the Edirne region. A number of factors, including physical and social, affecting settlement mobility have already outlined by Whittle (*Whittle 1997.20–21*) It is not yet clear whether settlement change in the Edirne region was due to changes in landscape (soils or natural water sources), climatic changes or other, social factors.

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REFERENCES

ARNUAD J. E. M. 1989. The Mesolithic Communities of the Sodo Valley, Portugal, in Their Ecological Setting. In C. Bonsall (ed.), *The Mesolithic in Europe: Papers presented at the 3th International Symposium: 614–631.*

BAILEY D. W. 1990. The living house: signifying continuity. In R. Samson (ed.), *The Social Archaeology of Houses: 18–48.*

1997. Impermanence and Flux in the Landscape of Early Agricultural South Eastern Europe. In J. Chapman and P. Dolukhanov (eds.), *Landscapes in Flux. Central and Eastern Europe in Antiquity. Colloquia Pontica 3: 41–58.*

CHAPMAN J. 1985. The Early Balkan Village. In S. Bökönyi (ed.), *The Neolithic of Southeastern Europe and Its Neareastern Connections. Varia Archaeologica Hungarica II: 33–53.*

1993. Social power in the Iron Gates Mesolithic. In J. Chapman and P. Dolukhanov (eds.), *Cultural Transformations and Interactions in Eastern Europe: 61–106.*

1994. Social power in the early farming communities of Eastern Hungary-Prespectives from the Upper Tisza region. *Jósa András Múzeum Évkönyve XXXVI: 79–99.*

ERDOGU B. 1995. The Matt-White Painted Pottery from Eastern Thrace: A new look at the relations between the Balkans and Anatolia. *Anatolian Studies XL: 267–272.*

1997. Edirne ili 1995 yili Yuzey Arastirmasi. *XIV Arastirma Sonuçlari Toplantisi I, Ankara: 273–291.*

1999a. 1997 yili Edirne ili Yuzey Arastirmasi. *XVI Arastirma Sonuçlari Toplantisi. Ankara (in press).*

1999b. Late Chalcolithic Pottery from Kavakli and Yumurta Tepe, Edirne, Eastern Thrace. *Proceedings of the Prehistoric Society 65 (in press).*

FOL A., LICHARDUS J., BERTEMES F. and KARASTEV I. 1987. Bericht uber die bulgarisch-deutschen Ausgrabungen in Drama (1983–1988). *Bericht der Römisch-Germanischen Kommission 70: 10–128.*

GIMBUTAS M. (ed.) 1976. *Neolithic Mecedonia: as reflected by excavations at Anza.* Los Angeles.

GIMBUTAS M., WINN S. and SHIMABUKU D. 1989. *Achilleion: A Neolithic Settlement in Thessaly, Greece, 6400–5600 BC.* Los Angeles.

HILLER S. and NIKOLOV V. (eds.) 1997. *Karanovo: Die Ausgrabungen im Südsektor 1984–1992.* Salzburg-Sofia.

KANSU S. A. 1963. Marmara Bölgesi ve Trakyada Prehistorik Iskan Tarihi Bakimindan Arastirmalar. *Belleten, XXVII: 289–296.*

NEMESKERI J. and LENGYEL I. 1976. Neolithic Skeletal Finds. In M. Gimbutas (ed.), *Neolithic Mecodenia: as reflected by excavations at Anza: 375–410.*

NEUSTUPNY E. 1991. Community areas of prehistoric farmers in Bohemia. *Antiquity 65: 326–331.*

ÖZDOĞAN M. 1983. Dogu Marmara ve Trakya Arastirmalari, 1982. *I. Arastirma Sonuçlari Toplantisi, Ankara: 63–68.*

1985. A Surface Survey for Prehistoric and Early Historic Sites in Northwestern Turkey. *National Geographic Research Reports-1979 Projects: 517-541.*

1987. 1986 yili Trakya ve Dogu Marmara Bölgesi Arastirmalari. *V. Arastirma Sonuçlari Toplantisi II, Ankara: 323-346.*

ÖZDOĞAN M., PARZINGER H. and KARUL N. 1997. Kirklareli Kazilari: Asagipinar ve Kanligeçit Höyükleri. *Arkeoloji ve Sanat 77: 2-11.*

PRICE T. D. 1985. The Mesolithic of Western Europe. *Journal of World Prehistory 1/3: 225-305.*

SREJOVIĆ D. 1972. *Europe's First Monumental Sculpture: New Discoveries at Lepenski Vir.* New York.

RADOVANOVIĆ I. 1996. *The Iron Gates Mesolithic.* Michigan, Prehistory Press.

ROCHE J. 1989. Spatial Organisation in the Mesolithic sites of Muge, Portugal. In C. Bonsall (ed.), *The Mesolithic in Europe: Papers presented at the 3th International Symposium: 607-613.*

ROWLEY-CONWY P. 1993. Cemeteries, seasonality and complexity in the Ertebølle of Southern Scandinavia. *University of Durham and Newcastle upon Tyne Archaeological Reports 1992: 1-5.*

van ANDEL T. H., GALLIS K. and TOUFEXIS G. 1995. Early Neolithic farming in a Thessalian river landscape. In L. Lewin, M. G. Macklin and J. C. Woodward (eds.), *Mediterranean Quaternary River Environments: 131-144.*

van ANDEL T. H. and RUNNELS C. N. 1995. The earliest Farmers in Europe. *Antiquity 69: 481-500.*

WHITTLE A. 1997. Moving on and Moving around: Neolithic settlement mobility. In P. Topping (ed.), *Neolithic Landscapes: 15-22.*

ZVELEBIL M. 1998. What's in a name: the Mesolithic, the Neolithic and social change at the Mesolithic-Neolithic transition. In M. Edmuns and C. Richards (eds.) *Understanding the Neolithic of Northwestern Europe: 1-36.*

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Documenta Praehistorica XXVI

The built environment: pit-huts and houses in the Neolithic

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ABSTRACT - *Among the major changes which emerged in southeastern Europe after 6500 BC, one of the most significant was that people began to build their social environments. Two main types of architecture were used: pits-huts and surface-level structures. This paper examines the character of these two forms of buildings and suggests that they represent important differences in community structure and organization. Examples are drawn from three sites, Divostin (phases I and II), Usoe and Ovcharovo-gorata.*

IZVLEČEK - *Med mnogimi spremembami, ki so se pojavile v jugovzhodni Evropi po letu 6500 BC, je bila ena najpomembnejših, da so ljudje začeli postavljati stavbe in s tem graditi svoje socialno okolje. Glavni vrsti arhitekture sta bili: polzemljanke in stavbe, postavljene na nivoju tal. V članku raziščemo značaj obeh vrst stavb. Menimo, da kažeta pomembno razliko v ustroju in organiziranosti skupnosti. Primere navajamo iz treh najdišč: Divostin (fazi I in II), Usoe in Ovcharovo-gorata.*

KEY WORDS - *Southeastern Europe; Neolithic; pit-huts; houses; social environment*

INTRODUCTION

One of the most important developments in human behaviour which occurred in prehistoric southeastern Europe was the adoption of permanent architecture. After 6500 BC, people built new social environments of pit-huts and surface-level houses which they grouped in camps and villages. The emergence of the built environment had major consequences for the ways people lived their lives. The most important of these consequences were changes in the physical and social arrangements of people, places and things.

This article investigates the emergence of the built environment in southeastern Europe after 6500 BC. Two forms of building are examined: pit-huts and surface-level structures. Several examples will be described and then assessed in terms of three variables: spatial arrangement; the processes of construction and abandonment or destruction; and duration. Examination of the built environment of Neolithic southeastern Europe in these terms reveals important distinctions in the organisation and structure between the communities which lived in pit-hut camps and those which lived in villages of surface-level structures.

PIT-HUTS

The digging out of shallow pits and the erection, over them, of wood, twig and clay superstructures made up the built environment for many Neolithic communities in both the early part of the Balkan sequence and in its later phases. Two examples of pit-huts will illuminate their character.

The first example comes from the late seventh and early sixth millennium BC, Starčevo phase, camp at Divostin in Serbia (*Bogdanović 1988*) (Fig. 1). The pit-huts, or 'earth-cabins' as the excavators termed them, were round or elliptical in form; some had concentrations of stones in the middle of their floors and these would have supported posts which would have held-up pit-hut roofs. In some huts small

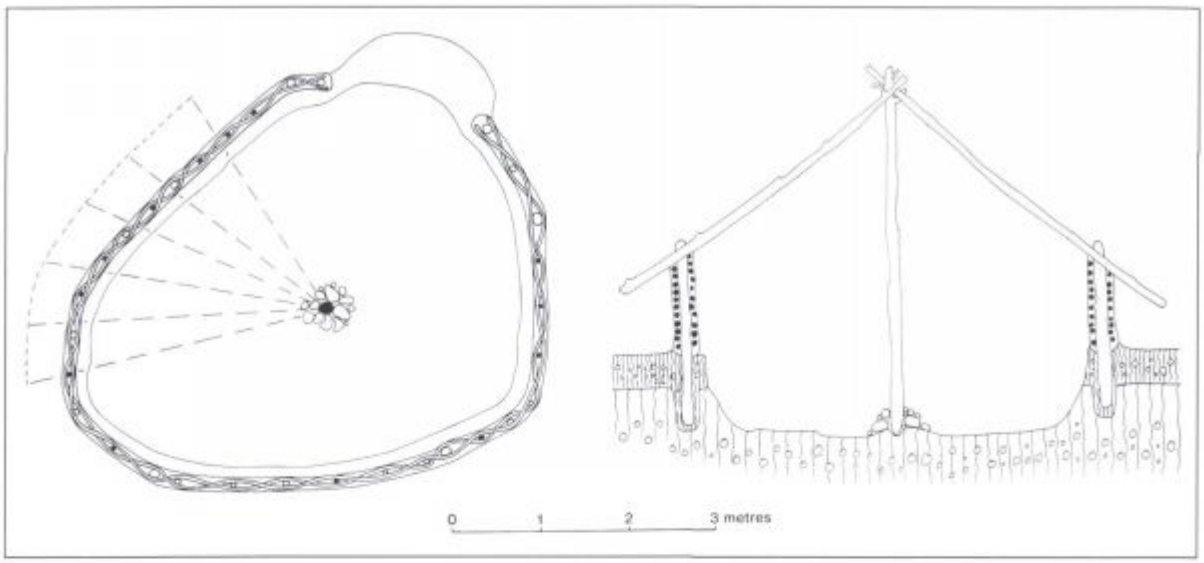

Fig. 1. Pit-hut from Divostin I (after* Bogdanović 1988*).

hearths were built. The Divostin pit-huts were not very large, measuring no more than 5 x 5 m; in depth they were no deeper than 0.5 m. When excavated the pit-huts contained a variety of different things including ceramics, flint tools, animal bones, anthropomorphic figurines, and as well as deposits of rubbish and ash. In terms of type and quantity of hut content, as well as in hut size and form, there is great variation between the structures at Divostin.

The second example of pit-huts comes from the early fifth millennium BC site of Usoe in northeastern Bulgaria (*Todorova 1973; Vajsov 1990; Gatsov 1990*). As at Divostin, there is great variation in the size and contents of the Usoe huts. Some were quite large, measuring more than 10 m in length, others were much smaller. Some pit-huts contained hearths. In and around the pit-huts were concentrations of lithic tools, pottery and anthropomorphic figurines. Also found were a great many zoomorphic figurines, all of which represent quadrupeds, and most have horns. In some pits there specific sets of lithic tools, perhaps dedicated to butchering animals and working hides and skins (*Gatsov 1990*). The huts were spread out along a terrace in a roughly linear arrangement and there may have been several, loose, clusters of structures, although there is no clear division of space within the site (Fig. 2). In its linear spread along the terrace, Usoe resembles many Neolithic sites, especially those in the northern Balkans, which overlooked river- and stream-valleys and floodplains.

What can we infer from these records of the built environment about the ways in which people lived their lives and, most especially, about people's interrelationships?

The character of pit-huts

The Divostin and Usoe pit-hut camps were very similar, despite the 1000 years which separate them. Their common character is evident in the spatial arrangement of huts, in the processes of their construction and abandonment and in their duration. Spatial arrangement concerns the form and size of the huts themselves, the organisation of their interiors and the horizontal layout of pit-huts, one to another, across the site. Investigation of spatial arrangement must also consider the numbers and types of activities which took place within individual pit-huts and those which would have taken place outside and between them. Assessment of the processes of construction and abandonment includes an examination of the methods and materials of building, as well as the processes which mark the end of pit-hut use. Duration reflects the life-history of structures.

Spatial arrangement

With very few exceptions, the pits-huts were small and round. Their limited size meant that, at any one time, they could have accommodated few people and few separate activities. The evidence for activities taking place outside of pit-huts is strong, both for the sites in question and for many other similar sites from the Balkan Neolithic. If separate activities are conceived in spatial terms as different domains (*see Cribb 1994*), then in pit-hut camps many different,

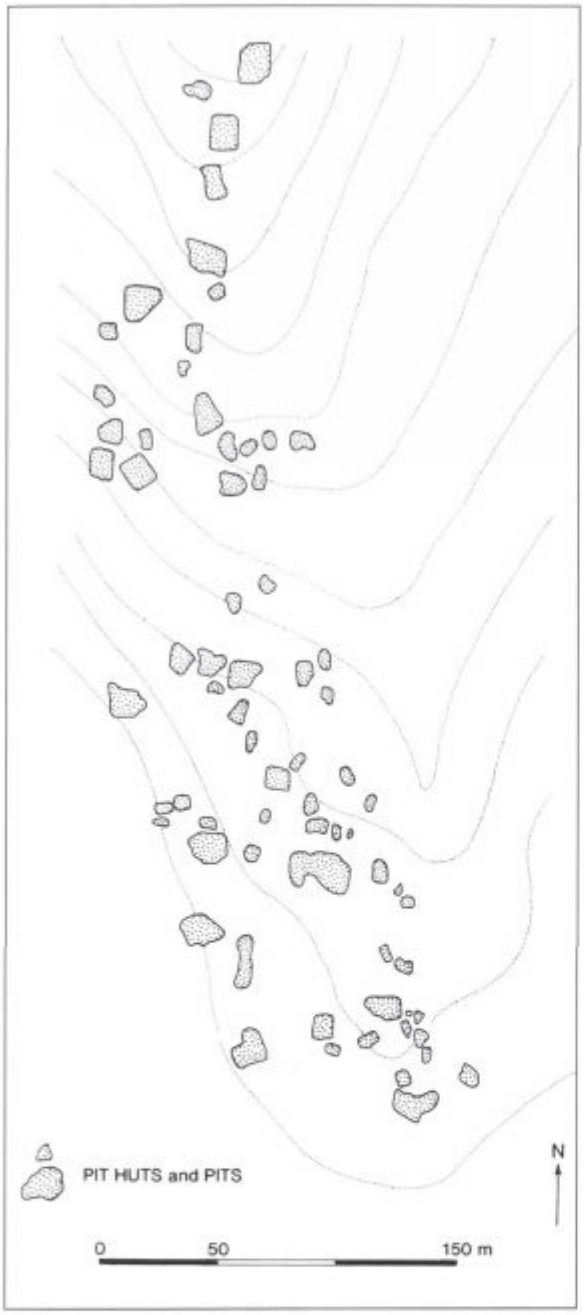

Fig. 2. The site of Usoe in northern Bulgaria (after* Vajsov 1990*).

separate domains of activities existed in the pit-hut camps, both within, but also, perhaps more frequently, outside of huts. In pit-hut camps, domains of activity were not fixed or permanent zones; they were adjustable and overlapping areas and would have shifted around a site and changed according to different working or living activities or social occasions.

A distinction can be drawn between two types of activities which took place in and around these pit-huts. Some activities concern the biological functions of life such as eating and sleeping; these can be considered as living-aspects (*Hunter-Anderson 1977*). The second type of activities can be considered as role-aspects; these are activities through which people establish, intentionally or otherwise, their identity and place within their communities. In the Divostin and Usoe camps, the majority of activities which took place were living-aspects, such as making and repairing flint tools, working hides and skins, eating, sleeping and sheltering.

There is, however, evidence for role-related activities at Usoe and Divostin. At both sites people made and used anthropomorphic and zoomorphic figurines and, especially at Usoe, they made and used a series of small clay objects, which have been interpreted as tokens or counters (*Budja 1998.219–235*). These objects, especially the figurines, were employed in ceremonies and rituals related to the expression of identities and relationships among people (*Bailey in press*). On balance however, both of the pit-hut camps examined here and, I suggest, others of similar form across the region in the Neolithic, were dominated by living-aspect activities with role-related activities accounting for a much smaller part of people's time or of camp space.

It is highly likely that most role-related activities occurred away from pit-hut camps. This is important because similar distinctions between the places and types of activities are evident in many communities of foragers. In such communities, activities which were integral to the definition of peoples' roles and identities, such as animal kills and, more crucially perhaps, during the distribution of meat after kills, occur away from camps (*Hunter-Anderson 1977. 313*).

Other important patterns of spatial arrangement are evident in the alignment of pit-huts within camps. At both Divostin and Usoe there is no obvious pattern of spatial relationships of one hut to another, nor is there an ordered layout of structures across either camp as a whole. While the sense of spatial disorganisation is particularly strong at Divostin, it is also present at Usoe. If there is any pattern, it is at Usoe where the pit-huts are distributed in a roughly linear fashion along the terrace. Such an alignment of huts is common in communities where the maintenance of visual contact between settlement and some external part of the landscape is important; thus linear arrangements of structures are found in camps which face important resource zones or conduits of access such as beaches or rivers (*Whitelaw 1994.165*).

Of greater interest, perhaps, is the recognition that linear arrangements of huts restrict the number of direct neighbours that any one hut can have. In this sense, sites with linear arrangements of buildings do not emphasis the coherence of the larger community group (*Whitelaw 1994.165*). Thus, one could argue that the inhabitants of camps with linear arrangements of pit-huts may have engaged primarily in the types of activities which required only small-scale co-operation of people or of small groups of people; such activities may have included hunting, herding, simple gathering and small-scale garden horticulture.

Creation and abandonment of pit-huts

A second element of the shared character of pit-hut camps is evident in the processes of their construction and abandonment. As with their spatial arrangement, these processes have important implications for the organisation and structure of camp communities. In their creation, pit-huts were easy to make. Some took advantage of natural hollows in the ground; for others little digging was required as the depth of pit-floors was seldom lower than 0.5 m below the surface. The use of readily available materials, such as saplings, branches, mud and, perhaps, clay, which required little if any modification or transportation before use, also suggests that the creation of Neolithic pit-huts was not technically difficult and involved relatively small investments of time, effort or planning.

The social anthropologist Tim Ingold has highlighted the distinctions in planning evident in the creation of different types of living structures. At one end of the spectrum are the casually made nests which non-human primates, such as chimpanzees, gorillas and orangutans, create on a nightly basis and which are used once for nothing other than sleeping and which are abandoned each morning (*Ingold 1995; Groves and Pi 1985*). Nests are made out of materials which are close at hand and there is little, if any modification of materials or planning involved. In this sense, raw materials are 'co-opted' for use in the nest. In considering the creation of pit-huts, the distinction between building by co-option and building by construction is significant. Construction is the adaptation and transformation of raw materials, some of which may need to be acquired at a distance, to fit into an existing architectural form. Following Ingold's distinctions, the pit-huts of Neolithic sites such as Divostin and Usoe, were created through processes of co-option, although unlike the one-off nests, their creation involved some modification and transportation of materials and they were used for longer periods of time.

Duration of pit-huts

The recognition of the co-optive character of the creation of pit-huts invests them with a sense of the temporary and unplanned. This sense also pervades their life-use and destruction and abandonment. Many elements of hut creation, such as the posts, poles and coverings, were relatively perishable and would not have lasted beyond a single sequence of one or two seasons without substantial repair or replacement. However, pit-huts combine this sense of the impermanent with a degree, though more limited, of the fixed and the concrete. Thus, as well as the impermanent and perishable, pit-hut creation also used more permanent fixtures, such as stone platforms, hearths, stone post-footings and levelled or lined floors. This combination of the temporary and the fixed represents a trade-off between the demands of mobility and flexibility, on the one hand, with the need for security and comfort on the other (*Cribb 1994*).

One consequence of the simplicity of much of the building materials employed in creating the superstructure and the absence of any significant investment of labour in their creation was that the wood and mud superstructure of huts could be dismantled easily and moved or, more likely, simply discarded and abandoned. The more permanent fixtures could have been abandoned though, perhaps, with the intention that they were re-used at a later date.

Thus, while not as impermanent as the nests of non-human primates, pit-huts were relatively temporary structures. In terms of duration of occupation and settlement, they represent mobility and portability. Pit-hut camps such as Divostin and Usoe would have been occupied at any one time for a very limited period, perhaps over a season. If pit-huts were occupied over longer periods of time, then it is most likely that these longer uses were punctuated by significant episodes of vacancy and abandonment. Thus, although pit-hut camps may have been occupied repeatedly over longer periods of time, the dominant character of these camps was one of transience.

Social consequences and inferences of pit-huts

In terms of their spatial arrangement, creation, abandonment and duration, the pit-hut camps of the Neolithic Balkans are best characterised as loose collec-

tions of structures which were designed and used for single living- or role-aspect activities and which were used over the short-term. The people who inhabited such camps were probably members of small groups whose relationships may have been based on kinship and on descent through generations. These kinship relations were rooted in routines and rituals of alliances, contacts, sharing and communality which occurred without any great concern for a particular place in the landscape, let alone in any individual built structure. Indeed, few activities took place in pit-hut interiors; most took place outside of pit-huts and away from the camps themselves. The character of pit-huts which is shared by the structures at Divostin and at Usoe and the inferences drawn from them are very different from the character and inferences of surface-level structures

SURFACE-LEVEL STRUCTURES

Surface-level structures are the second major architectural form of the Balkan Neolithic and they are different from pit-huts in important ways. Again, two examples will be described and assessed. The first example comes from the fifth millennium BC, later Vinča culture phase of Divostin (*Bogdanović 1988*). In Divostin II, a number of separate surface-level structures were built. Building no. 14 is a good specimen (Fig. 3). Compared to the earlier pit-huts, Building 14 is large, measuring 16 m in length and 6 m in width. It is not circular, but rectangular in form and its interior is complex, divided into three separate rooms. Furthermore, the building contains four hearths and there are separate intra-mural domains for different activities. There is also a greater diversity and quantity of objects within the structure; pottery vessels were more numerous and complex in form. The distinction of separate, fixed, repeatedly used, domains dedicated to particular activities is a character of the Divostin village as a whole in this phase. Thus, there are areas given over to working copper, malachite, azurite and quartz. Other buildings at Divostin share Building 14's orientation and rectilinear form, although some are larger and others smaller.

The second example of surface-level structures comes from the site of Ovcharovo-gorata in northeastern Bulgaria (*Angelova 1988; 1992; Angelova and Bin 1988*). Like Building 14 at Divostin, the Ovcharovo-gorata buildings are rectilinear in form. In most cases they are no larger than 5 x 5 m and most have only one room. Two buildings, nos 7 and 15, are exceptions and have two rooms each. Every house has a hearth in its interior; one house, no. 15, has two, one in each of its rooms. As at Divostin, house interiors contain large numbers of tools, pottery and other objects. The similarity between different structures in terms of size and form is very strong; the orien-

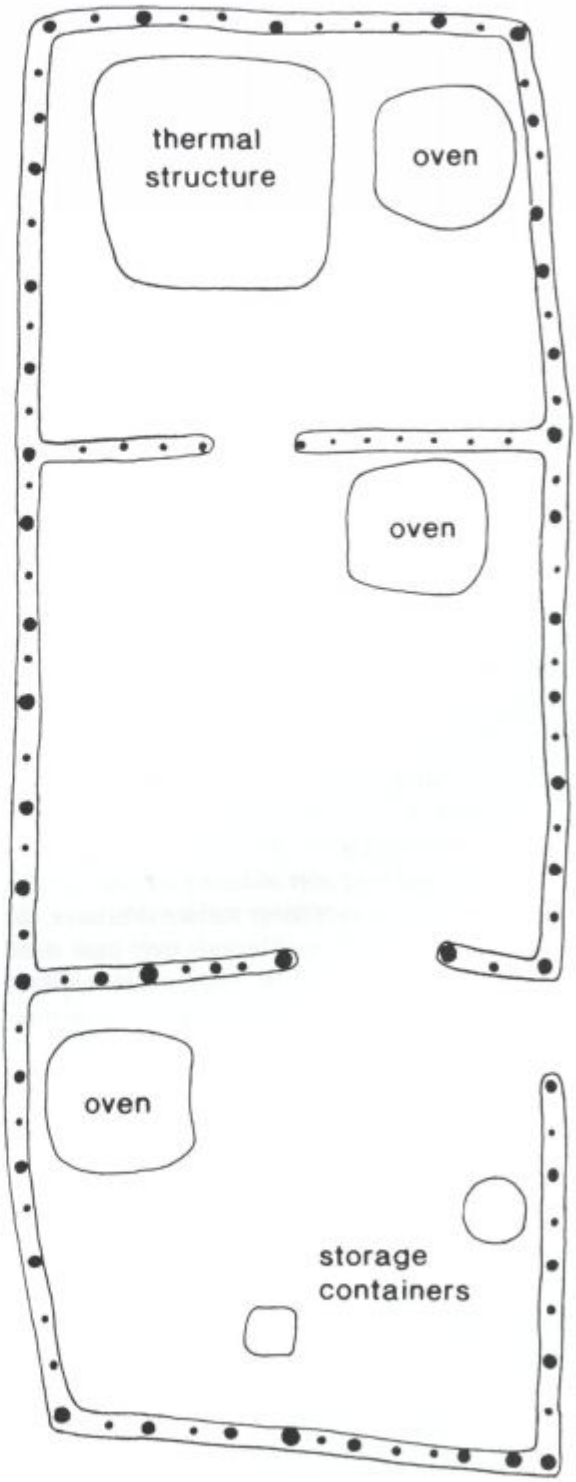

Fig. 3. Building no. 14 at Divostin II (after* Bogdanović 1988*).

tation of one building to another is also marked, although, as discussed below, there were three separate orientations in use.

Spatial arrangement

The Divostin building and, at least, two of the Ovcharovo structures are larger than the pit-huts. This difference has important implications for our examination of social structure and organisation. The larger size of the Divostin building and of two of the buildings at Usoe have the very practical implications that separate activities and more people could have been accommodated within any one structure at any one time. While there is continued evidence that activities occurred outside of buildings, there were more separate, fixed, domains dedicated to separate activities within the buildings at Usoe and Divostin II. Compared to the pit-hut camps, the villages of surface-level structures contain more permanent, fixed and unadjustable domains of activities. Both living- and role-aspect activities occurred within these surface-level structures, although there appear more role-related activities, such as textile production, than were present in pit-huts.

While the pit-huts were oval or round in plan, the surface level structures were rectilinear in form; this distinction has two important implications. On the one hand, the interiors of rectilinear buildings can be divided easily into smaller rooms and sub-units; the division of oval or round interiors sacrifices space to acutely angled corners. The potential for subdivision, and for easily added-on external rooms, suggests that in the rectilinear surface structures, the expansion of building-based groups, over time, could be accommodated within the same space or physically attached extensions. Thus rectilinear structures allowed efficient subdivision of interior space.

The abilities or needs to establish dedicated activity domains and to subdivide interior space were significant architectural developments. The former process solved the crisis of simultaneity, which had restricted the number of different activities which could be carried out at the same time within a building. Furthermore, the subdivision of interior space helped to prevent or avoid conflict, interference and disturbance between different activities or people.

It is also significant that rectilinear structures use external, village, space more efficiently than do circular forms of building; quite simply, more rectilinear than curvilinear buildings can be packed into the same area of space. In this sense, the use of rectilinear buildings implies that the area available for building was limited or, perhaps more importantly, that certain areas of space were deemed more appropriate or preferable for building than were others. At both Divostin and at Ovcharovo-gorata, buildings were arranged in particular spatial relationships to other buildings. On the most general level, buildings at both sites were focused on a common place; the sense of the aggregation of buildings is strong, especially at Ovcharovo-gorata, where buildings are packed tightly into a shared village space. At both sites structures were built with concern also for a common pattern of village order. At Divostin II, buildings share a common orientation of floorplans. At Ovcharovo-gorata, the sense of organisation in village layout is even more evident. Here there are three separate orientations: one to the northeast (Buildings 1–8 and 12); one to the southwest (Buildings 19–27); and a third between the other two (Buildings 9–11 and 13–18).

Creation, abandonment and destruction of surface-level structures

In terms of their creation, surface-level structures were built of more substantial and durable materials than were pit-huts. Building-walls were made of larger wooden posts, which were often set down into foundation trenches; posts were interwoven with branches and twigs and covered with clay and mud. In other regions, such as northern Greece and in the Danube Gorges, stone was used to form the lower parts of walls; in northern Greece, mud was mixed with clay and straw, shaped into blocks, dried in the sun to make 'mud-bricks' and used in building walls. Hearths and ovens were substantial and often had stone foundations. Many of the building materials in use required secondary and tertiary stages of transformation or acquisition; thus trees were cut and split into timbers and carried to the village; clay and stone was brought from streams, mud-bricks were formed and dried. In some cases walls were covered with layers of plaster.

In all of these ways, surface level structures of the Neolithic are better understood in terms of Ingold's definition of construction; people were using new combinations of material, some of which required significant investments of time and labour, to create an end-product which was much more than the sum of its parts. The investment of people in place evident in these surface level structures was greater than was the case for pit-huts.

Building duration, abandonment and destruction

The succession of repairs to walls, ovens and hearths, the relaying of floors and the reconstruction of buildings with their floor-plans in direct repetition of earlier generations of buildings document the desires which people had to occupy these places over relatively long periods of time. Perhaps most telling as an indicator of the duration of surface level buildings was the long-term repetition of structures seen in the four successive phases of buildings at Ovcharovo-gorata. In those cases, especially in the western Balkans, where buildings were not reconstructed in direct vertical repetition of floorplans, new buildings expanded the area of villages horizontally; sequential connections were maintained by adhering to common orientations of buildings.

In the light of the greater investment in the construction and maintenance of these surface structures, it is not surprising that events of building abandonment or destruction had greater significance as well. Increasingly through the later phases of the Neolithic in southeastern Europe, the end of many buildings' use-life was marked by intentional destruction by burning. Stevanović and Tringham have argued that the firing of buildings were important social events linked to the changing composition of village communities (*Stevanović 1996; 1997; Tringham 1995*).

Social consequences of rectilinear surface structures

The characteristics of the architecture of buildings at Ovcharovo-gorata, Divostin II and many similar sites across southeastern Europe after 6500 BC have important implications for the organisation and structure of society in these communities, especially when compared with those of pit-hut camps.

Perhaps most importantly, there appears a new ideology about the connection of groups of people to particular places in the landscape. While the relationships between people in pit-hut communities were defined and maintained through agreements, negotiations and alliances in which permanence of place was not an important factor, surface-level communities developed their social relationships via descent, which was grounded, repeatedly, in particular buildings which were firmly anchored to particular places.

Thus with surface-level structures there appeared a rise in the importance and value of the specific places in which people conducted their lives. This is evident within the construction (in the sense of that term suggested above) of individual buildings and in the concentration of buildings into, mainly, tightly packed villages. The emphasis was on permanence and continuity, of grounding people in places.

The concentration of buildings within a village, distinct from the disorganised or linear arrangements of many pit-hut camps, suggests that the people within the villages of surface-level structures may have needed to live and work together. One possible focus for communal work may have been increasing labour demands of field-based agriculture. If this was the case, then for parts of the year, the local workforce would have needed to have been in regular contact. The aggregation of buildings into villages would have provided a physical focus for contact and collaboration.

If groups of people were anchored to particular places at the level of a village community, what can be inferred about people at the level of smaller groups within the village communities? The most important development evident in the appearance of surface level structures in southeastern Europe after 6500 BC was the emergence of the household as a significant social institution in which social and economic decisions were made (*Bogucki 1993; Tringham 1991; 1995; Tringham and Krstić 1990a; 1990b; Kaiser and Voytek 1989; Chapman 1989; 1990; see also Bawden 1982; Netting et al. 1984; Ellis 1988; MacEachern et al. 1989; Bourdier and AlSayyad 1989*). Perhaps the most important consequence of the emergence of the household in southeastern Europe after 6500 BC is that it provided a new and powerful way in which social relationships between people could be created, maintained, manipulated and dissolved. From this perspective, houses can be seen as physical and permanent creators and regulators of relationships between people.

The membership of individuals within particular households was a critical social division within the structure and organisation of these village communities. The induction of individuals into household membership would have been an important focus for ritual ceremony. Thus, the burial, especially of infants and children, in household floors and the display and, perhaps intentional, breakage of anthropomorphic figurines probably were the foci of ceremonies employed to declare membership within households (*see Bailey in press*). In this sense, the identity of individuals may have been based prima-

rily on their inclusion within particular households. Identities of individuals within households, in turn, may have been based on the different skills, tasks and knowledges, which each particular person brought to the group. From this perspective it is possible to see that the built environment was a powerful factor in the production of individuals' identities.

Just as individuals obtained identities through their incorporation within particular households which were grounded in surface level structures, so also did the households themselves acquire identities. Identities of individual households were probably based on differentials of building size, contents and the particularities of individual household membership. Differentials between households within the same village and the inter-relationship of household to household, both for co-operative, communal activities as well as for more divisive, perhaps competitive behaviour would have formed the fabric of village social structure. The built environment was the basic component of this structure.

Where more mobile communities, including those who built and used pit-huts, regulated and manipulated social relationships through mostly temporary or ephemeral short-term co-residence or verbal agreements, rituals and ceremonies, the physical permanence of village houses invested social relationships with a strong and lasting legitimacy. The emphasis on maintaining residence in the same place over very long periods of time which is seen in the superimposed rebuilding of houses at sites such as Ovcharovo-gorata, develops across much of the Balkans into multi-level tell settlements. By the end of the fifth millennium BC, community life in southeastern Europe was dominated by an ideology of the house and the household which was founded on the built environment.

CONCLUSIONS

Thus, the two major types of architecture built in southeastern Europe after 6500 BC reveal two different trends, in many places contemporary, of social organisation. The mobile, less permanent, communities which built and used pit-hut camps were flexible social groups; inter-relationships within these communities, both between individuals and between groups, were open to continuing negotiation and rearrangement. The social organisation of the more permanent communities which built and lived in villages of surface level structures were fixed, much less flexible and immune to the effects of routine negotiations and alterations.

Importantly, as the examples provided were chosen to show, the distinction between the two types of architecture and the social correlates suggested, cannot be explained in terms of a simple chronological development or evolution of cultural behaviour. Nor can the development of the built environment be explained away in terms of a natural human desire for shelter from the elements.

A more accurate explanation of the differences between the forms of architecture may rest in terms of differences in local strategies of resource exploitation, such as the distinction between tending herds of grazing animals and planting and harvesting cereals. Equally important is the possibility that different communities in southeastern Europe at this time took different decisions as to the degree of commitment they wished to make to a particular place in the landscape or to a particular set of people. The decision to settle down which both pit-huts camps and household villages represent, to varying degrees, may therefore have been a decision based as much on social perceptions as on the potential of economic benefit.

REFERENCES

ANGELOVA I. 1988. Predvaritelni rezultati ot razkopkite na neolitnoto selishte "Ovcharovo-gorata". *Terra Antiqua Balcanica 3: 31–6.*

1992. Predvaritel'nye rezul'taty raskopok neoliticeskogo poseleniya Ovcharovo-gorata. *Studia Praehistorica 11–2: 41–50.*

ANGELOVA I. and BIN N. V. 1988. Kremnevye artefacty iz neoliticheskogo poseleniya Ovcharovo-gorata. *Studia Preahistorica 9: 16–33.*

BAILEY D. W. 1990. The living house: signifying continuity. In Samson R. (ed.), *The Social Archaeology of Houses: 19–48.*

1996a. The life, times and works of House 59 from the Ovcharovo tell, Bulgaria. In Darvill T. and Thomas J. (eds.), *Neolithic Houses in Northwest Europe and Beyond: 143–56.*

1996b. The analysis of tells in northeastern Bulgaria: settlement behaviour in the context of time, space and place. *Reports of Prehistoric Research Projects (Sofia) 1, 2–4: 289–308.*

(in press) *Balkan Prehistory: Exclusion, Incorporation and Identity*. London: Routledge.

BAWDEN G. 1982. Community organization reflected by the household. *Journal of Field Archaeology 9: 165–81.*

BOGDANOVIĆ M. 1988. Architecture and structural features at Divostin. In McPherron A. and Srejović D. (eds.), *Divostin and the Neolithic of Central Serbia: 35–141.*

BOGUCKI P. 1993. Animal traction and household economies in Neolithic Europe. *Antiquity 67: 492–503.*

BOURDIER J. P. and ALSAYYAD N. (eds.) 1989. *Dwellings, Settlements and Traditions: Cross-cultural Perspectives.*

BUDJA M. 1998. Clay tokens – accounting before writing in Eurasia. *Documenta Praehistorica 25: 219–235.*

CHAPMAN J. 1989. The early Balkan village. In Bökönyi S. (ed.), *Neolithic of Southeastern Europe and its Near Eastern Connections: 33–53.*

1990. Social inequality on Bulgarian tells and the Varna problem. In Samson R. (ed.), *The Social Archaeology of Houses: 49–92.*

CRIBB R. L. D. 1994. Mobile villagers: the structure and organisation of nomadic pastoral campsites in the Near East. In Parker Pearson M. and Richards C. (eds.), *Architecture and Order: Approaches to Social Space: 371–393.*

ELLIS F. 1988. *Peasant Economies: Farm Households and Agrarian Development*. Cambridge: Cambridge University Press.

FLANNERY K. V. 1972. The origins of the village as a settlement type in Mesoamerica and the Near East. In Ucko P., Tringham R. and Dimbleby G. W. (eds.), *Man, Settlement and Urbanism: 23–53.*

GATSOV I. 1985. Kremuchni ansambli ot neolitnoto selishte Usoeto. Tekniko-tipologicheska karakteristika. *Sbornik Dobrudzha 2: 105–16.*

1990. Le site néolithique d'Oussoe', dépt. de Varna. Répartition du matérial en silex par tranchées de fondation. Caractéristiques et comparisons des artefacts. *Studia Praehistorica 10: 91–102.*

GROVES C. P. and PI J. S. 1985 From ape's nest to human fix point. *MAN 20: 22–47.*

HUNTER-ANDERSON R. L. 1977. A theoretical approach to the study of house form. In Binford L. R. (ed.), *For Theory Building in Archaeology: 287–315.*

INGOLD T. 1995. Building, dwelling, living: how animals and people make themselves at home in the world. In Strathern M. (ed.), *Shifting Contexts: Transformations in Anthropological Knowledge: 57–80.*

KAISER T. and VOYTEK B. 1989. Sedentism and economic change in the Balkan Neolithic. *Journal of Anthropological Archaeology 2: 323–53.*

MACEACHERN S., ARCHER D. and GARVIN R. (eds.) (1989) *Households and Communities.*

NETTING R., WILKE R. and ARNOULD E. (eds.) 1984. *Households. Comparative Studies of the Domestic Group.*

PARKINGTON J. and MILLS G. 1994. From space to place: the architecture and social organisation of

Southern African mobile communities. In Parker Pearson M. and Richards C. (eds.), *Architecture and Order: Approaches to Social Space: 355–370.*

PINE F. 1996. Naming the house and naming the land: kinship and social groups in highland Poland. *Journal of the Royal Anthropological Institute 2: 343–359.*

STEVANOVIĆ M. 1996. *The Age of Clay. The Social Dynamics of House Destruction.* Unpublished PhD dissertation, UC Berkeley.

1997. The age of clay: the social dynamics of house destruction. *Journal of Anthropological Archaeology 16: 334–395.*

TRINGHAM R. E. 1991. Households with faces: the challenge of gender in prehistoric architectural remains. In Gero J. and Conkey M. (eds.), *Engendering Archaeology: Women and Prehistory: 93–131.*

1994. Engendered places in prehistory. *Gender, Place and Culture 1: 169–203.*

1995. Archaeological houses, households, housework and the home. In Benjamin D. and Stea D. (eds.), *The Home: Words, Interpretations, Meanings and Environments: 79–107.*

TRINGHAM R. E. and KRSTIĆ D. 1990a. Selevac and the transformation of southeast European prehistory. In Tringham R. E. and Krstić D. (eds.), *Selevac. A Prehistoric Village in Yugoslavia: 567–616.*

(eds) 1990b. *Selevac. A Neolithic Village in Yugoslavia.* Los Angeles: UCLA.

VAJSOV I. 1990. La sculpture anthropomorphe du site néolithique d'Oussoe' prés du village d'Asparoukhovo, département de Varna. *Studia Praehistorica 10: 103–141.*

WHITELAW T. M. 1994. Order without architecture: functional, social and symbolic dimensions in hunter-gatherer settlement organization. In Parker Pearson M. and Richards C. (eds.), *Architecture and Order: Approaches to Social Space: 217–43.*

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Documenta Praehistorica XXVI

The ecology of Neolithic environmental impacts – re-evaluation of existing theory using case studies from Hungary & Slovenia

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ABSTRACT – *Traditional interpretations of Neolithic environmental impacts are discussed in light of new palaeoecological sequences from Slovenia and Hungary. Popular perceptions of large-scale Neolithic landscape clearance are not apparent and instead the environmental response to agricultural activity is represented as a shift in the species composition of forest following observed cycles of decline in the forest dominant. An existing archaeological model, hitherto unused by palaeoecologists, is adapted to explain the forest response to known Neolithic activity.*

IZVLEČEK – *V članku razpravljamo o tradicionalnih razlagah neolitskih vplivov na okolje v luči novih paleoekoloških sekvenc iz Slovenije in Madžarske. Priljubljene razlage, da so v neolitiku v velikem obsegu čistili pokrajino, nismo mogli potrditi. Namesto tega je odgovor okolja na kmetovanje predstavljala sprememba sestave vrst v gozdu, ki je ciklično sledila nazadovanju gozdne dominante. Da bi razložili odziv gozda na znane neolitske aktivnosti, smo prilagodili že obstoječ arheološki model, ki ga paleoekologi doslej še niso uporabili.*

KEY WORDS – *Ljubljansko barje; Mátra hills; Neolithic; palaeoecology; pollen sequence; environmental change; transition to farming; forest clearance*

INTRODUCTION

Conventional environmental research informs us that the Neolithic saw a period of intense deforestation throughout Europe which has been identified in sedimentary sequences as a decline in forest taxa and an expanse in herbaceous taxa, particularly graminids. There exist numerous records of forest clearance attributed to Neolithic activity, but many of these were either published prior to routine ^{14}C determinations or were subject to inadequate ^{14}C dating and were consequently dependent on unreliable methods of relative dating such as the Blytt-Sernander peat-based classification. Ultimately, many such records should be discounted, but the concept of a dramatic widespread environmental change is so well established in the literature that it could be considered a paradigm of archaeological research. Consequently, intellectual inertia is extensive and presents a considerable hurdle for new research to overcome.

The concept of forest clearance during the Neolithic is well established and is derived largely from analyses of sediments in northern Europe. Several models have been proposed to account for the expansion of agriculture during the early Neolithic, and palaeoecological schemes such as the *Landnám* of Iversen (*1941*), the 'leaf-foddering' model of Troels-Smith (*1954*) and the 'forest utilisation' model of Göransson (*1986; 1987*) are widely cited in both the palaeoecological and archaeological literature. The schemes of Iversen and Troels-Smith pioneered the notion of forest manipulation by humans rather than forest clearance, yet suffered problems of chronology, resolution and logistics, which became apparent with a more objective and quantitative appreciation of human activity (*e.g. Edwards 1979; 1993; Rackham 1986*). The Göransson scheme has been regarded as highly controversial (*Edwards*

1993) and suggests that pollen production *increases* as the landscape is first opened *(sensu stricto Aaby 1988; 1994*) due to greater exposure of tree crowns to sunlight, thus demanding a complete reinterpretation of Holocene palaeoecological records.

Although these models have moderated the conventions for interpreting human activity, they arise from a palaeoecological perspective and do not benefit from modern archaeological opinion regarding the onset of agriculture (*Ammerman & Cavalli-Sforza 1973; 1984; Barker 1985; Halstead 1984; 1989; Zvelebil 1988; 1990; 1994; Edwards et al. 1996*). In addition, all of these models have been formulated with respect to the unique Scandinavian transition to agriculture, which cannot be applied to the central or south-east European situation. These interpretations fail somewhat when applied to the archaeologically and ecologically more complex situation evident in south-east Europe at the time of Neolithic settlement. Much of south-eastern Europe was covered with deciduous forest from the Early Holocene (*Bennett et al. 1991; Willis 1994; 1995a*) and the earliest Neolithic activity is presumed to have exploited natural open spaces such as river terraces and forest gaps (*van Andel & Runnels 1995; Simmons & Innes 1996*). Such activity is difficult to detect in the palaeoenvironmental record as there is little deliberate environmental disturbance and the dominant signal is that of the 'pristine' landscape. However, the subsequent intensification of agriculture during the consolidation phase (*sensu Zvelebil & Rowley-Conwy 1984*) should be detected in the palynological record as a forest clearance event, as is evident in northern Europe (*Edwards & McDonald 1991*). Recent research (*Willis & Bennett 1994; Willis 1995a; 1995b; Gardner 1998; 1999; Gardner & Willis 1999*) has demonstrated that the timing and magnitude of such events varies spatially and that, contrary to traditional palaeoecological interpretations, the earliest discernible forest clearance arising from the transition to agriculture in south-east Europe occurs several millenia after archaeological evidence for the earliest intensive farming.

The factors contributing to this discrepancy are complex and have been described in detail elsewhere (*Willis & Bennett 1994; Willis 1995b; Gardner 1998; 1999*), but it is useful to introduce them here. Briefly, the contributory factors identified include spatial representation of the pollen source area, the location of palaeoecological sites in relation to archaeological sites and the temporal resolution of the palaeoecological samples.

The absence of any firm palaeoecological evidence for the early Neolithic, despite abundant archaeological evidence for agricultural settlements, suggests that either established palaeoecological methods are unsuitable for the interpretation of south-east European Neolithic impacts or that the impacts of Neolithic agriculture were so small that they remain undetected.

This paper presents results from two sites in south-east Europe which are situated in the vicinity of settlements occupied during the Neolithic. The palaeoenvironmental records from each of the sites will be discussed with reference to modern ecological studies of forest dynamics and used in a comparative analysis of Neolithic impacts. The concept of Neolithic landscape clearance will be addressed by recourse to new models which account for the shortcomings of established theories.

STUDY SITES AND METHODS

Sirok Nyírjes Tó (47° 55' 81" N, 20° 11' 14" E) is a small oligotrophic peat bog on the fringe of the Mátra hills in Heves county, north-east Hungary (Fig. 1). Situated at 200 m a.s.l., the basin is an ellipse approximately 200 m long and 100 m wide, surrounded by steep slopes supporting a gallery forest of *Quercus cerris, Carpinus betulus* and *Corylus avellana*. Podpeško Jezero (45° 58' 58" N, 14° 28' 30" E, 300 m a.s.l.) (Fig. 2) is a small circular lake of 80 m diameter at the north-western end of an elliptical basin which has an infilled with organic deposits. The surrounding steep slopes are covered by a thin rendzina soil supporting a *Picea abies* and *Fagus sylvatica* forest plantation.

All methods used are identical to those presented in Gardner (*1998*), with the exception of the coring method and age-modelling procedures adopted for

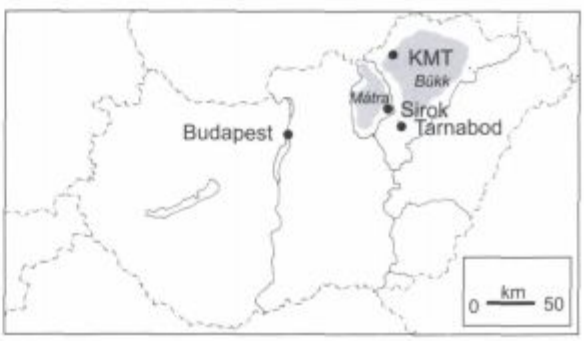

Fig. 1. Location map of Sirok Nyírjes Tó and surrounding area.

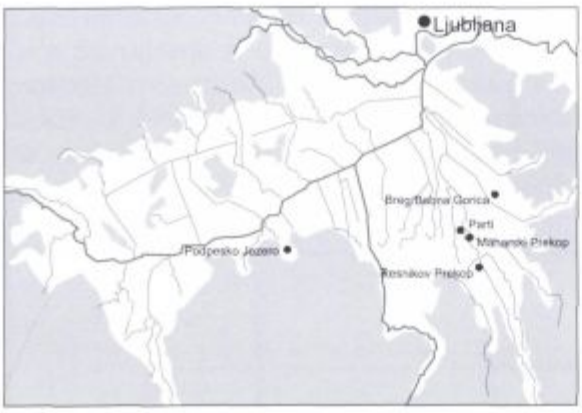

Fig. 2. Location map of Podpeško Jezero and surrounding area.

Sirok. The peaty sediments from Sirok were collected using a hand-held Russian corer with a chamber of 50 cm length and 5 cm diameter. The Sirok age model was constructed using the Bernshtein polynomial curve (*Bennett 1997*), which was then extrapolated following the routines of Maher (*1998*) using the sequence of Willis *et al.* (*1995*) to constrain the basal date.

RESULTS AND DISCUSSION[1]

Sirok Nyírjes Tó

The pollen sequence from Sirok Nyírjes Tó (Fig. 3a–b) has been divided into 7 zones, which are summarised in table 2. The 4.5 m profile spans the last 10 000 years and is composed primarily of *Sphagnum* peat, except for the lowermost 50 cm, which comprise a unit of silty clay overlain by a 6 cm unit of clay. The resolution of the sequence is one sample every 113 calendar years, except for a fine-interval section where one sample represents 36 calendar years.

The base of the sequence exhibits features characteristic of a change from a predominantly coniferous to a mixed deciduous forest. This type of event is typical of the Holocene after a period of total dominance by *Pinus* during the lateglacial/Holocene transition. The establishment of a mixed deciduous forest dominated by *Corylus* is complete by ca. 8300 cal BP and persists without change for ca. 600 years. This type of forest has no modern analogue (*Rackham 1988*), but is a feature apparent in several other pollen records from the region (*e.g. sites in Willis 1994; Willis et. al 1997*) and represents a distinct phase in south-east European vegetation development (*Huntley & Birks 1983*).

From ca. 6900 cal BP a series of high frequency cycles occur during which *Corylus* declines and other taxa, most notably *Carpinus betulus*, expand briefly. It is plain that the previously stable forest is being disturbed in some manner and that *Corylus* is being selectively removed, allowing minor flourishes of *C. betulus*. Furthermore, minor increases in wet-habitat field-layer taxa such as *Thelypteris palustris* and some members of the Liliaceae, in addition to expansions in *Sphagnum* and Filicales, imply a change both in hydrological conditions and light penetration to forest floor.

The removal of this disturbance is evident in the stabilisation of *Corylus* in reduced abundance and the expansion of *C. betulus* to a position of dominance within the forest, a component of the typical post-

lab code	sample code	sample material	uncalib. years bp	cal. years BP (2σ)	cal. years BC/*AD* (2σ)	calibration dataset used	$\delta^{13}C_{PDB}$ ± 0.1‰
AA-27177	Sir 64 cm	*Sphagnum* peat	380 ± 50	516 (467) 302	*1434 (1483)1648*	1	-27.9
AA-27178	Sir 160 cm	*Sphagnum* peat	2955 ± 55	3324 (3100) 2945	1374 (1150) 995	2	-25.14
AA-27179	Sir 240 cm	*Sphagnum* peat	4580 ± 55	5451 (5300) 5046	3501 (3350) 3096	1	-25.12
AA-27180	Sir 300 cm	*Sphagnum* peat	5135 ± 60	5989 (5910) 5738	4039 (3960) 3788	1	-29.6
AA-27185	Sir 394 cm	wood	5805 ± 55	6742 (6640) 6469	4792 (4690) 4519	1	-29.2
AA-27186	JZ 233 cm	wood	365 ± 45	509 (345) 301	*1441 (1605) 1649*	1	-27.5
AA-27187	JZ 348 cm	wood	930 ± 45	935 (829) 727	*1015 (1121) 1223*	1	-25.14
AA-27188	JZ 477 cm	wood	6110 ± 75	7176 (6970) 6786	5226 (5020) 4836	1	-31.2
AA-27189	JZ 651 cm	wood	9075 ± 70	10 279 (10 030) 9922	8329 (8080) 7972	3	-29.0

Tab. 1. ^{14}C AMS determinations and calibration results. Calibration performed using method A of CALIB 3.0 (*Stuiver & Reimer 1993*).

1 Results from radiocarbon analyses are presented in table 1 and are incorporated in the stratigraphic diagrams (Figs. 3 & 4).

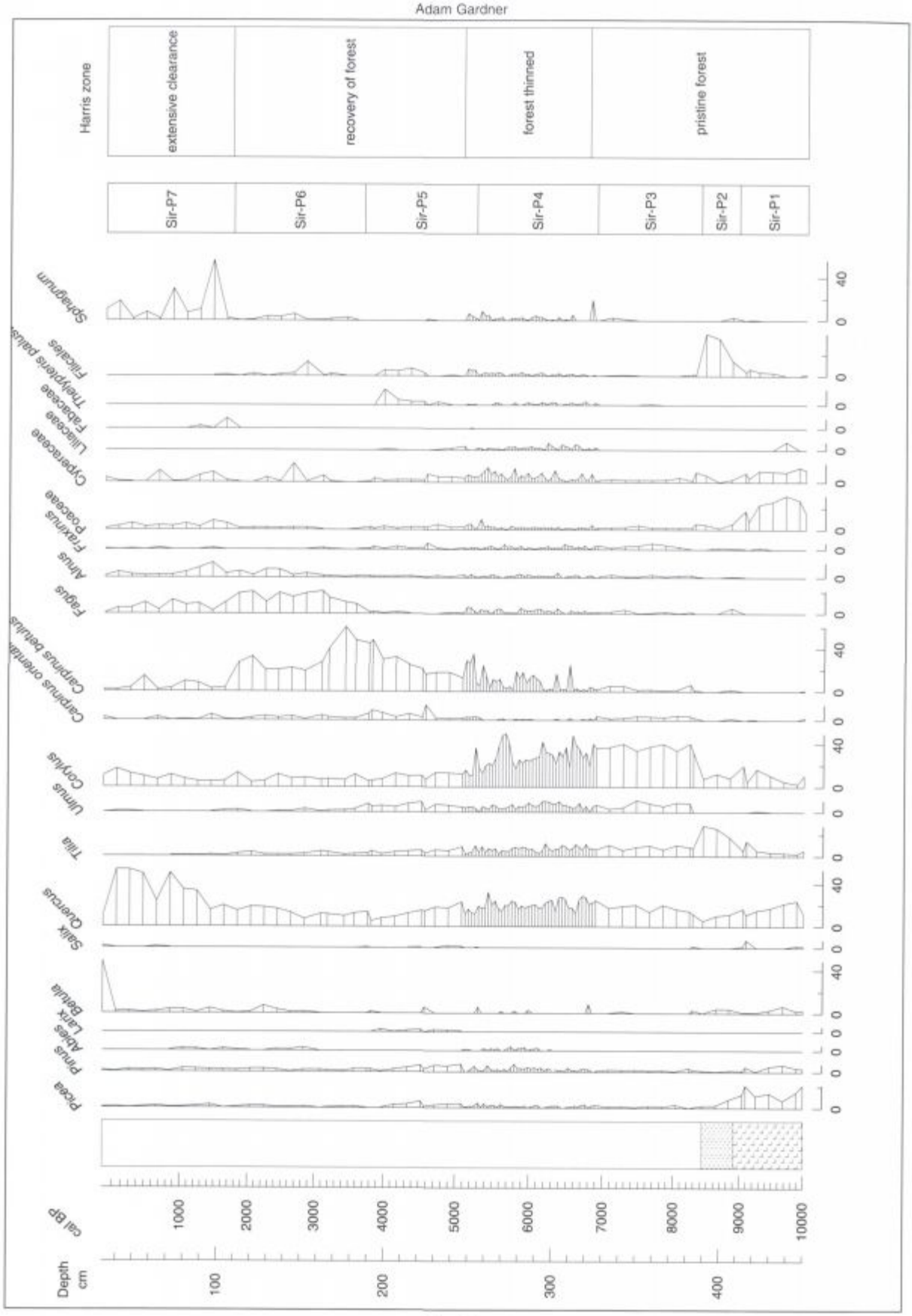

Fig. 3a

Figs. 3 a–b. Pollen percentage diagrams for Sirok Nyírjes Tó plotted against core lithology, depth and interpolated ^{14}C timescale; 3a Percentage diagram of major taxa; 3b Summary diagram showing total pollen percentages with and without aquatics and supplementary spectra. See text for explanation of 'Harris zones'.

glacial forest succession for south-east Europe. Similarly, the subsequent expansion of *Fagus* and the continued presence of *Quercus* in abundance is indicative of a forest which is not subject to appreciable external disturbance. The summary diagram (Fig. 3b) illustrates this point well: arboreal pollen reaches maximum values ca. 3600 cal BP and there is little variation in the forest composition.

The first appreciable forest change, presumably through anthropogenic activity given the increased charcoal concentration (Fig. 3b), occurs ca. 1850 cal

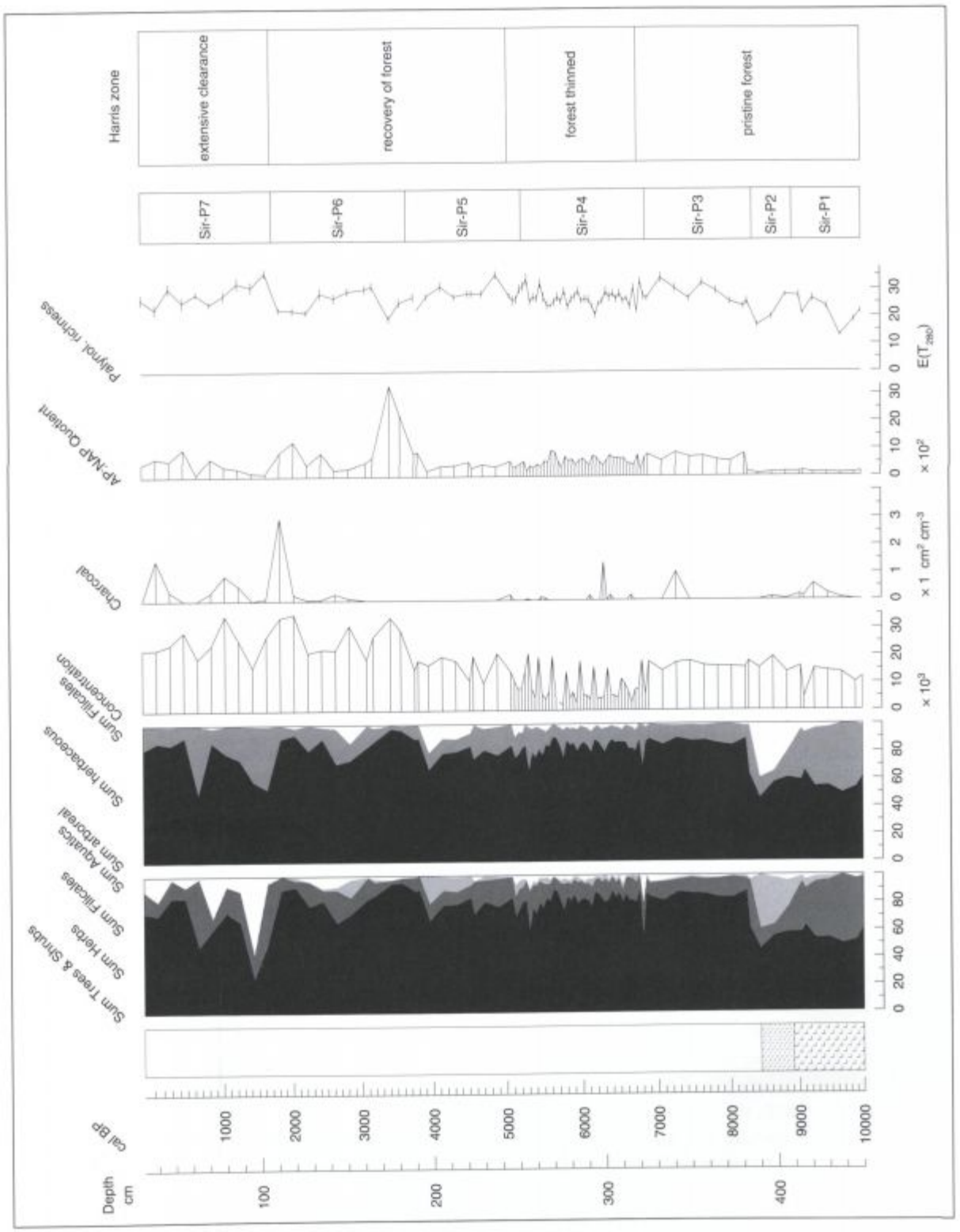

Fig. 3b

BP as *C. betulus* is reduced. The removal of the dominant forest element permits expansion in several taxa, all of which are adapted to wetter conditions. At this time the *Sphagnum* which forms the peat dramatically increases production of spores, indicating a change in surface wetness (*Barber 1981*). Subsequently, the space created by the removal of *C. betulus* is filled by an expansion of *Quercus* from ca. 1400 cal BP that persists to the present day.

Podpeško Jezero

The pollen sequence from Podpeško Jezero (Fig. 4a–b) has been divided into six zones, which are summarised in table 3. The 6.25 m of sediment recovered from Podpeško Jezero span 11 350 years within a sequence of (from the base upwards) marl, silty-marl and gyttja (Figs. 4a–b). Throughout the sequence, each sample represents 108 calendar years, except for the close-interval section between 7400 and 5600 cal BP where each sample represents 64 calendar years. The base of the sequence incorporates the lateglacial-Holocene transition with a coniferous forest dominated by *Pinus*. Although its pollen is present in abundance, the *Pinus* forest at this time is not complete (*sensu Aaby 1988; Peterson 1983*) and the pollen spectra probably represent a 'coniferous parkland' type of environment with open spaces. The shift from a coniferous to a mixed-deciduous forest begins with the expansion of *Betula* in the open spaces, followed by expansion of a full range of temperate deciduous forest taxa.

From about 9000 cal BP, an expansion of *Corylus* occurs which is followed by the dramatic expansion of *Fagus*. Once established, *Fagus* persists in the forest until the present, but is subject to changes in the vegetation structure. Initially, *Fagus* dominates the

Zone	Age (cal. BP)	Dominant features	Charcoal	%AP	Conc (grains cm^{-3})	AP: NAP	Palyn. richness
Sir-P7	1750–present	Increase of *Quercus*, herbaceous elements and *Sphagnum*. Sharp increase of *Betula* in top of zone	high	>70	20 000 to 30 000	low to moderate	maximum
Sir-P6	3400–1750	Maximum of *Carpinus betulus*; declines as *Fagus* expands	low; 1 peak	>75	20 000 to 30 000	maximum declines	high
Sir-P5	5200–3700	Increase of *C. betulus* and *C. orientalis*.	very low	>75	ca. 20 000	moderate; increases	high; steady
Sir-P4	6900–5200	High frequency fluctuations in *Corylus*, *Quercus* and *C. betulus*	low	>75	5000 to 15 000	moderate	high; steady
Sir-P3	8300–6900	Mixed assemblage of *Quercus*, *Tilia* and *Ulmus* dominated by *Corylus*.	low	>80	ca. 15 000	moderate	increasing
Sir-P2	8950–8300	Maxima in *Tilia* and Filicales, reductions in all other taxa.	low	50	ca. 20 000	low	decreasing
Sir-P1	1000–8950	Dominance of Poaceae, high values of *Picea*, *Quercus*, *Corylus* and Cyperaceae.	moderate	50	ca. 12 000	low	increasing

Tab. 2. Summary of major palynological events by zone for Sirok. All values are approximate; for further detail see figures 3a–b.

forest until the arrival of *Abies* ca. 7000 cal BP, when an *Abies-Fagus* forest similar to those currently present in the region was formed. Soon after the establishment of the *Abies-Fagus* stage, external influences manipulate the forest structure to the extent that the dominant *Fagus* is replaced briefly by *Corylus.*

The partial removal of *Fagus* and *Abies* provided conditions suitable for a secondary expansion of *Corylus* not typically seen in Slovenian Holocene sequences (*Šercelj 1996*). *Corylus* produces little or no pollen when growing as an understorey shrub (*Rackham 1988*), therefore this event represents a real dominance by mature trees. A significant thinning of the canopy occurred locally around the basin, resulting in enhanced light levels penetrating to the field layer. From about 5000 cal BP the canopy openings contracted as *Fagus, Abies* and *Quercus* increased to form a forest, which although dense, nonetheless allowed sufficient light penetration for *Carpinus betulus* to establish and flourish.

From ca. 3200 cal BP the landscape surrounding the basin underwent rapid and dramatic change, during which herbaceous taxa (Poaceae, Cyperaceae, *Cannabis)* and Filicales increased and several arboreal taxa *(Fagus, Abies, C. betulus)* were reduced. Low values for the AP:NAP ratio (Fig. 4b) support this assumption and reveal that non-arboreal taxa dominated the pollen rain from ca. 3000 cal BP. This event probably represents the formation of the modern landscape of mixed (predominantly *Abies-Fagus*) forest surrounding open land which was exploited for agriculture.

DISCUSSION

Sirok Nyírjes Tó

In the early postglacial, the slopes around Sirok supported an open parkland composed of *Picea, Quercus, Tilia* and *Corylus,* with open spaces dominated by Poaceae (Fig. 3a). Moderate burning of the vegetation was occurring up to ca. 8900 cal BP. A transition from lake to peat deposits occurred in the basin from 10 000–8300 cal BP. Over the same interval distinct changes were also occurring in the vegetation, each of which corresponds to a different sedi-

Zone	Age (cal. BP)	Dominant features	Charcoal	%AP	Conc (grains cm^{-3})	AP: NAP	Palyn. richness
JZ-P6	2100–present	Expansion of Poaceae, Cyperaceae, *Cannabis* and Filicales	maximum values	ca. 50	5000–30 000	minimum	maximum
JZ-P5	6400–2100	Secondary (and maximum) *Corylus* peak. *Abies* declines. Appearance of *Carpinus betulus.*	virtually absent	>80	ca. 5000	low	increases
JZ-P4	7000–6400	*Abies* maximum. *Fagus* declining sharply.	low	>90	ca. 5000	high	fluctuates; generally low
JZ-P3	8500–7000	Total dominance by *Fagus.*	negligible	>90	ca. 5000	maximum values	declines
JZ-P2	9850–8500	Transition from coniferous to mixed deciduous assemblage. *Corylus* rise and fall, *Fagus* rise begins.	low	80–90	ca. 12 000	increasing	fluctuates
JZ-P1	11 300–9850	*Pinus* dominates. High values of *Picea, Betula,* Poaceae.	moderate	>75	ca. 7000	low	low

Tab. 3. Summary of major palynological events by zone for Podpeško Jezero. All values are approximate; for further detail see figures 4a–b.

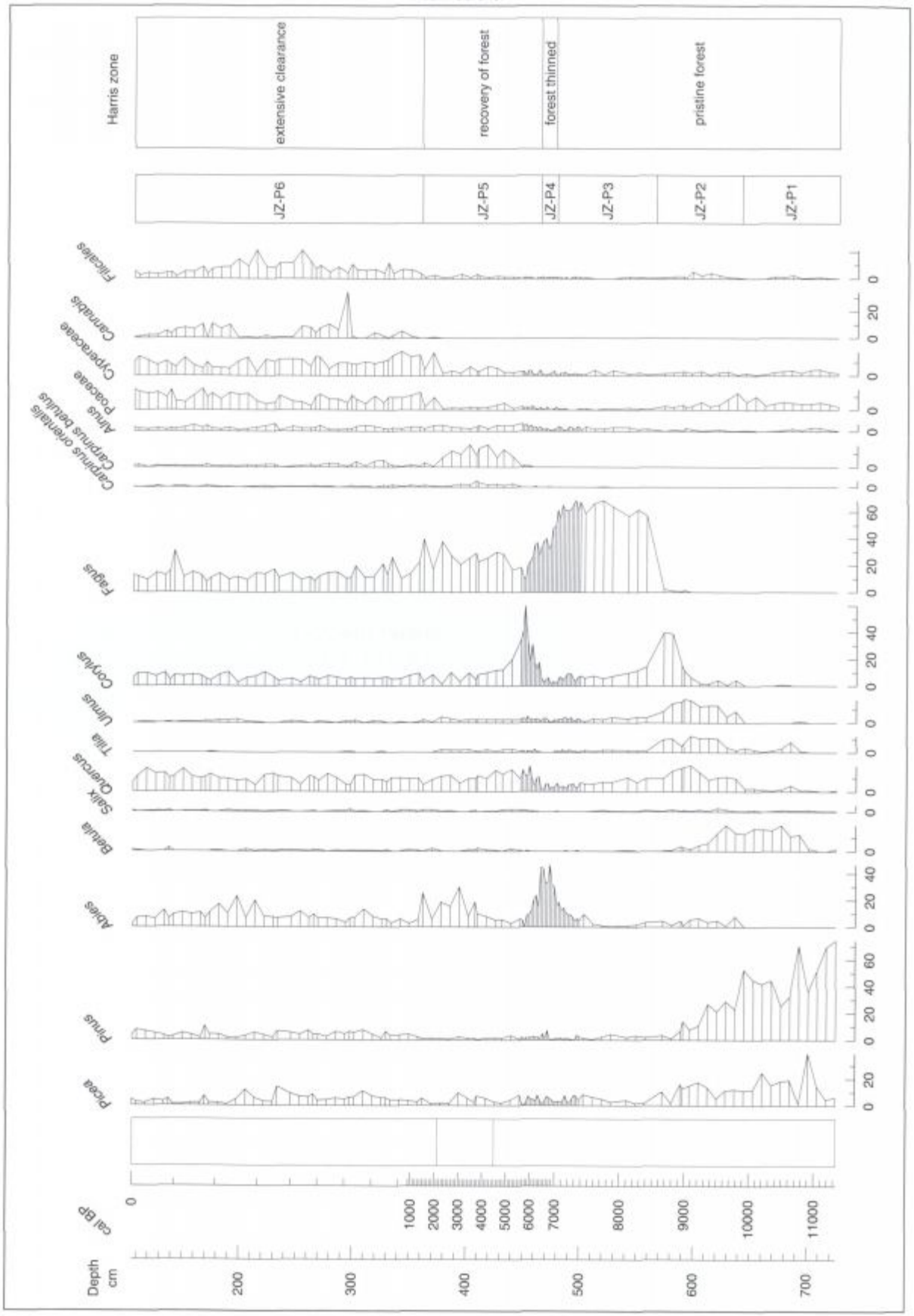

Fig. 4a

Figs. 4 a–b. Pollen percentage diagrams for Podpeško Jezero plotted against core lithology, depth and interpolated ^{14}C timescale; 4a Percentage diagram of major taxa; 4b Summary diagram showing total pollen percentages and supplementary spectra. See text for explanation of 'Harris zones'.

mentary unit: 1. a decline of *Picea, Pinus* and *Betula* and open-ground herbaceous elements (lake sediment); 2. a dramatic increase of *Tilia* and Filicales (silt); and 3. the establishment of closed deciduous forest *(Sphagnum* peat). *Tilia* and Filicales were present at the base of the sequence, but the expansion to 25–30% of the pollen sum between 8900 and 8300 cal BP is unusual and not apparent in any other published diagram, although a sharp increase in *Tilia* at ca. 9500 BP (ca. 10 600 cal BP) has been recorded at Bátorliget, eastern Hungary (*Willis et al. 1995*), and a peak in Filicales dated to ca. 9500 cal BP is apparent at Kis Mohos Tó (*Willis et al. 1997*), 50 km north of Sirok.

Given the change in the hydrological regime and the poor dispersal characteristics of *Tilia* pollen, an expansion of this sort is difficult to reconcile in terms of ecology. *Tilia* typically thrives on well-drained soils such as those of the English lowland (*Tutin et al. 1989; Rackham 1988; Packham & Harding 1992*) and is unlikely to have flourished on the waterlogged basin surface. However, dispersal of *Tilia* pollen is so poor that individual trees must have

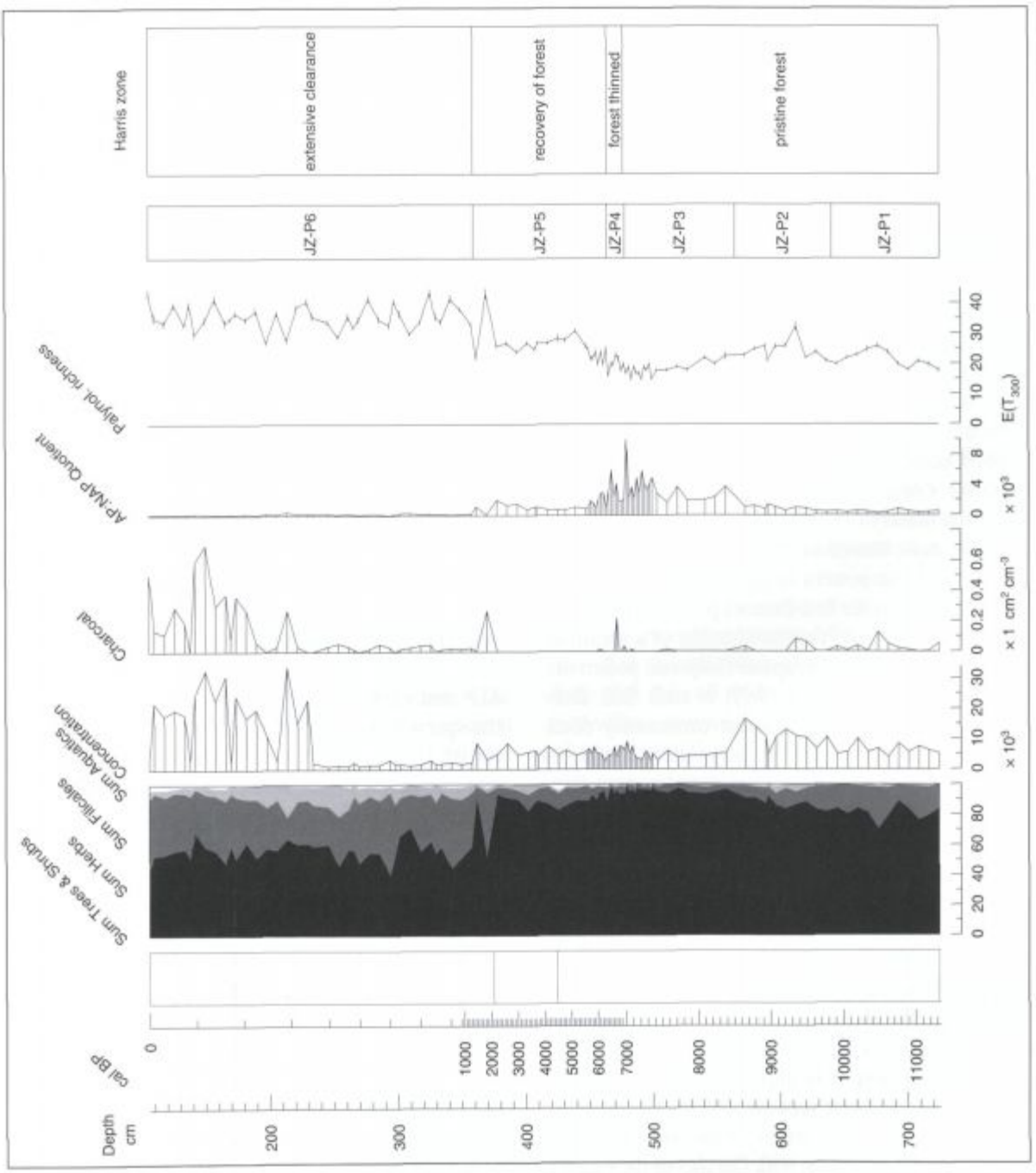

Fig. 4b

been within a few metres of the basin (*Nilsson & Praglowski 1992*) and the possibility exists that a dense gallery forest (which is composed of *Corylus avellana, Carpinus betulus* and *Quercus cerris* at present), of which *Tilia* was a dominant component, developed on the well-drained slopes at the periphery of the basin (*cf. Ellenberg 1988*).

The order Filicales includes taxa which characteristically thrive on burnt or nutrient-poor soils, but specifically certain taxa (such as *Thelypteris palustris* and *Athyrium* sp.) which grow on wet ground (*Tutin et al. 1989*). The charcoal concentration for this section of the core decreases prior to the expansion of Filicales (Fig. 3b), therefore fire would appear to be an unlikely factor to account for this event. However, the gradual infilling of the lake revealed newly exposed land which could have been colonised by advantageous taxa such as Filicales. Therefore, the abundance of Filicales spores at this time can probably be explained in terms of colonisation of newly exposed land.

From 8300 to 5200 cal BP the forest around the site became dominated by *Corylus* with *Quercus, Tilia* and *Ulmus*. The expansion of *Corylus* to values >40% is a common feature of European Holocene pollen diagrams (*Huntley & Birks 1983*) and is conventionally taken to represent a shrub layer in a forest. However, *Corylus* produces little pollen when growing in the understorey (*Rackham 1988*) and the population must therefore have either been a dominant canopy component or growing on the fringe of the basin. The latter is a distinct possibility in small basins such as Sirok, yet the ubiquity of a pronounced *Corylus* phase in European Holocene pollen diagrams (*Huntley & Birks 1983*) is such that there may once have existed a forest community dominated by *Corylus* which has no modern analogue. By extension, this implies that *Corylus* may have existed as a canopy tree. Three palynologically indistinguishable species of *Corylus* exist in Europe, of which two (*C. avellana* and *C. maxima*) are shrubs and one *(C. colurna)* is a canopy tree reaching 22 m (*Huntley & Birks 1983; Tutin et al. 1989*). All are currently distributed throughout the Balkans (*Tutin et al. 1989*) and are presumed to have been present throughout the Holocene (*Huntley & Birks 1983*). Given the possibility of two alternative species for the Balkan region, it is impossible to say whether the *Corylus* spectrum represented in this sequence is a shrub layer on the fringe of the basin or a now extinct forest assemblage with *Corylus* in the canopy.

From 6900 to 5200 cal BP, there were several forest cycles in which the dominance of *Corylus* in the sequence was periodically reduced and in which *Carpinus betulus* rapidly expanded. These cycles occurred over various timescales, the shortest being ca. 36 years and the longest ca. 288 years. This selective removal of *Corylus* and the subsequent expansion of *Carpinus betulus* (Fig. 3a) may be due to anthropogenic intervention on the landscape, given the respective ecology of the two taxa. However, the climate of this period was significantly different to that of today (*Kutzbach & Guetter 1986; Huntley & Prentice 1988; 1993; Kutzbach et al. 1993; Cheddadi et al. 1997*) and underlying climatic factors which could account for these events must also be examined.

Between approximately 7800 and 5700 cal BP the climate of Europe experienced conditions which have traditionally been described as 'optimal' and which were designated as 'Atlantic' under the Blytt-Sernander classification (*Roberts 1998*). These optimal climatic conditions were considered to be uniformly warmer and moister than present across Europe, yet recent research has shown this not to be the case. Cheddadi *et al.* (*1997*) demonstrated that although the idea of a 'climatic optimum' is acceptable for northern Europe, conditions in south-east Europe at 6ka BP (6800 cal BP) were up to 4°C cooler than present and precipitation was up to 200 mm $year^{-1}$ greater. Given that *Corylus* is more tolerant of cool summers and of wetter conditions than *Carpinus betulus* (*Huntley & Prentice 1993*), there is no apparent climatic reason for the onset of the periodic declines observed in the *Corylus* curve.

ALP and early copper-using cultures flourished on the sparsely wooded plains between 7300 and 5800 cal BP (*Sherratt 1982a; 1982b; Willis et al. 1998*) and the forests of the Mátra and Bükk mountains represented the only reliable source of wood for raw materials and fuel, in particular for the nearby Tarnabod (Fig. 1) settlements which were occupied from 7240 cal BP. The possibility exists that forest grazing and browsing by livestock from the ALP settlements gradually introduced a change in the forest composition, but this is unlikely, as the *Alföld* provided vast expanses of grassland suitable for both arable and pastoral use (*Kosse 1979*). Therefore, the coincident timing of these events in the pollen record and of the occupation of the Tarnabod tells suggests that the changes to the forest could be attributed to human activity.

Coppicing of *Corylus* is an effective land-use strategy which would have ensured a continuous supply of raw material (*Evans 1992*) from the Sirok area. *Carpinus betulus* was present as a minor element of the stable *Corylus* dominated forest for ca. 600 years, and selective removal of *Corylus* through coppicing created the conditions into which *C. betulus* had the opportunity to expand. *C. betulus* seedlings are light-demanding and severe disturbance or coppicing allows the establishment of new specimens (*Rackham 1980*) which, if left undisturbed, will grow and cast dense shade. Therefore, there must have been an external influence between 7000 and 5200 cal BP which prevented the expansion of *C. betulus* into the forest canopy. *C. betulus* also coppices extremely well (*Rackham 1980; Evans & Barkham 1992*) and although it has virtually no uses as timber, burns at an extremely high temperature (*Evans 1992; Mabberley 1997*) and is hence valuable as fuel. It is therefore reasonable to suggest that two coppice cycles were operative; *Corylus* coppice with a short rotation of 6–10 years and *C. betulus* coppice with a longer rotation of 15–35 years (*Evans 1992*). Clearly these cycles are too brief to register within the limits of the available temporal resolution (1 sample = ca. 36 years), but the varied timescales of these cycles (36–288 years) suggests that there may be a threshold level at which the signal of coppicing activity is recorded.

The recovery of the woodland from ca. 5200 cal BP coincides with the abandonment of the settlements at Tarnabod (*Kalicz & Makkay 1977*) and a gradual eastward shift in settlement pattern during the Copper Age (*Sherratt 1982a*). It is highly probable, therefore, that woodland recovery is linked to abandonment of coppicing. This would have lead to the inevitable closure of the canopy and the gradual accession of *C. betulus* to a position of dominance within the forest. Figures 3a–b shows that this process occurred over more than a millennium. More significant, however, is the apparent lack of any sedimentological influx through erosive disturbance during the entire period of coppicing and *C. betulus* expansion, indicating the validity of coppicing as a sustainable land-use strategy.

The removal of human influence allowed natural forest processes to resume at Sirok and the expansion of *Fagus* occurred at the expense of the *C. betulus* canopy. Recent ecological studies (*Peters 1997*) have demonstrated that the deep shade cast by *Fagus* restricts growth in all the forest taxa present, and the decline in *C. betulus* appears to be directly associated with the expansion of *Fagus*. However, *Fagus* does not achieve total dominance in the forest and merely restricts *C. betulus* to a position within a mixed deciduous assemblage containing *Quercus, Corylus, Tilia, Ulmus* and *C. orientalis*. Thus, the expansion of *Fagus* from ca. 3500 cal BP appears to have coincided with a reduction in total forest cover.

From ca. 1700 cal BP to the present day, the vegetation around the basin changed once again and became dominated by *Quercus* with a greater proportion of non-arboreal taxa. Taxa tolerant of wetter conditions (e.g. *Alnus* and *Sphagnum)* expanded and charcoal concentrations increased (Fig. 3b), suggesting burning of the landscape. The most striking feature of these events is the expansion of *Quercus* to a position of dominance in the pollen assemblage. Clearly, the combination of increased burning, the removal of the deciduous tree cover and the apparent shift in the water table are related to increased impacts from anthropogenic activity, perhaps as a result of increased populations, lack of effective controls (e.g. coppicing) to mitigate against landscape degradation, or a combination of both.

The period from 1700 BP to the present represents a turbulent period in the cultural history of Hungary. The early Middle Ages (2000–1625 BP; AD 0–375) saw the colonisation of the Mátra region by Barbarian groups of Celts, Dacs, Vandals and Sarmatians, followed by migration groups of Huns, Avars and Slavons between 1625 and 1105 BP (AD 375–895) and the Hungarian conquest of 1105–1045 BP (AD 895–955) (*Trogmayer 1980; Willis et al. 1997*). Not until the evolution of the Hungarian Kingdom from 995 BP (AD 955) did the population resettle into village communities and return to managed use of woodland (*Fügedi 1986*), by which time the forest composition had totally changed. The response evident between 7000 and 5200 cal BP is therefore not apparent over the past millennium. In addition, *Quercus*, the dominant taxon present from ca. 995 BP (ca. 920 cal BP), does not coppice well and is a highly valued timber tree (*Rackham 1980; 1986; Mabberley 1997*). Furthermore, *Quercus* mast provides good fodder for livestock (*Newbold 1983*) and the forests may therefore have been subject to an alternative form of managed use.

Podpeško Jezero

The Holocene pollen stratigraphy of Podpeško Jezero is similar to the regional pollen record estab-

lished for Slovenia (*Culiberg 1991; Šercelj 1996*). The characteristic lateglacial assemblage of predominantly coniferous types with Poaceae and Cyperaceae is evident up to ca. 9800 cal BP. From 9800 cal BP the vegetation changed rapidly and became dominated by a mixed deciduous forest composed of *Quercus, Tilia, Ulmus* and *Corylus,* and the open areas decreased in size. This persisted for approximately 600 years until the expansion of *Corylus* at ca. 9000 cal BP. The basin at this time was occupied by a diverse, dominantly deciduous forest into which *Corylus* expanded rapidly. The forest was dominated by *Corylus* for ca. 300 years until the expansion of *Fagus* at ca. 8500 cal BP. An almost pure *Fagus* forest existed in the basin until the expansion of *Abies* at ca. 7000 cal BP when a mixed *Abies-Fagus* occupied the slopes surrounding the lake.

From ca. 7000 cal BP a series of changes to the forest occurred which does not follow the sequence of Šercelj (*1996*) or the general trends suggested for south-east Europe (*Huntley & Birks 1983; Huntley & Prentice 1993*). The decline of *Fagus* and *Abies* and the subsequent expansion of *Corylus, Quercus* and *Carpinus betulus* from ca. 6400 cal BP (Fig. 4a) is an unusual event in forest development. The characteristic internal dynamics of *Fagus* forest are driven by its canopy dominance and tolerance of extremely low light levels, particularly during the juvenile stage of growth (*Newbold 1983; Peters 1997*). Shade tolerance whilst juvenile is especially important to maintain *Fagus* dominance. Furthermore, Huntley and Prentice (*1993*) show that elsewhere in south-east Europe, *Fagus* and *Abies* were expanding at this time and the eastern range of *Corylus* was in decline. Thus, there is no readily apparent reason for a *Fagus-Abies* population to become reduced by *Corylus* through competition alone.

A possible explanation for the retraction of *Fagus* is a change to an unfavourable climate more suitable for other deciduous forest taxa. However, this does not account for the initial expansion of *Fagus* at 8500 cal BP during conditions which were less favourable for growth than those of ca. 6400 cal BP (*Huntley & Prentice 1993*). The microclimate of the Ljubljana Moor region is modulated by the constant temperature of inflowing karstic streams from the southern highlands. Consequently, local climatic conditions throughout the Holocene have been warmer and moister than elsewhere (*Šercelj 1996*), favouring the growth of temperate deciduous forest. Coupled with the close proximity of refugial populations (*Willis 1994*), this explains the early expansion of *Fagus* at 8500 cal BP during climatic conditions described by Huntley and Prentice (*1993*) as unfavourable. However, given this constant microclimate, there is no apparent climatic explanation for the decline of *Fagus* at 6400 cal BP.

Recent research (*M. Budja, unpublished data: personal communication, 1999*) has produced the earliest reliable radiocarbon date for human settlement on Ljubljana Moor. New excavations at Breg have revealed Mesolithic artefacts and occupation layers dated to 9180 cal BP, whilst at Babna Gorica early Neolithic occupation layers containing monochrome pottery have been dated to 6290 cal BP. The early Neolithic has hitherto been considered absent from the region and these excavations provide a cultural framework in which to view the forest changes at Podpeško Jezero.

Forest grazing by livestock has been shown to reduce deciduous forest by limiting the regeneration of seedlings (*Pigott 1983*) with the effect that forest stands gradually decline. The immature shoots of deciduous taxa, especially *Fagus*, are exceptionally palatable to grazing animals (*Rackham 1980*) and consumption of seedlings drastically reduces the success rate of regeneration (*Newbold 1983*). Furthermore, consumption of beechnuts by herbivores (*Newbold 1983*) places an additional strain on the marginal success of *Fagus* replacement. Grazing and browsing by animals could therefore account for the decline in *Fagus* apparent from 6400 cal BP, but this would not have operated in isolation and additional agencies must have contributed to the selective removal of forest elements.

The selective removal of *Fagus* and *Abies* could be regarded as the result of repeated small-scale clearances within the catchment with the intention of creating useful pockets of land for cultivation or grazing. The opening of the forest canopy would have promoted the establishment of a rich field-layer and advantageous fast-growth arboreal taxa such as *Corylus* respond rapidly and soon dominate the canopy gap. In addition, present day ecological studies have demonstrated that *Fagus* will not regenerate if gaps are large (*Peters 1997*). However, these findings have not been incorporated into any of the popular models proposed to characterise the environmental response to Neolithic agriculture.

Carugati *et al.* (*1996*) present a model for small-scale agricultural activity in the forest of Neolithic Sammardenchia on the Friuli Plain of north-east

Italy. In this example, a small gap is created in *Quercus-Fraxinus* forest by felling or ring-barking, and the cleared land is used for the growth of cereals. The stumps of felled trees remain in position and after removal of any undergrowth, cereals are sown in the sheltered glade surrounded by mature forest. After several years of use for crops, the perimeter of the clearance is encroached by shrubs such as *Corylus* which subsequently close the abandoned plot as the forest recolonises.

Although relatively simple, this model serves as a useful example for the nature of early human impacts upon dense forest and demonstrates the manner in which small-scale activity may produce a localised shift in forest composition. Repeated openings of this type within a small forest are palynologically invisible (*Sugita et al. 1999*), yet over an extended period of time may result in a shift in the forest composition.

The expansion of *Corylus* from 6400 cal BP reached a peak ca. 5800 cal BP, but was rapidly reduced by the expansion of *Carpinus betulus, C. orientalis* and by the partial recovery of *Fagus* (Fig. 4a). Small increases in Poaceae and Cyperaceae are apparent, indicating greater availability of light in an increasingly open landscape. In addition, the summary diagram (Fig. 3b) shows a reduction in arboreal pollen to ca. 80%, which suggests the existence of openings in the canopy (*sensu Aaby 1988; 1994*). Large-scale landscape clearance is apparent from 2300 cal BP and herbaceous types increase. Accumulation of organic deposits began at 2300 cal BP with the onset of eutrophication and the transition to the gyttja phase of sedimentation. At this time, the forest in the catchment was composed of *Abies-Fagus* forest with *Picea, Pinus* and *Quercus* and a greater (ca. 40%) non-arboreal component dominated by Poaceae and Cyperaceae.

The forest clearance at 2300 cal BP represents the first large-scale landscape disturbance and the first reliable appearance of 'anthropogenic indicators' (*Behre 1981; 1986*). Increases in Poaceae, Cyperaceae and Filicales palynomorphs reflect the expansion of non-arboreal vegetation within the catchment which, nonetheless, was floristically poor. The expansion of *Cannabis* -type pollen in the sequence includes *Humulus lupulus* and *Cannabis sativa,* which are palynologically indistinguishable. Both types are used for fibre production (*Polunin 1980; Mabberley 1997*), although the primary use of *Humulus* is in brewing.

However, Godwin (*1967*) suggests that as only the female infructescence of *Humulus* is used for brewing, female plants are selectively cultivated and the pollen is scarce. Therefore pollen of *Cannabis*-type is more likely to represent *Cannabis sativa* than *Humulus lupulus*. An expansion of this magnitude can be taken to represent either pollen deposition from a large stand growing nearby or retting of fibres in the lake (*Bradshaw et al. 1981; Willis et al. 1998*). *Cannabis* will not grow in large stands unless cultivated (*Polunin 1980; Clapham et al. 1987*) so it is reasonable to assume that both processes were active.

The range of economically important taxa present in the pollen assemblage from 2300 cal BP is surprisingly poor in consideration of the number and density of archaeological settlements in the region (*Bregant et al. 1980*). Other than those taxa mentioned above, the only crops present in more than trace abundance are represented by pollen of cereal-type, *Fagopyrum, Apiaceae* and *Brassicaceae*, and of those, none reach 5% of the total terrestrial pollen. In addition, arboreal pollen remains at ca. 50% from 2300 cal BP to the present day. Surface samples taken from the sediment-water interface (*Gardner 1998*) display a similar pollen assemblage, with low values of crop pollen and a total arboreal pollen value of 48%. The only marked difference is a higher proportion of *Fagopyrum* and the total absence of *Cannabis*-type pollen. Thus the present day landscape was formed ca. 2300 cal BP.

DYNAMICS OF HOLOCENE ENVIRONMENTS IN SOUTH EAST EUROPE

Theoretical Framework

In the Holocene palaeoecological record of south-east Europe there appear three dominant phases of environmental change (*Gardner 1999*):

1. Early Holocene 'primary' forest development; recolonisation of the landscape by forest upon climatic improvement; rapid change characterised by high species turnover.

2. Mid Holocene 'secondary' forest development; maturation of the forest soils and canopy structure; expansion of the dominant forest taxon.

3. Late Holocene large-scale forest clearance by human populations; high species diversity, essentially static equilibrium achieved.

Each of these three phases is characterised by regional differences in floral composition and timing of events, but the broad explanation for the mechanisms of change is simple. In the early Holocene, the magnitude of climatic events exerted a greater influence upon the environment than did any aspect of human activity. Thus, the rapid environmental change recorded for the early Holocene in south-east Europe was driven by climate. Conversely, the late Holocene was characterised by a comparatively stable climate and exploitation of the environment by human populations which exceeded climatic forces in driving environmental change. However, in the mid Holocene, a combination of climatic factors and steadily increasing human impact produced a palaeoenvironmental signal which is complex and extremely difficult to define (*Birks & Line 1993*).

Explaining the mechanisms of change

The dramatic environmental change apparent in the early Holocene phase was driven entirely by an increase in summer temperatures of 4–10°C between 12 and 9ka BP (*Kutzbach & Guetter 1986; Kutzbach et al. 1993*). All other factors relating to environmental change during this period are linked to increased temperature, in particular moisture availability (*Willis 1994; Bennett & Willis 1995*) and soil development (*Pennington 1986; Willis et al. 1997*). Expansion of primary forest at the onset of the Holocene in southern Europe occurred in response to climate change and was characterised by a rapid succession from raw mineral soils supporting coniferous parkland to a mixed deciduous forest on organic soils, characterised by high variability and high species turnover (*Bennett & Willis 1995*).

The mid Holocene phase of south-east Europe is characterised by floristic stability, with the development of a secondary deciduous forest of usually one dominant taxon (e.g. *Carpinus* sp. in Greece, *C. betulus* in Bulgaria, *Quercus ilex* in Croatia and *Fagus* in Slovenia - *Willis 1994 and references therein*) which persists to the present day, albeit in reduced importance. This phase is eloquently summarised by Bennett & Willis (*1995*) as *pattern 2* of their scheme for Holocene vegetational development. In climatic terms, the mid Holocene forest developed during an optimum growth period when temperatures were 2°C higher than present (*Huntley & Prentice 1993*) and humidity more suitable for dense deciduous woodland (*sensu Magri 1996*). In human terms, the mid Holocene forest matured at a crucial point in the establishment of sedentary societies in south-east Europe who, in addition to growing arable crops, exploited the forest for raw materials, fuel, pasture, fodder and wild food resources.

The late Holocene phase is characterised by almost complete domination by human activity as an environmental driving mechanism. Climatic forces remained very much in evidence and periodic oscillations such as the Little Ice Age from ca. AD 1590–1850 (*Lamb 1977*) were of sufficient magnitude to cause local re-advance of Alpine glaciers (*Grove 1988*). However, increasingly intensive land-use from the late Bronze Age/early Iron Age (ca. 3ka BP) onwards initiated irreversible soil erosion (*van Andel et al. 1990; Halstead 1996*), a reduction of 50% of global forest cover (*Birks & Line 1993*) and the expansion of arable field and meadow plant communities.

Synthesis of Mid Holocene Human Impacts

The dominant driving forces behind early and late Holocene environmental change are undoubtedly climatic and human agencies respectively, but the situation for mid Holocene environmental change is not so clearly defined. Climatic change alone cannot account for the subtle changes in forest composition evident in this study, yet other than the proximity of known archaeological sites, there is no evidence from the sedimentary or charcoal records to suggest a dominantly human origin for these changes.

Comparison of the characteristics of Holocene forest species decline with long pollen sequences from previous warm stages serves as a guide to unravel human impacts from natural processes. Several such sequences exist in southern Europe (*e.g. Ioannina (Tzedakis 1993; 1994)* and Tenaghi Phillipon (*Wijmstra 1969; van der Wiel & Wijmstra 1987a; 1987b*) in Greece; Valle di Castiglione (*Follieri et al. 1988*) in Italy; and Les Echets (*de Beaulieu & Reille 1984*) and La Grande Pile (*Woillard 1978; de Beaulieu & Reille 1992*) in France), each of which extend back to at least the oxygen isotope stage 5e (Eemian interglacial) and reveal the development of a forest assemblage composed of ecological groups which bear striking similarities to those seen in the Holocene of south-east Europe. The distinction should be made that species may or may not adopt the same

positions in previous warm-stages as they do in the Holocene or may be totally absent (*Bennett & Willis 1995*) (cf. *Fagus* at Ioannina and *Carpinus betulus* at Les Echets and La Grande Pile), but the overall ecological classification (e.g. temperate deciduous, boreal etc.) is similar. Therefore, at the onset of each warm-stage a coniferous woodland assemblage existed which changed rapidly to a mixed temperate deciduous forest. This was followed by a mature 'secondary' forest with a dominant broad-leaved taxon which developed by the middle of each stage.

All of the mid warm stage forest phases from the long terrestrial sequences outlined above are terminated by the expansion of cold tolerant forest elements (e.g. *Picea* or *Pinus)* over secondary deciduous taxa, thus completing the 'interglacial cycle' (*Birks 1986*). In no instance is there a shift in forest composition as seen in the Podpeško Jezero sequence (Figs. 4a–b) and no secondary expansion of advantageous taxa such as *Corylus.* Similarly, the nature of the transition to secondary forest at Sirok Nyírjes Tó whereby a *Corylus* dominated forest (which has no modern analogue) is punctuated by cycles of *Carpinus betulus* (the secondary forest dominant) expansion is not apparent in any of the long sequences. The implication of underlying climatic trends producing distinct ecological phases in warm-stage forest development serves as a guide in evaluating the additional external factors experienced during the mid Holocene. Thus, although a climatic cause could possibly produce the change in forest composition at these sites, it is not apparent in previous warm stages and, given the presence of agricultural communities, is more likely to have resulted from human activity.

Comparing the Evidence

The on-going excavations at Breg have revealed lithic and ceramic evidence for Mesolithic and early Neolithic occupation of Ljubljana Moor and biological analyses in progress are expected to produce data on subsistence strategies (*M. Budja, personal communication, 1999*). Similarly, excavations at Maharski Prekop (*Bregant 1974a; 1974b; 1975*) have revealed the full range of crops and animals used by the inhabitants of the region and have demonstrated a community reliant on arable agriculture, but which maintained important livestock herds and continued to exploit wild resources. In contrast, there is no firm palaeoecological evidence for Neolithic arable agriculture in any of the available sequences for the area (*e.g. this study; Culiberg & Šercelj, 1978a; 1978b; Andrič, 1997*). Similarly, archaeological excavations of the nearby Tarnabod tells have revealed a typical ALP assemblage comprising a full range of domesticated plant and animal remains (*Kalicz & Makkay 1977*) which is not recorded in the Tarnabod palaeoecological sequence (*Gardner 1999*). The attendant off-site sequences, Podpeško Jezero and Sirok Nyírjes Tó, do not display any evidence of arable farming activity from the pollen record (*sensu Behre 1981; 1986*) during these settlement phases, nor do they show any evidence of landscape instability from the sedimentological record. In contrast, both sites display a subtle suite of changes to the forest composition which are interpreted from this study to be a result of managed forest-use.

The forest-farming model of Carugati *et al.* (*1996*) has already been presented and serves as a useful scheme for visualising the changes apparent in a south-east European landscape during the early Neolithic, yet offers no cultural basis for the sequence of human activities suggested. Harris (*1996a; 1996b*) advances a more detailed conceptual model for plant and animal exploitation in which he proposes a multi-stage transition from dependence on wild resources to dependence on domesticated resources. For the plants he suggests two phases of cultivation in which initially small clearings are used for morphologically wild plants before intensive agriculture begins with fully domesticated crops. Similarly, an intermediate 'protection' phase is suggested by Harris (*1996a; 1996b*) to demarcate exploitation of wild animals and full domestication.

Harris' (*1996a*) model serves as a useful conceptual basis on which to explain the forest changes apparent in this study. Table 4 shows a development of the Harris model adapted to clarify proposed impacts on mature south-east European forest during the preliminary stages of Neolithic agriculture. Initial agriculture, both arable and pastoral, impinged on relatively untouched forest and influenced forest development to the extent that the composition changed and there was a shift in canopy dominance. Subsequent agricultural expansions introduced greater influence on the environment by a change to large-scale clearance practices, which did not introduce any clearance-abandonment cycles and allowed the partial recovery of certain forest elements (*sensu Iversen 1941*).

The scheme in table 4 can be fitted readily to the sequences from Sirok Nyírjes Tó (Figs. 3a–b) and Pod-

Wild food procurement	Food production	
	wild plants and animals important as food	domesticated food production dominant
Gathering and collecting	*Cultivation* • small clearances • minimal tillage	*Agriculture* • large clearances • increased tillage
Hunting *Scavenging* *Fishing*	*Livestock keeping* • pasture • forest grazing and browsing	*Livestock raising* • transhumance • nomadic pastoralism
Decreasing dependence on wild resources →		
Increasing dependence on domesticated resources →		
forest virtually unmodified	forest thinned; compositional change	partial recovery of forest / large scale landscape clearance

Tab. 4. Conceptual basis for evolution of agricultural systems and attendant impacts on forested environments (*modified from Harris, 1996a; 1996c*). Note that individual phases are not rigid and the entire scheme is temporally flexible.

peško Jezero (Figs. 4a–b) and serves to illustrate the extent of activity occurring within the catchments. In both cases the basal 'Harris zone' is relatively pristine forest, more or less unaffected by human activities. Previous work (*Mellars 1975; Simmons & Innes 1996*) has proposed forest firing by Mesolithic populations as a strategy for hunting success, although Rackham (*1980*) has discredited such theories on account of the incombustibility of temperate deciduous forest. Despite the excavations at Jászbérény (*Kertész et al. 1994*) in Hungary and Breg (*Chapman & Müller 1990; Budja 1997*) in Slovenia demonstrating Mesolithic occupation of the two study regions, there is no evidence from charcoal records or pollen data to suggest Mesolithic manipulation of forest. Therefore, the early Holocene forest at both sites can confidently be termed 'pristine'.

The second 'Harris zone' reveals two different manifestations of forest thinning. The Sirok sequence (Fig. 3b) shows a pollen assemblage interpreted as the forest response to a coppice regime, demonstrated by a high rate of change and fluctuations in *Corylus* and *Carpinus betulus*. Plant food production occurred on the fertile terraces of the *Alföld* adjacent to the ALP settlements, as did pasture for livestock. At Podpeško Jezero, (Fig. 4b) repeated cycles of clearance for small cultivation or pasture plots are suggested in this study to have caused a shift in the composition of the forest canopy as a result of competitive interactions between tree species. Suitable land for cultivation was available on Ljubljana Moor, but this was probably under extreme pressure as a result of loss of low-lying land to unpredictable floods.

At Sirok and Podpeško Jezero the forest recovered partially as the smaller scale disturbance became more restricted. At Sirok, abandonment of coppicing initiated further development of secondary forest, leading to the expansion of *Fagus*. At Jezero, the *Abies-Fagus* forest recovered slowly and was interrupted by a phase of *Carpinus betulus* as changing hydrological conditions on Ljubljana Moor permitted greater exploitation of the land surface there.

The final phase of the Harris scheme occurs ca. 2000 BP at Sirok and Podpeško Jezero, during large-

scale landscape clearance. However, *Quercus* expands during this stage at Sirok and the total forest cover at both sites remains at 50%. Results from this study suggest that extensive settlement of both regions by Iron Age agricultural communities has resulted in widespread disruption of the natural environment and the establishment of the modern landscape.

Thus, the adoption of a modified 'Harris' model for Neolithic activity can be used to account for the environmental changes recorded in the palaeoecological sequences from Sirok Nyírjes Tó and Podpeško Jezero. No model is infallible, yet the Harris model serves to place the small scale palaeoecological changes observed at the two sites into a tangible archaeological context.

CONCLUSION

Palaeoecological models previously proposed to explain the earliest human activity are considered unsuitable for characterising the environmental response to Neolithic agriculture in Hungary and Slovenia. Such models over-emphasise the ability of Neolithic communities to change their environment and suffer problems concerning sampling resolution and chronology. Archaeological models fare better in terms of temporal resolution, but include few considerations of forest dynamics or broader environmental concepts. A new scheme, based on the existing 'Harris' archaeological model, is presented in an attempt to classify changes apparent in this study according to the human activity apparent from the archaeological record. By application of this model, it is evident that the environmental response to Neolithic activity is complex and can not be represented by simple models of forest clearance and arable field expansion. Consideration of contemporary ecological research is crucial to deciphering pollen signals of forest use by prehistoric societies, and by adopting appropriate methods and models suitable for unique geographical situations, a more realistic impression of human-environment interaction may be gleaned.

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REFERENCES

AABY B. 1988. The cultural landscape as reflected in percentage and influx diagrams from two Danish ombrotrophic mires. In Birks H. H., Birks H. J. B., Kaland P. E. & Moe D. (eds.), *The Cultural Landscape, Past, Present and Future: 209–228.*

1994. NAP percentages as an expression of cleared areas. In Frenzel B. (ed.), *Evaluation of the Land Surfaces Cleared from Forests in the Roman Iron Age and the Time of Migrating Germanic Tribes Based on Regional Pollen Diagrams: 13–27. Palaeoclimate Research X.*

AMMERMAN A. J. and CAVALLI-SFORZA L. L. 1973. A population model for the diffusion of early farming in Europe. In Renfrew C. (ed.), *The Explanation of Culture Change, 1973: 343–357. Models in Prehistory.*

1984. *The Neolithic Transition and the Genetics of Population in Europe*. Princeton.

ANDRIČ M. 1997. *Paleoetnobotanika v neolitskih študijah.* M. A. Thesis, University of Ljubljana.

BARBER K. E. 1981. *Peat Stratigraphy and Climate Change.* Balkema, Rotterdam.

BARKER G. 1985. *Prehistoric Farming in Europe.* Cambridge.

BEHRE K. E. 1981. The interpretation of anthropogenic indicators in pollen diagrams. *Pollen et Spores 23: 225–245.*

ed. 1986. *Anthropogenic Indicators in Pollen Diagrams.* Balkema, Rotterdam.

BENNETT K. D. 1997. PSIMPOLL 3.00 & PSCOMB 1.03: 'C' programs for analysing and plotting pollen data. Available from the Department of Quaternary Geology, University of Uppsala at URL:http://www.kv.geo.uu.se/software.html

BENNETT K. D., TZEDAKIS P. C. and WILLIS K. J. 1991. Quaternary refugia of north European trees. *Journal of Biogeography 18: 103–115.*

BENNETT K. D. and WILLIS K. J. 1995 The role of ecological factors in controlling vegetation dynamics on long temporal scales. *Giornale Botanico Italiano 129: 243–254.*

BIRKS H. J. B. and LINE J. M. 1993. Glacial refugia of European trees – a matter of chance? *Dissertationes Botanicae 196: 283–291.*

BIRKS H. J. B. 1986. Late Quaternary biotic changes in terrestrial and lacustrine environments, with particular reference to north-west Europe. In Berglund B. E. (ed.), *Handbook of Holocene Palaeoecology and Palaeohydrology,1986: 3–65.*

BRADSHAW R. H. W., COXON P., GRIEG J. R. A. and HALL A. R. 1984. New fossil evidence for the past cultivation and processing of hemp (Cannabis sativa L.) in Eastern England. *New Phyologist 89: 503–510.*

BREGANT T. 1974a. Kolišče ob Maharskem Prekopu pri Igu – raziskovanja leta 1970. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji III: 7–35.*

1974b. Kolišče ob Maharskem Prekopu pri Igu – raziskovanja leta 1972. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji IV: 39–67.*

1975. Kolišče ob Maharskem Prekopu pri Igu – raziskovanja 1973 in 1974 leta. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji IV: 7–115.*

BREGANT T., JERMAN M., SLABE M. and VUGA D. 1980. Varovanje arheoloških terenskih spomenikov Ljubljanskega Barja. *Arheološka zaščitna raziskovanja na Ljubljanskem Barju v letu 1979: 11–18.*

BUDJA M. 1997. Landscape changes in the Neolithic and Copper Ages in Slovenia. Case Study: Ljubljana Basin microregion. In Chapman J. and Dolukhanov P. M. (eds.), *Landscapes in Flux. Colloquia Pontica 3: 75–78.*

CARUGATI M. C., CASTELLETTI L. and ROTTOLI M. 1996. L'agricoltora nel primo neolitico del Friuli. Le ricerche a Sammardenchia, Fagninola a Valer. In Ferrari A. & Pessina A. (eds.), *Sammardenchia e i primi agricoltori del Friuli Banca di Credito Cooperativo di Basiliano: 103–112.*

CHAPMAN J. C. and MÜLLER J. 1990. Early farmers in the Mediterranean basin: the Dalmatian evidence. *Antiquity 64: 127–134.*

CHEDDADI R., YU G., GUIOT J., HARRISON S. P. and PRENTICE I. C. 1997. The climate of Europe 6000 years ago. *Climate Dynamics 13: 1–9.*

CLAPHAM A. R., TUTIN T. G. and MOORE D. M. 1987. *Flora of the British Isles (3rd edition).* Cambridge University Press.

CULIBERG M. 1991. Late Glacial Vegetation in Slovenia. *Razprave SAZU IV XXIX/10: 1–52.*

CULIBERG M. and ŠERCELJ A. 1978a. Ksilotomske in palinološke analize rastlinskih ostankov s kolišča na Partih pri Igu – Izkopavanja leta 1977. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji VI: 95–99.*

1978b. Ksilotomske analize lesa iz s kolišča ob Maharskem prekopu – Izkopavanja 1976 in 1977. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji VI: 103–107.*

DE BEAULIEU J. L. and REILLE M. 1984. A long Upper Plesitocene pollen record from Les Echets, near Lyon, France. *Boreas 13: 111–132.*

1992. The last climatic cycle at La Grande Pile (Vosges, France): a new pollen profile. *Quaternary Science Reviews 11: 431–438.*

EDWARDS K. J. 1979. Palynological and temporal inference in the context of prehistory, with special reference to the evidence from peat and lake deposits. *Journal of Archaeological Science 6: 255–270.*

1993. Models of mid-Holocene forest farming for north-west Europe. In Chambers F. M. (ed.), *Climate Change and Human Impact on the Landscape: 132–145.*

EDWARDS K. J., HALSTEAD P. and ZVELEBIL M. 1996. The Neolithic transition in the Balkans – archaeological perspectives and palaeoecological evidence: a comment on Willis & Bennett. *The Holocene 6,1: 120–122.*

ELLENBERG H. 1988. *Vegetation Ecology of Central Europe (4th edition).* Cambridge University Press.

EVANS M. N. and BARKHAM J. P. 1992. Coppicing and natural disturbance in temperate woodlands - a review. In Buckley G. P. (ed.), *Ecology and Management of Coppice Woodlands: 79–98.*

EVANS J. 1992. Coppice forestry - an overview. In Buckley G. P. (ed.), *Ecology and Management of Coppice Woodlands: 18–28.*

FOLLIERI M., MAGRI D. and SADORI L. 1988. 250 000-year pollen record from Valle di Castiglione (Roma). *Pollen et Spores 30: 329–356.*

FÜGEDI E. 1986. *Castle and Societies in Medieval Hungary.* Akadémiai Kiadó, Budapest.

GARDNER A. R. 1998. Biotic response to early Holocene human activity: results from palaeoenvironmental analyses of sediments from Podpeško Jezero. *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji XXIV: 63–77.*

1999. *The Impact of Neolithic Agriculture in the Environments of South-East Europe.* Ph.D. Thesis, University of Cambridge.

GARDNER A. R. and WILLIS K. J. 1998. Prehistoric farming and the postglacial expansion of beech and hornbeam: a comment on Küster. *The Holocene 9/1: 143–145.*

GODWIN H. 1967. The ancient cultivation of hemp. *Antiquity 41: 42–49, 137–138.*

GÖRANSSON H. 1986. Man and the forest of nemoral broad-leaved trees during the Stone Age. *Striae 24: 143–152.*

1987. On arguing in a circle, on common sense, on the smashing of paradigms, on thistles among flowers, and on other things. *Norwegian Archaeological Review 18: 43–45.*

GROVE J. M. 1988. *The Little Ice Age.* Routledge, London.

HALSTEAD P. 1984. *Stategies For Survival: An Ecological Approach to Social and Economic Change in Early Farming Communities of Thessaly, N. Greece.* Ph.D Thesis, University of Cambridge.

1989. Like rising damp? An ecological aproach to the spread of farming in south-east and central Europe. In Milles A., Williams D. & Gardner N. (eds.), *The Beginnings of Agriculture, B.A.R. International series 496: 23–53.*

1996. The development of agriculture and pastoralism in Greece: when, how, who and what? In Harris D. R. (ed.), *The Origins and Spread of Agriculture and Pastoralism in Eurasia: 296–309.*

HARRIS D. R. 1996a. Introduction: themes and concepts in the study of early agriculture. In Harris D. R. (ed.), *The Origins and Spread of Agriculture and Pastoralism in Eurasia: 1–11.*

1996b. The origins and spread of agriculture and pastoralism in Eurasia: an overview. In Harris D. R. (ed.), The Origins and Spread of Agriculture and Pastoralism in Eurasia: 552–574.

1996c. Domesticatory relationships of people, plants and animals. In Ellen R. & Fukui K. (eds.), *Redefining Nature: Ecology, Culture and Domestication Berg: 437–463.*

HUNTLEY B. and BIRKS H. J. B. 1983. *An Atlas of Past and Present Pollen Maps for Europe: 0–13,000 years ago.* Cambridge University Press.

HUNTLEY B. and PRENTICE I. C. 1988. July temperatures in Europe from pollen data, 6000 years before present. *Science 241: 687–690.*

1993. Holocene vegetation and climates of Europe. In Wright H. E., Kutzbach J. E., Webb T. III, Ruddiman W. F., Street-Perrott F. A. and Bartlein P. J. (eds.), *Global Climates Since the Last Glacial Maximum: 136–118.*

IVERSEN J. 1941. Land occupation in Denmark's stone age. *Geological Survey of Denmark II series 66: 5–68.*

KALICZ N. and MAKKAY J. 1977. *Die Linienbandkeramik in der Grossen Ungarischen Tiefebene.* Akadémiai Kiadó, Budapest.

KERTÉSZ R., SÜMEGI P., KOZÁK M., BRAUN M., FÉLEGYHÁZI E. and HERTELENDI E. 1994. Archaeological and palaeoecological study of an early Holocene settlement in the Jászág area. *Acta Geographica Ac Geologica et Meteorologica Debrecina 32: 5–47.*

KOSSE K. 1979. Settlement ecology of the Körös and Linear Pottery Cultures in Hungary. *B.A.R. International Series 64.*

KUTZBACH J. E. and GUETTER P. J. 1986. The influence of changing orbital parameters and surface boundary conditions on climate simulations for the past 18,000 years. *Journal of Atmospheric Sciences 43: 1726–1759.*

KUTZBACH J. E., GUETTER P. J., BEHLING P. J. and SELIN R. 1993. Simulated climate changes: results of the COHMAP climate-model experiments. In Wright H. E., Kutzbach J. E., Webb T. III, Ruddiman W. F., Street-Perrott F. A. and Bartlein P. J. (eds.), *Global Climates Since the Last Glacial Maximum: 24–93.*

LAMB H. H. 1977. *Climate: Present, Past and Future (2 vols.).* Methuen, London.

MABBERLEY D. J. 1997. *The Plant Book: a Portable Dictionary of the Higher Plants.* Cambridge University Press.

MAGRI D. 1996. The Neolithic transition and palaeoecology in the Balkans: a comment on Willis & Bennett. *The Holocene 6,1: 119–123.*

MAHER L. J. 1998. SLOTDEEP v. 1.8 adds DC profiles to its DC map. INQUA Commission for the Holocene. Sub-Commission on Data-Handling Methods Newsletter 18 (available from URL: http://www.kv.geo.uu.se/inqua/news18/n18-ljm2.htm)

MELLARS P. 1975. Fire ecology, animal populations and man: a study of some ecological relationships in prehistory. *Proceedings of the Prehistoric Society 42: 14–45.*

NEWBOLD A. J. 1983. *Some aspects of the regeneration of oak and beech.* Ph.D. Thesis, University of London.

NILSSON S. and PRAGLOWSKI J. (eds.) 1992. *Erdtman's Handbook of Palynology (2nd Edition).* Munksgard, Copenhagen.

PACKHAM J. R. and HARDING D. J. L. 1982. *Ecology of Woodland Processes.* Edward Arnold, London

PENNINGTON W. 1986. Lags in adjustment of vegetation to climate caused by the pace of soil development: evidence from Britain. *Vegetatio 67: 105–118.*

PETERS R. 1997. *Beech Forests.* Kluwer Academic, Dordrecht.

PETERSON G. M. 1983. Recent pollen spectra and zonal vegetation in the western USSR. *Quaternary Science Reviews 2: 281–321.*

PIGOTT C. D. 1983. Regeneration of oak-birch woodland following exclusion of sheep. *Journal of Ecology 71: 629–646.*

POLUNIN O. 1980. *Flowers of Greece and the Balkans.* Oxford University Press.

RACKHAM O. 1980. *Ancient Woodland: Its History, Vegetation and Uses in England.* Edward Arnold, London.

1986. *The History of the Countryside.* Dent, London.

1988. Trees and woodland in a crowded landscape – the cultural landscape of the British Isles. In Birks H. H., Birks H. J. B., Kaland P. E. & Moe D. (eds.), *The Cultural Landscape, Past, Present and Future: 53–78.*

ROBERTS N. 1998. *The Holocene (2nd edition).* Blackwell, Oxford.

ŠERCELJ A. 1996. The Origins and Development of Forests in Slovenia. *Razprave SAZU IV: 35.*

SHERRATT A. 1982a. The development of Neolithic and Copper Age settlement in the Great Hungarian Plain part 1: the regional setting. *Oxford Journal of Archaeology 1,3: 287–316.*

1982b. The development of Neolithic and Copper Age settlement in the Great Hungarian Plain part 2: site survey and settlement dynamics. *Oxford Journal of Archaeology 2,1: 13–41.*

SIMMONS I. G. and INNES J. B. 1996. Disturbance phases in the Mid-Holocene vegetation at North Gill, North York Moors: form and process. *Journal of Archaeological Science 23: 183–191.*

SUGITA S., GAILLARD M.-J. and BROSTRÖM A. 1999. Landscape openness and pollen records: a simulation approach. *The Holocene 9,4: 409–421.*

TROELS-SMITH J. 1954. Ertebølle culture – farmer culture. Results of the past ten years' excavations in Aamosen Bog, West Zealand. *Aarbøger for Nordisk Oldkyndighed og Historie.*

TROGMAYER O. 1980. Pannonia before the Roman conquest. In Lengyel A. C. & Radan G. T. (eds.), *The Archaeology of Roman Pannonia: 65–82.*

TUTIN T. G., HEYWOOD V. H., BURGESS N. A., MOORE D. M., VALENTINE D. H., WALTERS S. M. and WEBB D. A. (eds.), *Flora Europaea (2nd Edition, 5 volumes), 1989.* Cambridge University Press.

TZEDAKIS P. C. 1993. Long-term tree populations in northwest Greece through multiple Quaternary climatic cycles. *Nature 364: 437–440.*

1994. Vegetation change through glacial-interglacial cycles: a long pollen sequence perspective. *Philosophical Transactions of the Royal Society of London B345: 403–432.*

VAN ANDEL T. H. and RUNNELS C. N. 1995. The earliest farmers in Europe. *Antiquity 69: 481–500.*

VAN ANDEL T. H., ZANGGER E. and DEMITRACK A. 1990. Land use and soil erosion in prehistoric and historical Greece. *Journal of Field Archaeology 17: 379–396.*

VAN DER WIEL A. M. and WIJMSTRA T. A. 1987a. Palynology of the lower part (78–120 m) of the core Tenaghi Phillipon II, Middle Pleistocene of Macedonia, Greece. *Review of Palaeobotany and Palynology 52: 73–88.*

1987b. Palynology of the 112.8–197.8 m interval of the core Tenaghi Phillipon III, Middle Pleistocene of Macedonia, Greece. *Review of Palaeobotany and Palynology 52: 89–117.*

WIJMSTRA T. A. 1969. Palynology of the first 30 metres of a 120 m deep section in northern Greece. *Acta Botanica Neerlandica 18: 511–527.*

WILLIS K. J. 1994. The vegetational history of the Balkans. *Quaternary Science Reviews 13: 769–788.*

1995a. Land degradation in the Balkans: variations in time and space. In van der Leeuw S. (ed.), *L'Homme et la degradation de L'Environment.* Editions APDCA.

1995b. The pollen-sedimentological evidence for the beginning of agriculture in southeast Europe and Anatolia. In *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji XXII: 9–25.*

WILLIS K. J. and BENNETT K. D. 1994. The Neolithic transition – Fact or Fiction? Palaeoecological evidence from the Balkans. *The Holocene 4/3: 326–330.*

WILLIS K. J., BRAUN M., SÜMEGI P. and TÓTH A. 1995. The Late Quaternary Environmental History of Bátorliget, N.E. Hungary. *Palaeogeography, Palaeoclimatology, Palaeoecology 118: 25–47.*

1997. Does soil development cause vegetation change or vice versa? A temporal perspective from Hungary. *Ecology 73(2): 730–740.*

1998. Prehistoric land degradation in Hungary: Who, How & Why? *Antiquity 72: 101–113.*

WOILLARD G. M. 1978. Grande Pile peat bog: a continuous pollen record for the last 140,000 years. *Quaternary Research 9: 1–21.*

ZVELEBIL M. 1990. Mesolithic prelude and neolithic revolution. In Zvelebil M. (ed.), *Hunters in Transition: 5–15.*

1994. Plant use in the Mesolithic and its role in the transition to farming. *Proceedings of the Prehistoric Society 60: 35–74.*

ZVELEBIL M. and ROWLEY-CONWY P. 1984. Transition to farming in northern Europe: a hunter – gatherer perspective. *Norwegian Archaeological Review 17,2: 104–128.*

ZVELEBIL M. and ZVELEBIL K. V. 1988. Agricultural transition and Indo-European dispersals. *Antiquity 62: 574–583.*

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Documenta Praehistorica XXVI

Landscape dynamics on the Ljubljana Moor

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ABSTRACT – *A geographical Information System (GIS) based dynamical model of streams migration was constructed in order to gain insight into the dynamics of the palaeo landscape. Model implications related to the settlement patterns and perception of the landscape by the mid-Holocene men and women dwelling in it are discussed.*

IZVLEČEK – *Članek predstavlja uporabo geografskega informacijskega sistema (GIS) pri rekonstrukciji dinamike poplavne ravnice na Ljubljanskem barju. Predstavljen je model dinamike krajine Ljubljanskega barja v srednjem holocenu in model nastanka poselitvenega vzorca.*

KEY WORDS – *Ljubljansko barje; Mesolithic; Neolithic; Eneolithic; Geographical Information System; alluvial geoarchaeology; landscape dynamics*

The purpose of modeling is insight, not numbers.
(Hamming 1962)

INTRODUCTION

The aim of the present paper is to access the palaeodynamics of the Ljubljana Moor landscape in the period between 6500 BP and 4000 BP. My intention is to take one step beyond the traditional debate concerned mainly with the description of the static site environs and the detection of the human impact on the landscape and which is – at least in my opinion – unable to access long-term co-evolutionary dynamics of human groups and landscape on the Ljubljana Moor. The following text aims to suggest that Geographical Information Systems (GIS) can provide not only a sophisticated cartographic tool, but a flexible environment within which the dynamics of the past landscapes can be modelled and explored.

Using an on-going case-study focused upon the landscape dynamics of the Ljubljana Moor, a dynamic GIS model was constructed in order to explore the dynamics of the floodplain and its implications in the context of the Mesolithic/Neolithic/Eneolithic occupation of the Ljubljana Moor.

BACKGROUND TO THE STUDY AREA

Ljubljana Moor or Ljubljansko barje (Fig. 1) is a large wetland in the extreme south of the Ljubljana basin in the central part of Slovenia. It is a tectonic depression, with an extensive alluvial floor and flat surface, fringed by three major topographical regions: the Alpine foothills, carstic Dolenjska region and northern tip of carstified Dinaric mountains. The bottom can be generally divided into three basic topographic units, the most extensive being a marshy flood-plain, then alluvial fans and, finally, isolated hills. The whole area is characterised by dynamic tectonic activity taking forms from long-term subsidence and uplift to catastrophic earthquakes, the last one in 1895. The main water-courses are Ljubljanica, Ižica and Iška rivers, with extensive carstic watersheds in the Dinaric Mountains, and the River Gradaščica from the Alpine foothills. Prior to the major regulation works and commercial peat extraction in the 19th century, parts of the area were covered by up to 6 m of peat and characterised by predictable cyclical annual floods nested within an unpredictable cycle

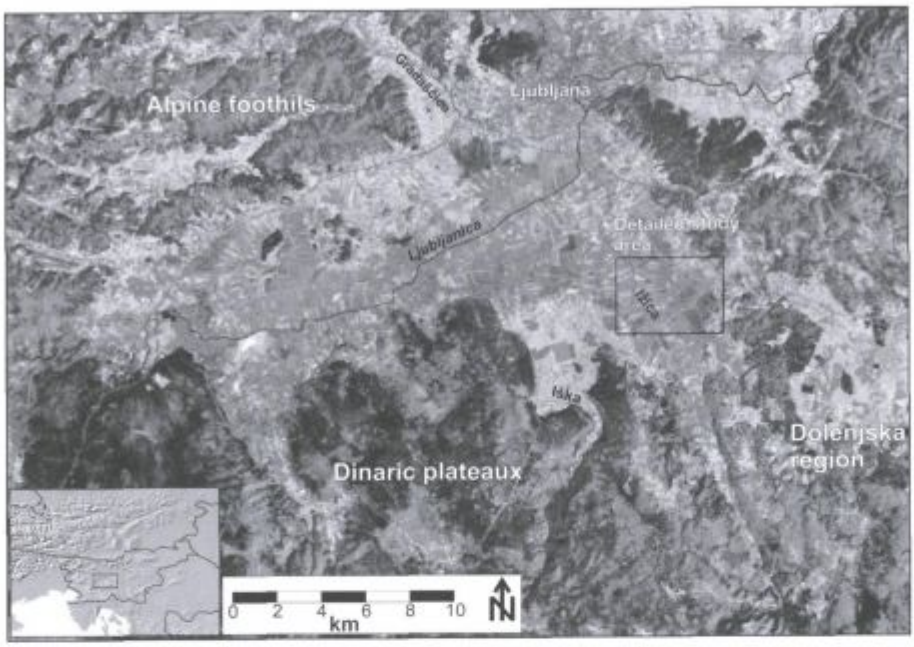

Fig. 1. False colour sattelite image of Ljubljana Moor with the places mentioned in the text. Landsat TM, channels 2,5,7. Source: EURIMAGE, Frascati, Italy. Owner of the data: Joint Research Centre, Ispra, Italy. Owner of the georeferenced mosaic: Zavod Republike Slovenije za Statistiko, Slovenia.

of major flood events. Today, as a result of flood control works, the landscape is effectively controllable and stable.

RECENT ARCHAEOLOGICAL RESEARCH

Archaeological interest in the region started in the second half of the 19th century when the first pile dwellings were discovered. This discovery was a part of the wider cultural historical context in the second half of the 19th century, when a chain reaction of pile-dwelling discoveries was triggered by the initial discovery of the pile dwelling on the Lake Zurich (*Greif 1997.72*). The peaceful landscape of a pile-dwelling situated at the edge of a lake surrounded by mountains served as a model for interpreting Neolithic settlement patterns and palaeo environment (*Keller 1854*). In the case of the Ljubljana Moor this romantic picture was supported by the generalised stratigraphic sequence of chalky lacustrine clays and marls followed by organogenic muds and finally peat, interpreted as a result of linear hydroseral succession from lake to swamp and raised bog (*Melik 1946; Šercelj 1966.443*). A vicious circle was formed when archaeological data was used to support environmental data and vice versa.

The model created in the mid-19th century was applied to the archaeological and palaeo environmental data at the Ljubljana Moor until the 1990s. This was a period when the search for pile-dwellings was fashionable and intensive - although poorly documented - excavations were important for the institutional promotion of Slovenian prehistoric archaeology (*Budja 1995.176*). The floor of Ljubljana Moor was privileged and other parts of the Ljubljana basin and background hills were neglected until the 1980s, when the discovery of Mesolithic lithic scatters (*Josipović 1985*) focused research interest on - and only on - the fringes of the Moor and at edges of isolated hills. But new data was still collected unsystematically and researchers ignored the Moor's hinterland. The Mesolithic settlement pattern was interpreted as an indicator of lakeside activities and was used to support the model of gradual and linear succession from lake to swamp and raised bog.

In 1995 Budja proposed an alternative scenario for the landscape dynamics and settlement patterns based on Šifrer (*1984*) flood-plain hypothesis. Šifrer interprets chalky silt and clay deposits as the sign of erosion of various soils in the Dinaric Karst region at the beginning of the Holocene. These sediments are interpreted as indicators of climate changes and past flooding of the Ljubljana Moor, rather than as proofs of a lake existence. Budja (*1995*) explained Neolithic and Eneolithic sites as riparian settlements and their pattern as a human response to flood-plain evolution.

ACCESSING PALAEO DYNAMICS

Detailed study area

The eastern part of the Ljubljana Moor was chosen for intensive research into floodplain dynamics. A

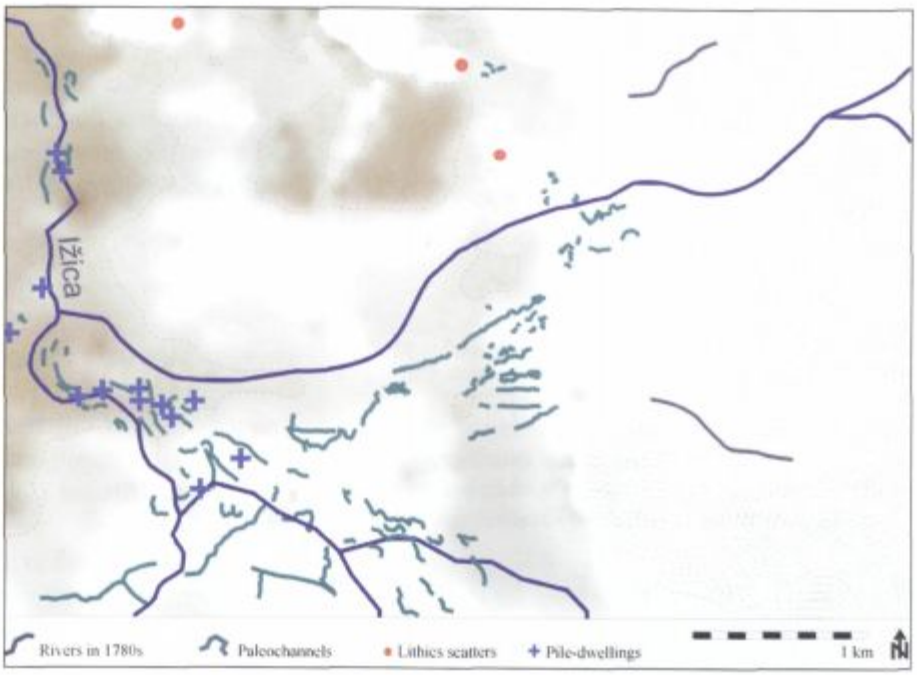

Fig. 2. Detailed study area. Shaded area between 288 m (dark shaded) and 291 m (light shaded).

detailed digital elevation model (DEM) was generated and floodplain features such as lakes, oxbow lakes and palaeo channels were identified from aerophotos and DEM. The pre-regulation hydrological network was reconstructed from historical maps (Fig. 2).

Settlement patterns

The remnant settlement pattern shows a clear preference for the floodplain by the Neolithic/Eneolithic "pile-dwellings" and a position just next to the palaeo channels. The distribution of the Mesolithic/Early Neolithic lithic scatters is limited to the edges of the floodplain.

Spatial statistics tests were performed in order to observe the relationship between sites and environmental variables, in this case, distance to the nearest river and palaeo channel.

Firstly, the relationship between sites and the pre-regulation hydrological network was tested using Kolmogorov-Smirnov two sample test (*Hodder and Orton 1976.226–229*).

Samples of the 32 pile dwellings and 19 lithic scatters was used in the analysis. The difference between distributions of pile-dwellings and streams proved to be significant at well below the 1% level. Pile-dwellings show a marked preference for proximity to water, with about 90% of the sites located less than 500 m from the nearest stream.

Lithics scatters display a similar, but less marked preference, and the difference between distributions was proven not to be significant at the 5% level (Fig. 3).

Another test was performed to observe the relationship between the location of pile-dwellings and palaeo channels in the detailed study area (Fig. 4). 13 pile-dwellings were used in analysis and the difference between two distributions was proven to be significant well below the 1% level.

Possible interpretations of the observed pattern are:

- There were no large scale river migrations since the Neolithic/Eneolithic.

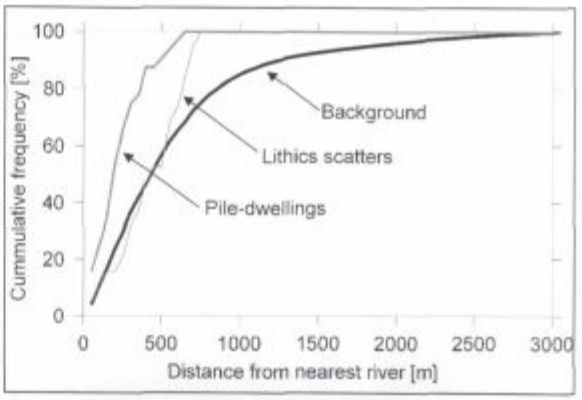

Fig. 3. Relationship between number of sites and background (expected number of sites) at distances from nearest river (obtained from historical map) on a regional (Ljubljana Moor) scale.

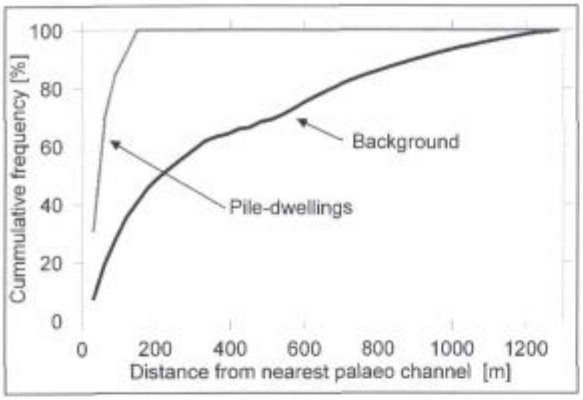

Fig. 4. Relationship between number of pile-dwellings and background (expected number of sites) at distances from nearest palaeo channel on a catchement (Detailed study area) scale.

- Pile-dwellings show a preference for riparian environments.
- Proximity to running water was not the key factor for choosing the location for activities, observed today as lithic scatters or
- drastic landscape restructuring (drying up of the lake and formation of the floodplain) took place in the Late Mesolithic.

However, this is a modern, quantifiable and first of all static landscape, and the next step is to access the dynamics which shaped it in the past.

Processes that shaped the floodplain

Looking at the long-term structuring of the Ljubljana Moor landscape it is obvious that floods are the main factor which contributed to the shaping of the floodplain. However, it was high magnitude, unpredictable floods that changed the floodplain dramatically.

There are four interlinked processes which are the consequences of flood events of different magnitudes and which can be read from the modern landscape.

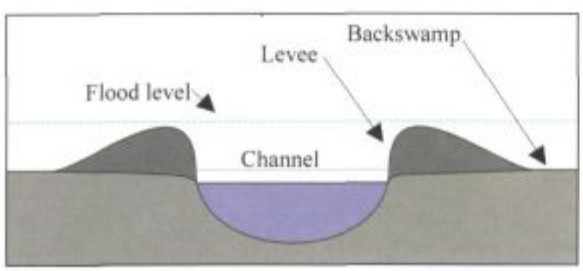

Fig. 5. Levee formation.

Levee formation

Levees (Fig. 5) are linear features located just next to a channel. They are formed by the deposition of sediment when flood-water exceeds bank height and its velocity drops abruptly (*van Andel and Runnels 1995.485; Brown 1997, Table 1.1; Knighton 1998.145*).

Meander migration

In meandering systems (as most of Ljubljana Moor rivers are) the most common type of channel change is meander migration (Fig. 6). This can be classified into a number of different forms, such as rotation, translation, extension, enlargement and combinations of these (*Brown 1997.26–27; Knighton 1998. 226–227*).

Meander neck cutoff

High energy flood water can find a shorter route and cut-offs meander into neck (Fig. 7). Result is a distinctive oxbow lake or swamp (*Brown 1997.28*). Meander neck cut-off can also be caused in a low magnitude, cyclical flood event.

Avulsion

The most dramatic process is called avulsion (Fig. 8). The gradual rise of the river bed and adjacent levees causes the river to seek a new course lower down in the flood-plain. Avulsion can be triggered by a high magnitude flood. Ribbon lakes or palaeochannels are typical result of this process (*Brown 1997.28; van Andel and Runnels 1995, Fig. 2, 484*).

The model

A simple GIS based dynamic model of stream behaviour was constructed in order to access the long-term structuring of the floodplain. It simulates the

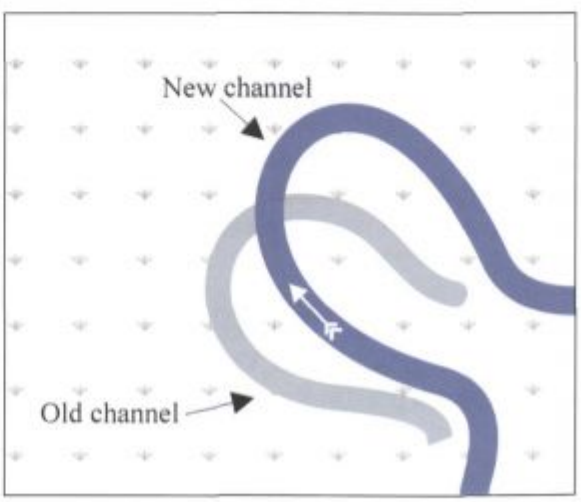

Fig. 6. Meander migration.

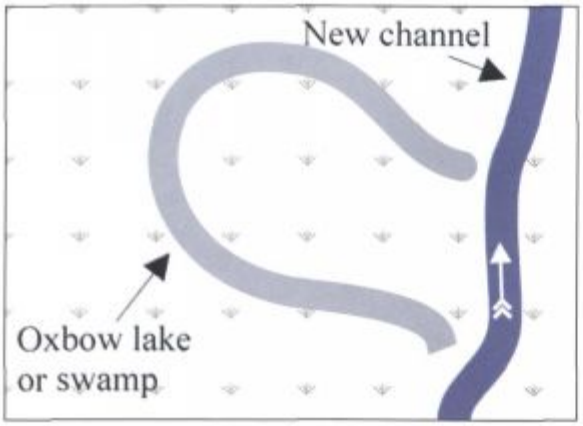

Fig. 7. Meander neck cutoff.

effect of various permanent alterations inflicted upon a landscape by the action of floods events of different magnitudes. GIS was then used to apply a group of hydrological modelling algorithms to the post-flood topographical data in order to simulate the movement and behaviour of water flows across the post-flood landscape. The modelled landscape has it own history as topographic changes of previous flood events are inherited and contribute to the shaping of subsequent events. Stream course data obtained after each run of the model were overlaid to observe the long-term effects of floodplain dynamics. The resultant map (Fig. 9) can be seen as a fuzzy set, with different levels of probability (uncertainty) for fluvial activity at each grain of the floodplain. A by-product of the model is an animation of stream migration which offers a truly dynamic view of the floodplain and replaces the static abstraction of the map.

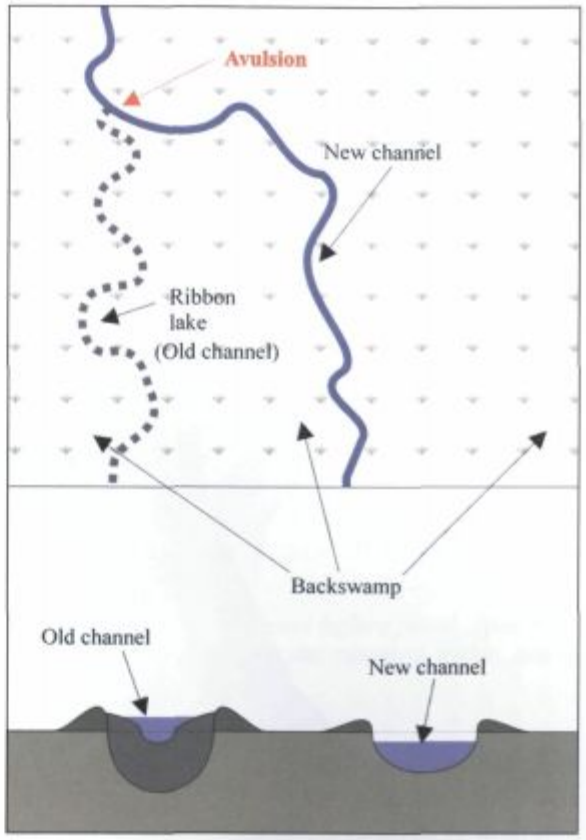

Fig. 8. Avulsion.

RESULTS

What strikes me most how dynamici the simulated floodplain is. Simulated streams change their course after each flood event. Small-scale stream migrations and large scale migrations also took place, but not

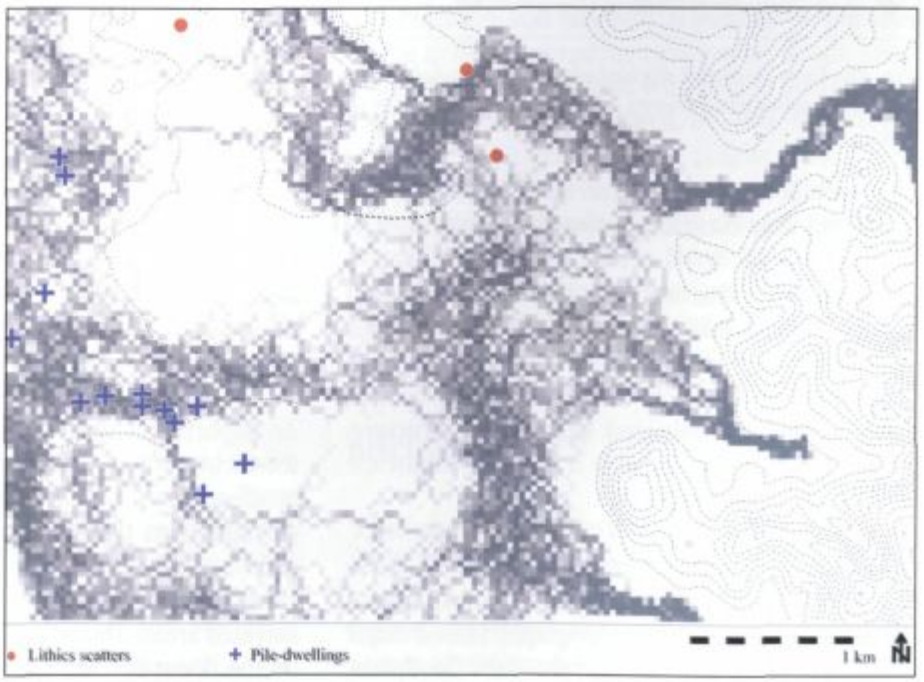

Fig. 9. Model results after 200 runs. Dark shaded areas indicate areas of high probability of fluvial activity.

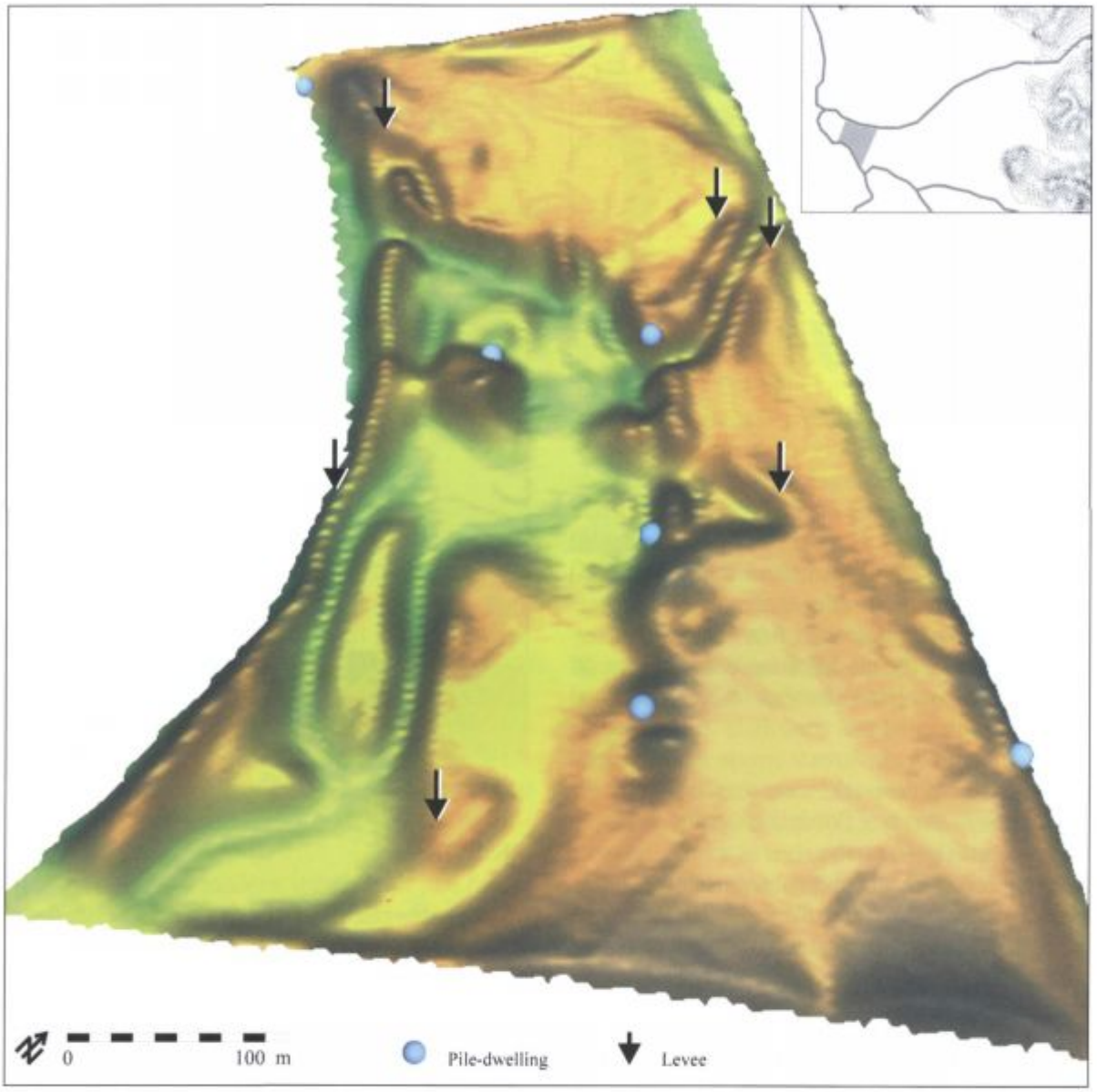

Fig. 10. Very detailed digital elevation model (DEM) of a small area of the floodplain. Several palaeochannels and adjoining leeves can be observed. Note the position of the pile-dwellings next to the palaeochannels.

randomly. Several possible corridors for each stream occur and flow oscillates between them.

If we translate this into the palaeo landscape, it means that the major consequences of the floods were not simply effects of the inundation, of high water, but the migration of water streams which reshaped the flood-plain and changed its structure. The floodplain was probably a dynamic landscape even on a human time scale.

Another feature is the enormous sensitivity of the simulated floodplain to disturbance. Simulating even the smallest changes in the topography caused major changes in the shape and structure of the floodplain.

A corollary of this observation could be that human intervention in the drainage catchement of the floodplain or in the floodplain itself – forest burning, deforestation, grazing, cultivation – could have had a profound effect on the landscape and the future actions of the people inhabiting it.

An important feature of the simulated floodplain is the occurrence of isolated patches almost completely unaffected by fluvial activity. These are areas slightly elevated from the floodplain.

Lithic scatters are located on some of these slightly elevated areas. Absence of evidence of lithic scatters on the floodplain is, in my opinion, not evidence of

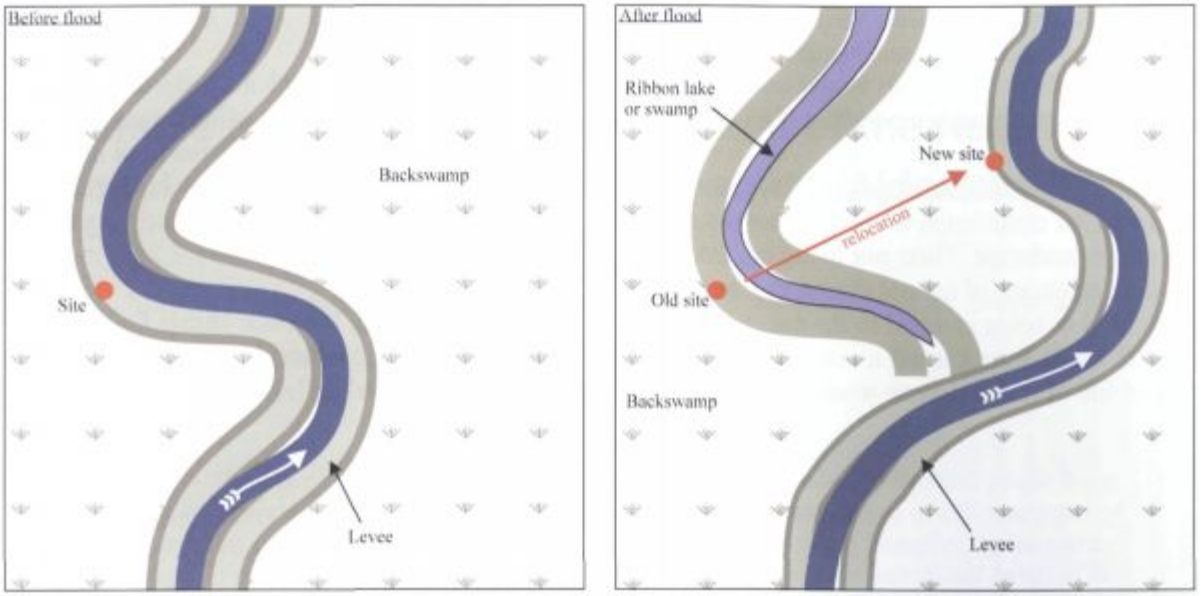

Fig. 11. Model of site relocation. Site located on a levee next to the active channel before flood. After high magnitude flood event, which restructures sites environ and cuts off site from the running water, site is relocated to the active channel.

absence. It is a result of a selective preservation of the sites with permanent structures (pile dwellings), whereas fragile Mesolithic/Early Neolithic sites of activities were washed away or rendered invisible by fluvial processes.

Neolithic and Eneolithic "pile-dwellings" display a different pattern. They are located just next to or in the stream corridors of the simulated flood-plain and just next to the identified palaeo channels in the real floodplain. As seen above, this pattern can be observed all over Ljubljana Moor. As suggested also by the stratigraphy of the excavated pile-dwellings (*Bregant 1975; Budja 1995*), sites were obviously located next to active channels on natural levees (Fig. 10), which were dry most of the time and never deeply submerged by flood-waters.

Flood can have several effects on the site:

- Inundation, which could have caused structural damage to the site. A human answer to that would be rebuilding of the site, probably at the same location.

- Bank erosion, which could have promoted undercutting of the levee and eventual bank collapse and damage to the site. A structure interpreted as a wave-break which was discovered at the Maharski prekop site could have served to protect the site from bank erosion (*Bregant 197. Fig. 1*).

- Stream migration and avulsion, as a result of catastrophic flooding which would have effectively changed the shape of the floodplain, restructured site environs and cut the site off from the active channel and running water. Human action would be the relocation of the site to the next active channel (Fig. 11). I believe that proximity to running water was a key factor in choosing a place to live.

- High density and number of sites can be seen in this perspective as a result of short duration of occupation and frequent relocation of the sites due to the effects of the catastrophic floods. Short duration of occupation was proved also by dendrochronological research on two sites to be about 50–80 years per site (*Čufar et al. 1998*). On the other side, long spans of radiocarbon data from sites Maharski prekop (*Budja 1995.174*) and Parti (*Harej 1978.74; Harej 1982.46*) suggest either long duration of occupation or more possibly, several re-occupation of the sites.

DISCUSSION

What can this exercise tell us about the perception of the flood-plain landscape by the people dwelling in it? I believe that cyclical, annual, predictable floods formed an integral part of the everyday lives of the people inhabiting flood-plain, just like the presence

of enriched soils, reed beds, wild-fowl, fish, water chestnut and other malign and benign things that the flood-plain offers. The floods would have served to construct and maintain temporalities (*Gillings 1998*).

However, it was rare and unpredictable, catastrophic floods which contributed to the long term structuring of the landscape. Their not being embedded in people's taxonomy of natural events and their being thought of as being external to the natural order of events, would have caused a major change in the way of life of mid-Holocene women and men.

ACKNOWLEDGEMENTS

This paper is a part of a diploma dissertation, 'Landscape dynamics and the first cultural landscapes at the Ljubljana Moor', at the Department of Archaeology, University of Ljubljana, under supervision by Professor Mihael Budja, and is currently a work in progress.

I would like to thank Professor Mihael Budja for his support during preparation of the dissertation and this paper. All mistakes, however, remain my own.

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REFERENCES

van ANDEL T. H. and RUNNELS C. N. 1995. The earliest farmers in Europe. *Antiquity 69: 481–500.*

BREGANT T. 1975. Kolišče ob Maharskem prekopu pri Igu – raziskovanja 1973. in 1974. leta (Der Pfahlbau am Maharski-Kanal – Forschungen aus dem Jahren 1973 und 1974). *Poročilo o raziskovanju neolita in eneolita v Sloveniji 4: 7–107.*

BROWN A. G. 1997. *Alluvial geoarchaeology. Cambridge Manuals in Archaeology.* Cambridge University Press.

BUDJA M. 1995. Spreminjanje naravne in kulturne krajine v neolitiku in eneolitiku na Ljubljanskem barju I (Landscape changes in the Neolithic and Eneolithic in Slovenia. Case study: Ljubljansko barje I). *Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji 23: 163–181.*

ČUFAR K., LEVANTIČ T. and VELUŠČEK A. 1998. Dendrokronološke raziskave na koliščih Spodnje mostišče 1 in 2 ter Hočevarica (Dendrochronological investigations in the pile dwellings Spodnje Mostiše 1 and 2 and Hočevarica from Ljubljana moor). *Arheološki vestnik 49: 75–92.*

GILLINGS M. 1998. Embracing uncertainty and challenging dualism in the GIS-based study of a palaeoflood plain. *European Journal of Archaeology 1: 117–144.*

GREIF T. 1997. Prazgodovinska kolišča na Ljubljanskem barju (The Prehistoric pile dwellings in the Ljubljansko barje). *Arheo 18.*

HAREJ Z. 1978. Kolišče v Partih pri Igu na Ljubljanskem barju (Der Pfahlbau in Parte bei Ig auf dem Moor von Ljubljana). *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji 6: 61–75.*

1982. Kolišče v Partih pri Igu na Ljubljanskem barju – Raziskovanja 1978. in 1979. leta (Der Pfahlbau in Parte bei Ig auf dem Moor von Ljubljana – Forschungen in den Jahren 1978 und 1979). *Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji 9–10: 31–101.*

HODDER I. and ORTON C. 1976. *Spatial analyisis in Archaeology.* Cambridge University Press.

JOSIPOVIĆ D. 1985. Ob odkritju najdišč sileksov na Ljubljanskem barju. *Kronika 33: 1–5.*

KELLER F. 1854. Die keltischen Pfahlbauten in den Schweizerseen. *Mittelungen der Antiquarischen Gesellschaft in Zürich (Bericht 1)1: 65–100.*

KNIGHTON D. 1998. *Fluvial Forms and Processes.* Arnold.

MELIK A. 1946. Ljubljansko koliščarsko jezero in dediščina po njem. *Dela SAZU.*

ŠERCELJ A. 1966. Pelodne analize pleistocenskih in holocenskih sedimentov Ljubljanskega barja. *Razprave SAZU IX/9: 431–427.*

ŠIFRER M. 1984. Nova dognanja o geomorfološkem razvoju Ljubljanskega barja (New findings on the Geomorphological Development on the Ljubljansko barje). *Acta Geographica 23/2: 9–45.*

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Stable isotope evidence of the diet of the Neolithic population in Slovenia – a case study: Ajdovska jama

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ABSTRACT – *The aim of this research was to determine the nutrition habits of Neolithic people living in Slovenia between 4000 BC and 3400 BC. The specific isotopic composition of different types of food is reflected in the isotopic composition of the tissues of the consumer. Therefore, by measuring the isotopic composition in the tissues we can draw conclusions about the nutritional habits of the consumer. We analysed the remains of human bones taken from Ajdovska jama and determined the stable isotopic composition of carbon and nitrogen in the bone collagen. Our results indicate that the diet consisted primarily of herbivores, most probably domestic animals.*

IZVLEČEK – *Namen našega dela je ugotoviti prehranjevalne navade neolitskega človeka na naših tleh iz petega in četrtega tisočletja BC. Izotopska sestava ogljika in dušika v hrani je različna in se odraža v izotopski sestavi tkiv uživalca, zato lahko na podlagi meritev izotopske sestave sklepamo o njegovem prehranjevanju. Analizirali smo vzorce kostnih ostankov iz Ajdovske jame in določili izotopsko sestavo ogljika in dušika v kostnem kolagenu. Rezultati meritev kažejo, da so pretežno prehrano naših prednikov predstavljale rastlinojede, v glavnem domače živali.*

KEY WORDS – *Ajdovska Jama; Neolithic diet; stable isotopic composition of carbon and nitrogen*

INTRODUCTION

Since its introduction in 1977, stable isotope analysis of bone collagen has become a very valuable tool for determining prehistoric human and animal diets (*DeNiro and Epstein 1978; Tauber 1981; Schwartcz and Schoeninger 1991; Lubell et al. 1994; Schulting 1998*). The inorganic and organic chemical constituents of bone provide a record of long-term dietary intake. Elements and amino acids liberated by the digestion of food are incorporated into bone minerals, collagen and non-collagenous bone proteins throughout a vertebrate's lifetime. Dietary information is thus recorded by carbon and nitrogen isotope ratios in bone collagen and by carbon isotope ratios in the carbonate component of the inorganic portion of bone minerals (bioapatite) and teeth mineral (*Krueger and Sullivan 1984*). The reconstruction of individuals' diets using isotopic methods has been limited to the analysis of collagen preserved in bone, because bioapatite is more difficult to deal with due to problems of diagenesis (*Schoeninger and DeNiro 1982*).

Carbon isotopes are fractionated by natural processes such as the photosynthetic assimilation of CO_2 and its adsorption in water. Carbon fractionation is affected by the type of metabolism used by a plant to fix CO_2 and differs in the marine and terrestrial foods chain and may therefore be used to elucidate questions on the origin of naturally occurring carbon compounds. Due to kinetic isotope effects, terrestrial plants that follow normal Calvin (C_3) photosynthesis are depleted in the heavy carbon isotopes, as is shown in a change in $\delta^{13}C$ values from -6 to -8‰ in atmospheric CO_2 to -24 to -32‰ in terrestrial plants. Terrestrial animals and human feeding on such plants show a similar ^{13}C content, although with a slight shift towards higher $\delta^{13}C$ values. The absorption of CO_2 in water and the subsequent formation of bicarbonate are governed by kinetic isotope effects and by thermodynamic equilibrium processes, which lead to an enrichment in heavy carbon isotopes to $\delta^{13}C$ values closed to 0‰. When marine bicarbonate is assimilated during pho-

tosynthesis in submerged plants, reaction kinetics again result in depletion in the heavy isotopes, in this case to $\delta^{13}C$ values about -10 to -18‰, and this fractionation is also reflected in marine animals and human whose food was based mostly on marine protein. The simple isotopic separation between terrestrial and marine plants and animals is partially obscured if the C_4 photosynthetic cycle has dominated in terrestrial plants. The isotopic composition of these plants ranged between -10 to -16‰. The most important cultivated C_4 plants were maize, sugar cane and millet. However, in our study, which concerns temperate Europe, the influence of C_4 plants can be excluded.

Little is known about the nitrogen isotopic composition of different types of food. It has been suggested that plants that can fix molecular nitrogen (due to the presence of symbiotic bacteria) have characteristically lower $^{15}N/^{14}N$ ratios than those which must assimilate other forms of inorganic nitrogen, such as ammonia or nitrate (*Delwiche et al. 1979*). The differences between the $\delta^{15}N$ values of the two types of plant appear to vary depending on the location in which they grew and the time of year at which they were collected (*DeNiro and Epstein 1981*). The basis for the geographical and temporal variability of plant $\delta^{15}N$ values must be resolved before a dietary analysis based on the isotopic ratios of animal nitrogen can be exploited to its full potential. It may also be possible to use the nitrogen isotopic method of dietary analysis to determine the relative amounts of terrestrial and aquatic food sources eaten by animals living in shore environments. Stable nitrogen isotopes, ^{15}N, are also enriched in marine systems relative to terrestrial systems, but for such studies the degree of trophic level fractionation is more important. Enrichment of ^{15}N through the trophic network is widely recognised among most animals, including invertebrates and vertebrates, leading to a value of 3.4 ± 1.1‰ (*Minagawa and Wada 1984; Wada et al. 1987*). These facts suggest that the isotopic composition of organisms provides basic information not only about their food source, but also the trophic level. Most marine fish that are eaten by humans are carnivores, and marine food chains are relatively longer than terrestrial chains, therefore ^{15}N contents are relatively high. The is true of lake fish, so that humans consuming a substantial proportion of fish and/or mammals will have higher stable nitrogen value than is possible to attain in a purely terrestrial system (*Schoeninger et al. 1983; Katzenberg 1989*).

Two important issues must also be considered. First, stable isotope results on human bones provide insights into the amount of protein an individual has consumed over approximately the last ten years of their lifetime (*Chisholm et al. 1983, Schwarcz and Schoeninger 1991*). And the second, the assumption that the bone collagen isotope ratio has not been modified by post-mortem processes. It was shown that the material isolated from prehistoric bones, with C/N ratios between 2.9 and 3.6 have not undergone diagenetic alteration (*DeNiro 1985*). It is possible they have, but previous studies suggest that such diagenetic shifts must be small enough for identification of the basic feeding behaviour of the individuals from their bone collagen isotope ratios to be possible.

Fig. 1. Ajdovska jama near Nemška vas is located in the south-eastern foot-hills of the Krško highlands.

Fig. 2. Human skeletons were discovered in the left corridor and in the central hall of the cave.

The aim of this paper is to determine the nutritional habits of Neolithic people living in Slovenia between around 4000 BC and 3400 BC using isotopic methods. The isotopic composition of different plant and animal remains in association with human skeletons were also determined in order to be able to define more precisely the roles of plants and animal protein in the diet of the humans living at the time.

MATERIALS AND METHODS

The human bone samples from Ajdovska jama near Nemška vas, also known as Kartušova jama located in the south-eastern foot-hills of the Krško highlands were collected in this study (Fig. 1). Human skeletons were discovered in the left corridor and in the central hall (Fig. 2). Anthropologists managed to identify 29 individuals, namely 13 adults (6 males and 7 females) and 16 infants. Different faunal species associated with the burials were also found. The most represented species were domesticated mammals, such as cattle, sheep, pigs, and plants – mostly wheat, which implies some domestic activity during both periods. Also, some remains of wild animals were found: brown bear, deer, field hare. The floral and faunal remains and the human bone samples were then transferred to labelled, polythene bags which were sealed until the start of pre-treatment. The AMS ^{14}C analysis was used to date the burial remains in Ajdovska jama. The results indicate that the samples are from two different periods *ca* 5300 and 6000 yrs BP.

Sample preparation

Since the accuracy of measurements mainly depends on the variability inherent in the collagen extraction and measurement techniques, we have compared two methods that have been developed for collagen extraction and purification. Four samples were selected for this test. The bone samples were cleaned in cold, distillate water in an ultrasonic bath to remove soil contaminants, and then oven-dried at 50°C to constant weight. The samples were ground in a mill to ~1 mm fine powder and subdivided into two portions. The first extraction method was that described by Longin (*1971*). Approximately 1 g of bone powder was weighed into a 250 ml beaker and 150 ml of 1M hydrochloric acid (HCl) added to remove the acid soluble inorganic portions of the bone, any acid soluble protein and peptide fragments, and free amino acids. The acid also breaks down some of the hydrogen bonds of collagen, so that it becomes soluble in hot water. The pre-treatment time must be short (< 20 min), otherwise the proteinic chain is hydrolysed and the collagen becomes soluble in hot water and is then lost. The acid solution is then discarded by filtration through a glass microfibre filter and well washed with distillate water. The remaining acid insoluble material, which includes undenatured, and insoluble collagen, is extracted under reflux for 10 hours in a hot water (90°C) of pH = 3. The heating serves to denature and partially hydrolyse the intact collagen, making it soluble, while the acidic pH 3 avoids dissolving any non-acid-soluble contaminates. The solution is then filtered through an 8 μm polyethylene filter to remove insoluble residues, and the collagen isolated by freeze-drying the filtrate.

Method 2 is the modification of the Longin method suggested by Richards and Mellars (*1998*). In this case, the inorganic portion is removed by extraction with 0.5 M HCl solution. The samples were kept at 4–5°C overnight. Powdered samples collected on glass microfibre filters were washed twice with distillate water. Then the residue was placed in a sealed

tube (under reflux) in a pH 3 HCl solution, and gelatinised for 48 hours at 75°C. The solution is then decanted and filtered through an 8 μm polyethylene filter and freeze-dried. This more gentle treatment is intended to reduce the collagen loss as compared to method 1.

No measurable effects on the determining of $\delta^{13}C$, and only a small effect on the $\delta^{15}N$ signal were obtained using these two methods. We conclude that the best collagen extraction technique is the second method proposed by Richards and Mellars (*1998*). Method 1 gives essentially the same results, but the collagen recovery may be lower.

Other researchers have included a sodium hydroxide wash in their preparation sequence (*DeNiro and Epstein 1981; Pate 1995*). The sample was treated before the hot water extraction step with 0.5% sodium hydroxide (NaOH) for ~20 h to remove base soluble contaminates such as humic acids. The results from other studies show that this pre-treatment has little effect on measured $\delta^{13}C$ and $\delta^{15}N$ values, and because of the apparently reduced yields (*Chrishol et al. 1983; Bonsall et al. 1997*) we decided not to use this method.

Isotopic analysis

The isotopic composition of collagen was then determined using a Europe Scientific 20/20 continuous flow mass spectrometer with ANCA-SL solid-liquid preparation module. The technique involves the coupling of a preparation system employing the Dumas principle with a stable isotope mass spectrometer detector. This allows measurements of not only total nitrogen and carbon in a sample, but also their ^{15}N and ^{13}C levels. The "collagen" solid was placed in tin cups and dropped sequentially into a combustion tube as a pulse of oxygen was injected. After various reduction reaction and chemical trapping, carried out in a helium carrier which transports released gases, the gas chromatography (GC) column separates N_2 and CO_2 from trace impurities before analysis by the IRMS (Isotope Ratio Mass Spectrometer). The samples are analysed in batches that include known references (working standards). References calibrate isotopic abundance and elemental composition measurements and allow correction for drift. As a working standard, pure collagen was used which was calibrated vs. reference materials (IAEA-CH-7 polyethylene and NBS22 oil for carbon; IAEA-N-1 and IAEA- NO-3 for nitrogen).

Following standard procedure, the isotopic ratios are expressed in δ-notation in parts per mil (‰):

$$\delta\,{}^{*}X = \left[\frac{({}^{*}X/X)_{sample}}{({}^{*}X/X)_{standard}} - 1\right] \times 1000$$

For carbon, $^{*}X/X$ is $^{13}C/^{12}C$ and the standard is the V-PDB carbonate, while for nitrogen $^{*}X/X$ is $^{15}N/^{14}N$ and the standard is atmospheric (air) nitrogen. The measurement uncertainties on the $\delta^{13}C$ values were ±0.2‰, and ±0.3‰ on the $\delta^{15}N$ values.

The reliability of stable isotopic analyses of collagen depends somewhat on the degree of preservation of collagen, which can be estimated from its C/N ration. Well-preserved collagen should display a C/N ratio between 2.9-3.6 (*DeNiro 1985*). As mentioned above, the continuous-flow mass spectrometer allows the determination of isotopic abundance and a sample composition (N content, C/N ratio) at the same time. Therefore, in our collagen samples the C/N ratios were also determined. The results are collected in table 1 and 2. Almost all samples fell within the prescribed range, suggesting that the collagen samples are in general well-preserved. The exceptions are the two samples marked with * in table 1. These sample were eliminated from our study because their $\delta^{13}C$, or more probably, $\delta^{15}N$ values might have shifted substantially and thus their use in dietary reconstruction might lead to erroneous conclusions.

RESULTS AND DISCUSSION

The isotopic composition of food sources in diet

As a part of the present study, samples of various foods (cultivated vegetables, meat from domestic and wild animals) in association with human skeletons were also analysed for their $\delta^{13}C$ and $\delta^{15}N$ values. The results are collected in table 1 and shown in figure 3. These results can serve as a base against which the stable isotopic measurements on human bone collagen can be compared to indicate diet, when allowance is made for the enrichment of *ca* 5‰ in $\delta^{13}C$ and 3‰ in $\delta^{15}N$ between consumers and the food consumed (*van der Merwe and Vogel 1978; Schoeninger 1985*). All cereal remains are C_3 plants with an average $\delta^{13}C$ value of -24.7 ± 1.5‰ and $\delta^{15}N$ value of +3.3 ± 1‰. The difference in the isotopic composition in plants was also observed. Leguminous plants have $\delta^{15}N$ values of +1.9‰, while the non-legumes, in our case wheat, have $\delta^{15}N$

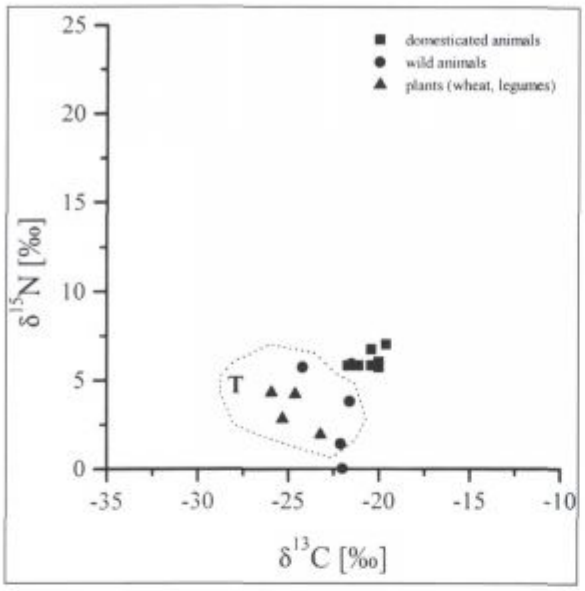

Fig. 3. $\delta^{13}C$ and $\delta^{15}N$ values for foods available in Neolithic and terrestrial (T) herbivores established by Schwarcz (1991).

values of +3.8 ± 0.4‰. Also, the results obtained from animal bones show that their diets favoured C_3 plants. The clear distinction between domestic and wild animals was observed in the $\delta^{15}N$ values. Samples from terrestrial wild herbivores have $\delta^{15}N$ values in the range of 0 - 6‰ (average = 3.7‰), while seven samples from domestic animals analysed have $\delta^{15}N$ values between 5 -7‰ (average = 6.1‰). These results are in good agreement with the two studies concerning analyses of wild animals performed by Schwartcz (*1991*), and domesticated animals available today in temperate Europe (*Bonsall et al. 1997*). It is still not clear why the (^{15}N values of wild and domesticated herbivores differ so markedly. Most probably the difference is connected with feeding patterns. Domesticated animals could be fed foodstuffs that were not available to wild herbivores. It is conceivable that animals kept by farmers ingested some cultivated vegetables (the $\delta^{15}N$ values are ~3‰ higher than that observed in plants - wheat, legumes) and also a certain amount of human food refuse. Our results for prehistoric domesticated animals correspond well with those obtained from modern livestock, suggesting that animals had similar foodstuffs and should be regarded as having more omnivorous diets than their wild counterparts.

Palaeodietary reconstruction

The $\delta^{13}C$ and $\delta^{15}N$ of collagen extracted from human bones from two different periods 5300 and 6000 BP are collected in table 2 and graphically presented in figure 4. No significant difference in the dietary habits of the population between the two periods was found. The isotopic composition of carbon in the human samples range between -22.5 and -19.6‰, while $\delta^{15}N$ values range from +4.9 to +11.5‰. The $\delta^{15}N$ and $\delta^{13}C$ values plotted in a single, well-defined cluster suggest a diet that was relatively homogeneous and predominantly based on a purely terrestrial system. In other words, essentially all of the protein in the diet over at least 10 or so years of their lives came from the terrestrial system. The very uniform $\delta^{15}N$ values, around 9‰ through this period, are indicative of a population obtaining most of its protein from herbivores, domestic and wild animals, and relatively little from plant foods. Similar values are observed in Neolithic human remains from southern Portugal (*Straus et al. 1992; Lubell et al. 1994*). Whatever the case, there is no good linear correlation between $\delta^{15}N$ and $\delta^{13}C$ values. A simple explanation of the linear trend of these two values is that the individuals whose collagen is plotted along the line were eating varying proportions from only two isotopically distinct, homogeneous food sources. So, the data suggests that diets were not homogeneous and there was a de-

Sample	Age (yr BP)	$\delta^{13}C$ [‰]	$\delta^{15}N$ [‰]	C/N
ANIMALS				
domestic cattle	5300	-21.1	+5.8	3.4
domestic sheep	5300	-19.6	+7.0	3.2
deer *	5300	-24.3	+6.3	6.7 *
domestic cattle	?	-20.4	+6.7	3.4
brown bear	?	-22.1	+1.4	3.2
deer *	?	-24.2	+5.7	6.5 *
domestic cattle	6000	-21.7	+5.8	3.4
domestic cattle	6000	-20.4	+5.8	3.2
domestic cattle	6000	-20.0	+6.0	3.2
domestic pig	6000	-20.0	+5.7	3.3
field hare	6000	-21.6	+3.8	3.3
brown bear	6000	-22.0	+0.0	3.7
deer	6000	-21.5	+5.9	3.7
PLANTS				
wheat (mono-grain)		-24.6	+4.2	
wheat (two-grain)		-25.3	+2.8	
barley		-25.9	+4.3	
mixture peas		-23.2	+1.9	

Tab. 1. The isotopic composition of carbon and nitrogen of plants and animal remains associated with human skeletons.

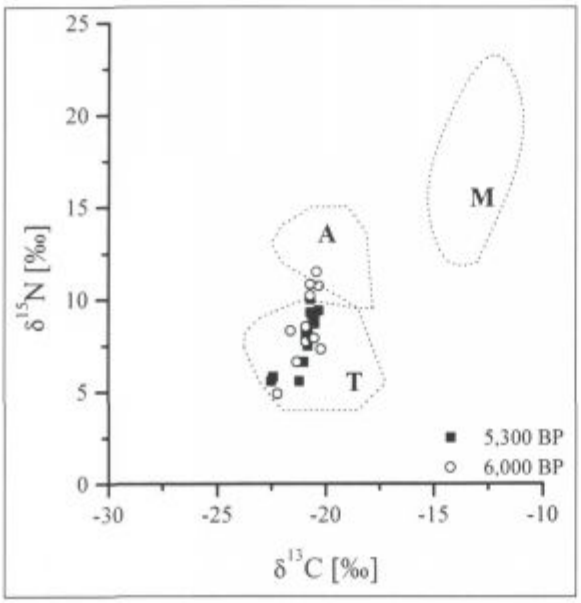

Fig. 4. Scatter diagram of $\delta^{13}C$ and $\delta^{15}N$ values in human samples from Ajdovska jama. The ranges of aquatic carnivores and omnivores (A), marine carnivores and omnivores (M) and terrestrial foods (T) established by Schwartcz (1991) (+5‰ for $\delta^{13}C$ and +3‰ for $\delta^{15}N$ is added to arrive at consumer values).

crease in the diversity of food choices during both periods in the Neolithic. The results indicate different nutritional habits among the Neolithic population in the central part of Europe in comparison with the study of Bonsall et al. (*1997*). The results of this study, which includes the Mesolithic and also the earliest Neolithic inhabitants, suggest that in the Mesolithic period people had high protein diets derived mostly from riverine food sources. A shift in dietary patterns occurred between 7600 and 7300 BP, reflecting the intake of higher proportions of terrestrial food. It seems that changes coincide with the introduction of cultivation in the Iron Gates, which was not so dramatic as that seen in some other areas of Europe, such as Portugal (*Straus et al. 1992; Lubell et al. 1994*). Traditional food sources were not abandoned in favour of agricultural produce.

Comparisons of the stable isotopic ratios of collagen from males, females and children are presented graphically in figure 5. It is seen from the results that in a given population with a range of possible foods, the individuals in the population have individual, personal, preferences in diet which in turn determine their individual δ-values. The different nutritional habits of individuals can be seen more clearly from the $\delta^{15}N$ values ranged from +4.9 to +11.5‰. The lowest values of $\delta^{15}N$ found in human collagen and average $\delta^{15}N$ value of 6.1 ± 0.9‰ for domestic

Sample	Age (yr BP)	$\delta^{13}C$ [‰]	$\delta^{15}N$ [‰]	C/N
HUMAN				
Male	5300	-22.5	+5.6	2.9
Male	5300	-21.2	+5.6	3.4
Male	5300	-20.5	+9.0	3.5
Female	5300	-20.9	+8.1	3.4
Female	5300	-20.7	+9.3	3.4
Female	5300	-20.5	+8.7	3.3
Child (boy 10-12 yrs)	5300	-20.3	+9.4	3.2
Child (boy 10 yrs)	5300	-20.8	+7.5	2.9
Child (7-8 yrs)	5300	-20.8	+8.2	2.8
Child (boy 6 yrs)	5300	-22.4	+5.8	3.5
Child (6 yrs)	5300	-20.6	+9.1	3.0
Child (4 yrs)	5300	-21.0	+6.6	3.2
Child (2 yrs)	5300	-20.7	+10.0	3.3
Male	6000	-22.2	+4.9	3.2
Male	6000	-20.9	+7.7	3.2
Male	6000	-20.6	+7.9	3.3
Female	6000	-20.9	+8.5	3.2
Female	6000	-20.5	+7.9	3.2
Female	6000	-20.2	+7.3	3.3
Child (6-7 yrs)	6000	-21.6	+8.3	3.6
Child (5 yrs)	6000	-20.3	+10.7	3.5
Child (boy 4 yrs)	6000	-21.3	+6.6	3.6
Child (1-2 yrs)	6000	-20.7	+10.2	2.9
Child (1-2 yrs)	6000	-20.4	+11.5	3.5
Child (1 yr)	6000	-20.7	+10.8	3.5

Tab. 2. The collagen stable isotope values in human skeletons. The table includes the amount of carbon vs. nitrogen in the extracted collagen samples are collected.

animal collagen, fit reasonably well with the expected values of 6‰ for vegetarian humans and herbivores, respectively. It is interesting that the lowest values are found in males' collagen, and there is a tendency for females to be associated with higher $\delta^{13}C$ and $\delta^{15}N$ values (Fig. 5), indicating that females' diet was based mainly on meat from domestic animals. This difference in the diets of males and females can arise for a variety of reasons related to economic or social customs as well as to biological need or health problems. Men and women often eat different foods because of food taboos, or because members of one sex are guaranteed preferential access to certain foods. During pregnancy and lactation, women's protein needs increase: pregnant women may consume more meat and have higher protein intake, than is the norm for men and non-pregnant women. Moreover, at this time metabolic turnover is higher and food eaten may be exaggerated in the overall collagen signal. Other reasons for the

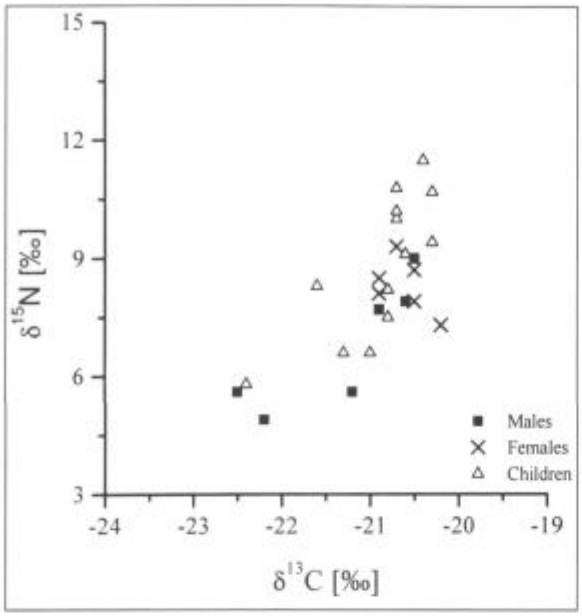

Fig. 5. $\delta^{13}C$ and $\delta^{15}N$ values of 'Neolithic' males, females and children from Ajdovska jama.

difference in nutritional habits may be related to different food supply activities. It is very difficult to see how the nutritional demands of pregnancy or the division of labour could account for the differences seen in men and women.

Comparing the results of adults and children also indicates significant differences. The highest isotopic composition of nitrogen was found in the bones of one- and two-year-old children. The values are approximately 3‰ higher than those found in the female bones, indicating the "weaning effect". These results could not be compared with other studies, because there is no data available on the bone samples of children at the same age until now. What is more remarkable is that the infants between 4 and 10 years old have lower $\delta^{15}N$ values in comparison with children one to two years old. These results indicate a new dietary regime that has been identified in the isotopic composition of collagen in a short period over two and ten years. The most probable reason is that in children bone collagen deposition has a very high turnover rate in comparison to adults. Therefore, bone chemistry changes quickly and can reflect new nutrition habits. A difference between older children is also observed. From the $\delta^{13}C$ and $\delta^{15}N$ values (approx. -22‰ and +6‰, respectively) it is seen that the protein consumed by some children is based mostly on plants, most probably on cereals, while the diet of other children favours meat from domesticated animals. The results correlate extremely well with the hypothesised model of human diets calculated by R. Schulting (*1998. 206, Tab. 1*).

In conclusion it is worth noting that the stable isotope evidence suggests that the Neolithic population living in Slovenia had individual, personal preferences in diet in which the bulk of the protein was derived from terrestrial food sources. This diet was based mostly on herbivores, domestic and wild animals and relatively little on plant foods. The most interesting and original results are obtained in infants and young children. The significant higher $\delta^{15}N$ values certainly relate to "weaning effects", while older children had new dietary habits which markedly changed the isotopic signature of bone collagen in a relatively short period.

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REFERENCES

BONSALL C., LENNON R., McSWEENEY K., STEWART C., HARKNESS D., BORONEANT V., BARTOSIEWICZ L., PAYTON R., and CHAPMAN J. 1997. Mesolithic and Early Neolithic in Iron Gates: A Palaeodietary Perspective. *Journal of European Archaeology 5: 50–92.*

CHRISHOLM B. E., NELSON D. E., SCHWARZ H. P. 1983. Marine and Terresterial Protein in Prehistoric Diets on the British Columbia Coast. *Current Anthropology, 24: 396–398.*

LUBELL D., JACKES M., SCHWARCZ H., KNYF M. and MEIKLEJOHN C. 1994. The Mesolithic-Neolithic transition in Portugal: Isotopic and dental evidence of diet. *Journal of Archaelogical Science 21: 201–216.*

DeNIRO M. J. 1985. Post-mortem preservation and alteration of *in vivo* bone collagen isotope ratios in relation to paleodietary reconstruction. *Nature 317: 806–809.*

DeNIRO M. J. and EPSTEIN S. 1978. Influence of diet on the distribution of Carbon Isotopes in Animals. *Geochim. Cosmochim. Acta, 42: 495–506.*

1981. Influence of diet on the distribution of Nitrogen Isotopes in Animals. *Geochim. Cosmochim. Acta, 45: 341–351.*

KATZENBERG M. A. 1989. Stable isotope analysis of archaeological faunal remains from Southern Ontario. *Journal of Archaelogical Science 16: 319–329.*

KRUEGER H. W. and SULLIVAN C. H. 1984. Models for carbon isotope fractionation between diet and bone. In J. R. Turnlund and P. E. Johnson (eds.), *Stable Isotopes in Nutrition. American Society Symposium Series: 205–220.*

MINAGAWA M. and WADA E. 1984. Stepwise enrichment of ^{15}N along food chains: further evidence and the relation between $\delta^{15}N$ in animal alge. *Geochim. Cosmochim. Acta, 48: 1135–1140.*

OWENS N. 1987. Natural variations in ^{15}N in the marine environment. *Advances in Marine Biology 24: 389–451.*

PATE F. D. 1995. Stable carbon isotope assessment of hunter-gatherer mobility in prehistoric South Australia. *Journal of Archaeological Sciences 22: 81– 87.*

RICHARDS M. P. and MELLARS P. A. 1998. Stable isotopes and the seasonality of the Oronsay middens. *Antiquity 72: 178–184.*

SCHWARTCZ H. P. 1991. Some theoretical aspects of isotope paleodiet studies. *Journal of Archaeological Sciences 18: 261–275.*

SCHWARTCZ H. P. and SHOENINGER M. J. 1991. Stable isotope analyses in human nutritional ecology. *Year book of Physical Anthropology 34: 283–321.*

SCHOENINGER M. J. 1985. Trophic level effects in $^{15}N/^{14}N$ and $^{13}C/^{12}C$ ratios in bone collagen and strontium levels in bone mineral. *Journal of Human Evolution 14: 515–525.*

SCHOENINGER M. J. and DeNIRO M. J. 1982. Carbon isotope ratios of apatite from fossil bone cannot be used to reconstruct diets of animals. *Nature 297: 577–578.*

SCHOENINGER M. J. DeNiro M. J. and TAUBER H. 1983. Stable nitrogen isotope ratios of bone collagen reflect marine and terrestrial components of prehistoric human diet. *Science 220: 1381–1383.*

SCHULTING R. J. 1998. Slighting the sea: Stable isotope evidence for the transition to farming in northwestern Europe. In Budja M. (ed.), *Documenta Praehistorica XXV, Neolithic studies: 203–219.*

STRAUS L. G., ALTUNA J., FORD D., MARAMBAT L., RHINE J. S., SCHWARCZ H. P. and VERNET J.-L. 1992. Early farming in the Algarve (Southern Portugal): A preliminary view from two cave excavations near Faro. *Trabalhos de Antropologia e Etnologia (Porto) 32; 141–162.*

TAUBER H. 1981. 13C evidence for dietary habits of prehistoric man in Denmark. *Nature 292: 332–333.*

VAN DER MERWE N. J. and VOGEL J. C. 1978. ^{13}C content of human collagen as a measure of prehistoric diet in Woodland North America. *Nature 276: 815–816.*

WADA E., MINAGAWA M., MIZUTANI H., TSUJI T., IMAIZUMI R. and KARASAWA K. 1987. Biogeochemical studies on the transport of organic matter along the Otsuchi river watershed, Japan. *Estuarine Coastal Shelf Sci. 25: 321–336.*