

# Summary

While looking at the imaginary map of Neolithisation of Europe one cannot but notice how fast the infiltration of the so called „Neolithic package“ from the Balkan into Central Europe was. The Greek and Balkan Neolithic cultures look very similar to the Near East ones. The culture was adapted only in the case of LBK in Central and Western Europe. The same can be said also about the wide areas of the Central and Western Mediterranean coasts. There the Neolithic package is not complete any more. As for the other regions of Western, Northern and Eastern Europe We might presume that they were under influence of acculturation or that colonisation played their only an unimportant role.

The infiltration of the Neolithic package into Central Europe was relatively quick, taking at least 500 years, and it is possible to explain it only by colonisation. It is necessary to discuss its form. Results of our experiments (*Tichy 1999*) suggest the possibilities of sea navigation (see **Appendix 1**) which is being considered in relation of Neolithisation of the Mediterranean. The penetration of colonists also from as far away as of Southern Turkish Anatolia or Greece (*Nikolov 1989, 1990*) therefore can't be excluded. Ours and other experiments with reconstruction of early Neolithic objects and making replicas of artefacts (**Appendix 2**) suggest great demands in the transfer of culture. It is not a question of technology but its mastering and learning it. It is about **experience** with it.

All these „dry land“ experiments support M. Zvelebil (*1986, 1989, 1995*), who set the borders of the availability of demic diffusion as far as the border of LBK. He improved the pioneer colonisation model (*Fig 2:2*) and presented an availability model (*Fig 2:3*) which has three phases: availability, substitution and establishment. I believe that it is possible in accordance with some explanations of Neolithisation to combine the availability model with the pioneer colonisation model. How would the Neolithisation look afterwards?

In the first **phase of availability** the hunter-gatherers would know of farming from hearsay and exchange of some materials. Hunter-gatherers and farmers would still follow their own ways of life. This phase finished when the hunter-gatherers accepted at least some elements of farming. At the same time a **selective** movement of small groups of farming colonists with the complete Neolithic package would continue and in some parts of Europe it did continue into the hunter-gatherers territory. In the early stages of arrival to Europe this movement would have had to take place across the sea, this could in accordance with the abilities of the colonist also have acted as a barrier. If the penetration into the hunter-gatherers' region was successful new areas in the stage of the first phase would have been created. In the second **phase of substitution** the foragers of the area adapted themselves to farming elements or farmers penetrated into their territory and competed with them in gaining of land and resources. This phase finished when hunters accepted farming or they stopped competing with farmers. In the third **phase of establishment** the bearers of Neolithic culture settled in the region on the best soils, they kept intensive farming and expanded into new territories. There again the establishment could be enforced by the meeting of old and new

colonisation groups. The other possibility is also of their competing and some of them eventually having to move to new territories (*Fig 9:1*).

Those who created newly stabilised units kept their identity by **visiting** each other which is a form of mobility. Because of this transport of inventions (decorative elements on pottery), knowledge (presence of resources), material (obsidian, flint, *Spondylus*) or sources (reinforcing of herds with unoriginal species) took place. It is difficult to look for causes of above described development because it differed from region to region dependant on the environmental, social and economic needs of populations.

**Demic diffusion** (that means penetrating of small groups of Neolithic colonists) reached Central-West Europe. It is difficult to follow its spread in the Central and Western Mediterranean. Mostly because of possible coastal navigation that allowed the selection of new territories even across great distances. Hunter-gatherer populations were able to compete and could have also played their own role. Cultures of hunters and farmers were different but the technological (weapons) psychological and intellectual abilities were comparable. None of them belong to definitely settled or permanently mobile.

According to results of Monoxylon Expeditions the prehistoric navigation depends much less on sea currents influencing either the speed and the direction of the boat or on the chains of islands acting as inter-stops. It was possible to travel in waves 2 metres high in wind of 7-9 Beaufort. Testing real craft in real conditions can correct our ideas about possibilities of transport in the Neolithic. Log-boats had higher capacities and were faster than reed boats, could cross larger distances (Cyprus, Crete, Pantelleria, Lampedusa, Sardinia) although it is impossible to deny influence of supposed Tyrrhenian filter model if it wasn't approached in a different way.

The object of this model is to point out the fact that the Neolithic package couldn't have spread only by diffusion of ideas, exchange or other ways of availability of Neolithic culture. Its transfer was possible only with presence of small but fully functional family groups of farmers. In the areas where there is evidence of only some elements of the Neolithic package we can consider acculturation or restricted colonisation removed from the original sources of ideas, knowledge and experience with farming way life.

The basic of preferred model presented here is the emphasising of the process of learning while adopting elements of farming culture. I believe that this effect had to function all over Europe but it didn't take place everywhere. The „tutor“ had to be only a bearer of Neolithic culture. This model is connected to the idea of migration but it doesn't suppose big transfers of people across the Europe. It doesn't want and doesn't need to use a demographic scale of migration because it counts only small groups of colonists. They had to have adopted elements of Neolithic culture. Then everything depended on concrete conditions of a concrete situation. Archaeologically the infiltration of Neolithisation to Europe is shown in certain time and geographical stages. Greece (since the 7 millennium BC), the Balkan

(since the 6 millennium BC), Central and parts of Eastern and Western Europe (since the 2 half of the 6 millennium BC) and Northwest and Northeast of Europe (since the 5-4 millennium BC). The Western Mediterranean (since the 6 millennium BC) has a special position. There the possibilities of coastal navigation created a specific situation - a mixture of culture with foraging and farming elements.

Concrete tutors of Neolithic culture didn't need to be anthropologically or genetically related to Greek or even Anatolian population. Their mingling with original hunter-gathering population could happen in many ways. Both populations weren't numerous and probably there still wasn't a lack of space for both cultures. The foragers could have been receptive „pupils“. Both cultures were used to live in accordance with nature. The imitation of Neolithic cultures would have necessarily shown in archaeological finds in the form of unsuccessful transfers of material cultures. That means if there wasn't somebody to correct the errors. The norm could be anchored in the spiritual sphere of culture but without presence of concrete persons it wouldn't be able to keep technological and functional components. We don't know why the farming way of life overwhelmed in the end. It didn't need to be simpler or happier. The transition could be caused by the relevant situation of the foragers so that the growing of new types of plants and the breeding of new species of animals should become a part of their post-glacial orientation on various sources of livelihood is understandable. Why should they then accept other elements of the culture? Maybe they corresponded to and supported their own system of values. Whatever the reason the transition wouldn't happen without the presence of bearers of Neolithic culture. The presence couldn't have been displaced by exchange, social levers of cultural adoption or mobility transferring information over great distances.

It was a large complex of changes based on technological innovations (Knapped industry, polished stone tools, pottery, used of special threads for making textile), their practical usage, obtaining different materials (for example stone for making polished tools, amount of clay and wood for building activities) buildings different construction with different construction principles (houses, corn silos, ovens), in changes of ways of life (looking after new animal species and plants, different food and hard labour). That all was anchored in the spiritual sphere archaeologically is shown by different ways of burying, production of clay figures and pottery decoration.

Experimental archaeology pointed out the importance of experience and its transition for the adopting of elements of Neolithisation (see **Appendix 2**). The same verified that the use of sea faring could speed up the advance of Neolithisation. Transfer of its parts depended on concrete situation (the difference between the Eastern and Western Mediterranean).

One way of introducing a model is also a critique of some different hypothesis. Their arguments are various. So we can start from a certain point I chose as a base of the origin of Neolithic Europe as presented by Alasdair Whittle in book „Europe in the Neolithic. The Creation of New Worlds“ (1999). I think it's very suitable for many reasons.

It is an interesting work with strong logical structure using a wide knowledge gained from European literature and overthrowing some till recently relevant models, originally also from British archaeological school (the role house in domestication of man - *Hodder 1991*). The author uses consistent critique of archaeological sources even in situations when they don't support his views. On the other hand he doesn't hesitate to use a model expansion to comprehend processes of Neolithisation. Many questions are exceeding archaeological thinking. Whittle's conception differs radically from the preferred model of interaction joined with migration. This opposite pole is suitable for arguing the object of which is not to turn over author's conclusions but to point out that there could be a number of rationally based explanation of similar probability. Respecting of experience can exclude elements based only on belief in this or that explanation of Neolithisation of Europe.

Were well-informed foragers willing to accept new sources as presented by Whittle (1999, 355-360)? He considers the ways of Neolithisation more as a possibility than an inescapable process (*Whittle 1999, 369-371*). Its beginnings should be influenced by chance of availability (Southeast Europe or Southeast Italy), some of it speeded by deliberate choice (origins of LBK), some were suppressed by existence of alternative traditions (the Danube Valley, many places of the Central and Western Mediterranean, Southern Scandinavia). The transition from the Mesolithic to the Neolithic was probably less monumental than is imagined. The technological and economic factors weren't so important which was given by the ability of foragers to choose certain solutions. The hunting ethics of sharing and joining continue into the Neolithic therefore growing crops and breeding animals together with elements of Neolithic material culture were added to already existing methods to lighten the sharing, gathering and celebrating of food, drinks and shows of group identity.

It is possible to discuss many processes presented in Whittle's explanation. I'll mention the main ones.

**1.** Unsettled occupation in such areas as Thessaly should be proved by small number of sites for the early (120 according to current research), and middle (also 120) Neolithic. The distances between site are about 5 kilometres but there is a hiatus in occupations on the tells. That should represent for one contemporary generation of Thessaly a scarce occupation (*Whittle 1999, 47*). The term „scarce occupation“ corresponds here only with assumptions of earlier Neolithic research. The prehistoric reality could have looked like that without denying anything of the farming character of the population. Large areas (0.5 - 1 ha) and heights (up to 12 m) of tells were possible only with long term occupation. In Central Europe long term occupation is shown by large amounts of building pits on LBK settlements.

**2.** In comparison with tells the site of Koros and Starcevo cultures have thin layers what could represent a short term or temporary occupation (*Whittle 1998, 48*). The LBK sites don't have any surviving settlement layers only structures. That can represent different ways of archaeologisation of those types of occupations, not necessarily the length of occupation.



- 3.** The occupation of Paltia Magoula Zarkou couldn't be permanent because it is in active flood zone of the Peneios River (*Whittle 1999, 52*). The settlement could be moved for transition period out of the flood zone without leaving the area.
- 4.** The small number of documented house foundations in some areas is used to prove mobility of early Neolithic populations (*Whittle 1999, 53*). This could present the current level of research (like „pit dwellings“ of LBK only 50 years ago).
- 5.** Among early Neolithic settlements it is possible to distinguish between tells with firm structures and continuous occupation and flat site with thin layers and less visible house foundations that remind us of the radiation mobility of foragers (*Whittle 1999, 54*). It is more a characteristic of settlements present through the whole of prehistory when some sites were repeatedly occupied.
- 6.** Remains of human activities on the Achilleion site are documented more between houses, which might present a temporary occupation (*Whittle 1999, 56-57*). This doesn't need to correspond with a suggested mobility of the inhabitants of the settlement as a whole.
- 7.** If the colonists were newcomers to the area, their knowledge of resources of materials for making knapped tools is surprising (*Whittle 1999, 61*). Neolithic population had to solve this problem anyway while looking for materials for the making of polished tools that weren't used by foragers. They couldn't have known of sources of stone for polished tools.
- 8.** The pollen diagrams from Greece show only a negligible human impact to the look of forests, which could mean surviving mobility (*Whittle 1999, 67*). The early farming doesn't need to show in these diagrams.
- 9.** Cattle and pigs could have been domesticated by foragers using knowledge learned from outside or not used earlier (*Whittle 1999, 67*). Is it possible to transfer these abilities only by contact in mobile way of life. And what about the other elements of the Neolithic package?
- 10.** The house is not a mechanism for domestication as was suggested by Hodder, who counted it as a counter pole of dangerous and non structured nature. From the remains of non domesticated sources of food it's clear the realisation of advantages of nature. The house probably wasn't there to give privacy and individualisation because the space between houses is also important. It was the settlement mound, that became a focus of group identity. Also sources were probably used commonly. The opposite of wild has to be spreading of co-operation values (*Whittle 1999, 69-70*). This likeable idea doesn't, unfortunately, have any support in archaeological findings.
- 11.** The lifestyle and values of foragers and LBK population could have much in common even if the food and technology look different (*Whittle 1999, 146*). We don't know anything certain about values, but the lifestyle of farmers was certainly different, more laborious.

**12.** A possible palisade on a little eroded settlement in Genleen-Jansjamperveld could be evidence of mobility - herds of animals (*Whittle 1999, 162*). This structure could be of the same importance to farmers.

**13.** The size of LBK long houses could reflect the ability of population to mobilised friends and relatives for building and repairs (*Whittle 199, 166*). This construction can be also a result of the labour of the community. The dwelling surely presented an element of stability which would be hardly completely abandoned to be laboriously repaired after return. Such a system would decrease the life of the building.

Because of the current level of knowledge it is impossible to comprehend all the activities done by people of that era and which were mentioned above. Differences are necessary to be interpreted for concrete situations. There were many differences given mostly by various accesses of foragers to new sources and their possibilities to use existing sources. It would be a mistake (made by *Whittle (1999)*) to think of an homogenous approach of hunters to elements of Neolithisation. Some areas provided enough sources so that the acceptance of new ones wasn't necessary (Franchthi, Grotta dell'Uzzo), others kept their culture in environment already influenced by the proximity of the Neolithic (Lepenski Vir on the Danube). The density of occupation wasn't large either by farmers or hunters. The farming populations started in various areas (river flood planes) missing numerous foragers' occupation areas (for example Thessaly). Only then would the acculturation start to work. Hunters and gatherers had the same potential of abilities without any doubt, but did not need to exploit them at all times.

The formation of all the components of the Neolithic package in Near East took thousands of years. It took thousands of years for the process of domestication of plants, animals and humans to exceed the border of the Fertile Crescent. The development is very difficult to follow. It took place irregularly over vast area where life was moving as people from one settlement mound to another when the surrounding sources were exhausted.

It is difficult to find what triggered the deliberate creation of the sources of livelihood but it's clear that people had greater chances to adopt new ways of livelihood than later or anywhere else in Europe. One reason was the presence of wild types of plants and animal species that proved amenable to domestication. Inside the imaginary Fertile Crescent on the territory of modern Iran, Iraq, Israel, Jordan, Lebanon, Syria and Turkey it was possible to use wild cereals and animals.

In these areas it wasn't difficult to use the new sources to improve the traditional livelihood of hunter-gatherers for a long time. It was possible to incorporate gradually new ways of working crops into food, construction of dwellings or different tools created by polishing suitable stone. The necessity to solve an eventual lack of food forced people only slowly to new solutions of livelihood sources.

Migration had to exist among early communities. It is proved by abandoned sites that were occupied again only after a few hundred years. It is also proved by

the spread of materials on Near East sites what can't be a result of exchange only. A small number of families or persons had to be moving between settlements offering in exchange for land something new and unusual although not always practical. Otherwise a certain homogeneity of artefacts of great artistic value wouldn't have happened. Those could barely become objects of trade. People don't trade ideas they swap them in direct contact.

If somebody wanted to gain new artefacts in ways other than exchange they had to know the way of making and using them. For objects of everyday life it would be necessary to know sources of materials and their ways of preparation. A large amount of them wouldn't have been ensured only by exchange. Know-how could also be an object of exchange but some processes of adopting of new activities are not short term. Transfer of experience would need a longer time. In the case of handling crops at least one cycle of sowing, harvesting and storing.

The Neolithisation of Greece relates to the crossing of the Aegean Sea which was possible for both populations and necessary for transfer of some elements alien to Europe for Neolithisation (sheep, goat, cereals) (*Broodbank - Strasser 1991*). Foragers could have been motivated by exchange but a farming population might find their target behind the net of uninhabited (or today only near the flooded coast?) islands. The conditions and space weren't sufficient even on the biggest of them and that lead to the occupation of optimal sites (Knossos on Crete) or a thin net of small settlements (Cyprus) (*Cherry 1990*). Settlements in today's silted river valleys of Western Asia Minor or settlements of the Eastern Mediterranean coast could have taken place in the farming colonisation. The Israeli site of Atlit-Yam, currently below sea level, could serve as an example (*Galili - Sharvit 1998, 31-44*).

Whittle's acculturation model is not adopted in this book. The reasons for the area of Greece are as follows.

- 1.** The occupation of populations of both hunters and farmers was scarce. Population pressure or trade didn't need to be the only reasons of colonisation. Simple looking for the most suitable life space could have been a good motive. Therefore, penetration of farming colonists to the distant opposite banks of the Aegean Sea could have been happening. The Aegean Sea was relatively easy to cross in that time. Only a small load (mostly sheep and goat) was necessary for colonisation because the knowledge and experiences of the colonists were sufficient to transfer the main components of the culture. In new territories there was already a functioning net of interrelations and values of identity and co-operation. This kept the farming character of culture with all its elements of the so called Neolithic package. This was enough to influence the small number of hunters by the small number of farmers.

- 2.** Outside the settlements all of the populations (both hunters and farmers) were mobile. Another question is the mobility of settlements, which is not important for this explanation.

- 3.** The hunters' knowledge of environment wouldn't be sufficient for farmers. Farmers needed apart from material for making knapped tools also suitable material for making polished axes. If they had to learn to find the latter, gaining of former couldn't present a big problem.
- 4.** The existence of contact and exchange between hunters and farmers is impossible to exclude. There is a question if know-how in technology and materials would be enough to transfer the Neolithic way of life.
- 5.** The Neolithic wasn't homogenous for very long time, it varied in single regions. Innovations were introduced in regional conditions to which they were adapted while keeping its original features. That also concerns the making pots. It's not completely right to exclude the possibility that in some areas of Central or Southern Greece the local hunting population adopted these innovations. It was already influenced by close contacts with farming colonists. The difference between the original incomers and native inhabitants of the country could be blurred at least in the basic features after tens of generations. That doesn't change the fact that this process couldn't have gone forward without the arrival of colonists who managed technologies and ways of farming life.

Farming populations moved from Thessaly only after a long time (nearly a thousand years?). The increased density of occupation from our point of view is a very relative term. It doesn't show in short distances between settlements in one time horizon, not even by permanent occupation. Populations didn't need to be fully settled yet, we can talk about it in case of an area, not population. A hiatus existed, similarly as it was through the whole of prehistory. The advance of farming took place in the spirit of Runnels - van Andel (1995) model of barriers in farming spreading. Now the barriers weren't any more represented by an open sea but people were looking for suitable agricultural land. The occupation stayed sporadic, corresponding to the needs of the farming population. Still before 6000 BC farming got as far as the Balkan. Not everywhere the occupation of sites created settlement mounds as in Thessaly. Sometimes as in the Middle Danube Valley the resistance of the bearers of the traditional foraging way of life showed. Both populations were mingling faster in less densely occupied areas. Culture was still passed on as a part of the Neolithic package.

The situation of the Balkan Neolithic could be described as follows.

- 1.** Trade or acculturation are not sufficient enough to explain the presence of Neolithic culture so far in the North Balkans. The only possibility could be a migration of farming colonists, even if it was only a scanty one.
- 2.** The reflection of Near east spiritual culture in the early Balkan Neolithic, described by V. Nikolov (1990), didn't need to be transferred as fast as he supposed, that means during one generation. They could be traditionally kept for long time as a source of keeping identity of the Neolithic way of life with all elements of the so called Neolithic package.



**3.** Looking for suitable land of specific quality by advancing farming colonists as was pointed out by T.H. van Andel and C. Runnels (1988), explains well not only fast penetrating of farming colonists but also the following balancing of levels of early Neolithic cultures in the Central. Some sites could be really founded as secondary through the engagement of foragers to the process of adopting elements of the Neolithic package. The role of trade in contact with foragers is not certain but these processes couldn't have taken place without close contacts with farmers.

**4.** We can count the surprising evidence of the quality of foragers' culture from the area of the Danube gate as being realistically reachable without the least relation to the presence of farming cultures. Places with such strong emphasis on identity of their creators could resist acculturation even of a straight colonisation of farmers. Not every population of foragers was found wanting innovations and changes of lifestyle.

**5.** The Central Neolithic has all the substantial features of the Greek Neolithic. If it is its continuation or next target of Near East colonists it doesn't make any difference in its conception or approach. The exception could be given by specific local conditions or our level of knowledge.

Sea faring allowed around 6000 BC transfer of neolithized populations to the Central and Western Mediterranean (*Courtin 1990*). Even in this case the importance of optimal places for settlement (for example Lake Bracciano) showed. There the farming culture appeared in all of its elements. The foragers could also with their proved abilities of sea faring (obsidian and tuna in settlement layers) come forward to meet those new elements. Their settlements therefore stayed protected from population exchange. They were returned back infected with the new features of farming culture. The amount was given by the reach of the contacts and time spent under their influence. In places where the Neolithisation didn't take place fully it is possible to think of a selective use by foragers or about its thinning out because of the distance from the original colonisation centres. Unknown conditions and mingling with local populations could also play its role. Concrete assessment depends on the revision of older excavations and the quality of new ones. Does the Neolithic package really appear at about 6000 BC and were its single features in layers of foragers' settlements given by intrusions? The examples are known from the Adriatic coast (*Muller 1988, Kozłowski 1990*) and it makes sense to speak of a boat-people model. The question of possibly flooded early Neolithic settlements is still a problem difficult to solve. Did they differ from the Neolithic package of the caves and rock hideouts that were counted as classic sites till recently (*Camps 1982, Guilaine 1990, 1996*)? Were these hideouts on the edge of the farming population world? Penetration of islands of farming occupations among foragers seems to be currently relevant for the regions of Spain and Portugal (*Zilhao 1990, 1997, Bernabeu - Auban 1996, 37 - 54*).

Before 5500 BC Neolithic settlements got to the Hungarian planes. Because of the dating of the finds it is difficult to say whether the advance of Neolithisation stopped there for some time. May be that this waiting for adaptation was caused by the deciduous forests of the temperate zone. More dense hunting population didn't reach up to the northern part of Central Europe. Neolithisation again advanced as a whole package, bearers of which were farming colonists. Again they were selecting terraces on the edges of river flood planes. They occupied mostly loess soils. The long and big houses with post structure were an interesting new way of adaptation. This way the first phase of occupation got as far as eastern part of The Middle Rhine Valley without any visible traces of the survival of foragers. Part of them could demographically take place in spreading of the new culture (LBK), part could continue in their traditional way of life in the marginal areas. In the next phase of development the occupation advanced further to the North (really only islands of occupation) and the West as far as Eastern France. On the Polish Territory the farming occupation had to meet a numerous population of foragers. Only later through long term acculturation do there appear in the North specific hunting cultures with some Neolithic elements. Also on the West edge of LBK there is evidence numerous various cultures defined only with pottery styles found in LBK structures. It is very difficult to estimate their origin without knowledge of their other culture features.

The colonisation hypothesis has many weaknesses but it is possible to say the same about the autochthonic arguments. We can summarise.

- 1.** We don't know how much of a living could the prehistoric countryside provide and at the same time we are judging the density of occupation. As low both for hunters and farmers. It is difficult to estimate what is and what is not a population pressure. It might reflect in the „scarce“ occupation. We have to remember all the time how little has the archaeology uncovered from the past.
- 2.** The anthropological data document continuity of the original population. What size of sample are they working with? The evidence from burial grounds? Even A. Whittle pointed out that it doesn't reflect the state of the dead population. Hypothetically we can think about mixed populations as well.
- 3.** Could such fast mixing of populations of hunters and farmers as suggested by A. Whittle happen? There is evidence of their contemporaneity. At least in Northern Bohemia and the Saale Valley in Germany. Why did some of them accept farming and others didn't?
- 4.** Use of flint and obsidian of foragers for example in Bohemia is not proved. What else could they offer in contact with farmers? The emphasised shape continuity of knapped industry could have been only a general feature of the time.
- 5.** According to A. Whittle there doesn't seem to be any technological barrier for adopting architectural and domesticated sources by Mesolithic hunter-gatherers. That can describe their ability to accept innovations. They would be missing experience and in many cases also know-how.

Could also in the LBK region the penetration of colonisation groups deep inland happen as we saw it in Greece and the Balkan? Then there wouldn't be any evidence of these processes in the marginal zones. Compared to the Balkan we are not able to prove such concentrations. In one case it could be represented by the borderlands between Moravia, Austria and Slovakia, in another by Eastern Bohemia and finally by the Saale Valley. It is a paradox that in the case of LBK the problem is caused by the large number of known sites spread over a vast area. We are not able to date precisely their early phases therefore we are missing the oldest settlement centres in region. Does our knowledge of LBK contravene this reasoning?

The advance of Neolithisation in Western, Northern and Eastern Europe finally fits into Whittles model (although he mentioned only Northern Europe). There acculturation really might have happened. The most conclusive evidence is the selective adoption of components of the so called Neolithic package and their reworking. At first in is an interest in domesticated animals. There breeding could be close to hunters' experience. Further it is the acceptance of polished axes and adzes, which were already known to hunters including the way of fitting them to handles. Ceramic pots also had appeal, they were worked and decorated with their own recipes.

There are still differences between the areas of Western, Eastern and Northern Europe. The West seems to be also under influence of the Cardial Western Mediterranean cultures (*Roudil 1990*) which prepared over the long term the hunting populations for the forthcoming possibilities. A similar development might have happen in the Southern Russian steps (*Telegin - Titova 1993*) as they are situated close to the Balkan and Near East Neolithic. The advance of Neolithisation is different. Neolithic pots are found as imports, we don't know currently any from western Europe (*van Berg 1990, Gob 1990*). The North and Northeast probably got pottery indirectly. Direct examples are missing and it seems that local invention played an important role. The liberty of approaches was possible because the world of hunter-gatherers in those areas was independent yet for hundreds of years (*Dolukhanov - Timofeev 1993*).

Whittle's gathering of people can play an important role in these processes. It could be a possibility to exchange information. If according to the same author grave goods could helped to fix a memory of a long gone past it was an opposite process which helped hunter-gatherers to keep their original identity. This generalising view excludes the fast Neolithisation of foragers. They would never be willing to accept all the elements of the Neolithic package at the same time. This wouldn't be a manifestation of their retardation or lack of ability to adapt, but exactly the opposite, of their great ability to live their original way of life. Or at least where they didn't live in close proximity to farmers.



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**obr. Z.2** Člun expedice Monoxylon (1995). ■

## Appendix 1

# Monoxylon Expeditions

Expeditions of experimental archaeology organised in 1995 and 1998 were given names Monoxylon I and II. During the first one we crossed over 300 km between islands on a log-boat of a hypothetical design. During the second one a different boat covered over 800 km along the Mediterranean Sea coast. The performance of both expeditions modified our ideas about possibilities of early sea navigation.

### 1. Introduction

The completion of an experimental voyage with a replica or a reconstruction of a possible prehistoric craft (for example *Tzalas 1989*) always reflects back on theoretical research (*Broodbank - Strasser 1991, Cherry 1990*). But mostly it can correct our modern views of possibilities of prehistoric navigation. It corrects

models based on incorrect hypothesis with correct data (*Nikolov 1990, Korfmann 1988*). In other cases the problems of the oldest sea faring is put into relations with the prehistoric social processes. Modern reconstructions of them obscure the reality with abstract models (for example Tyrrhenian filter model, see *Lewthwaite 1986*).

The divided research of nautical archaeology (*Gardiner - Christensen 1996, Greenhill - Morrison 1995*) and settlement archaeology is one of current problems with recognition of the importance of prehistoric sea faring. A certain connection is the boat building itself. It had to take place within a settlement or in its vicinity. Such settlement had to have a strategically favourable position, suited to sea faring. The newly discovered site „La Marmota“ in the Italian Lake Bracciano (*Fugazzola Delpino - Mineo 1995*) gives us such evidence. The Neolithic settlement is supposed to be the oldest Cardial settlement in the Western Mediterranean. It shows us a probable place of boat building (log-boats). It is situated in a sheltered place connected in past with sea by a river. There was found evidence of the transportation of materials (obsidian from the Lipari Islands), cultural contacts (painted and impresso ware) and advanced domestication of animals and crops (*Cassoli - Tagliacozzo 1995*). Therefore it could have been a filial settlement for the Eastern Mediterranean and in the same time a principal settlement for the Western Mediterranean. The chance to find a whole chain of sequential settlements is currently minimal.

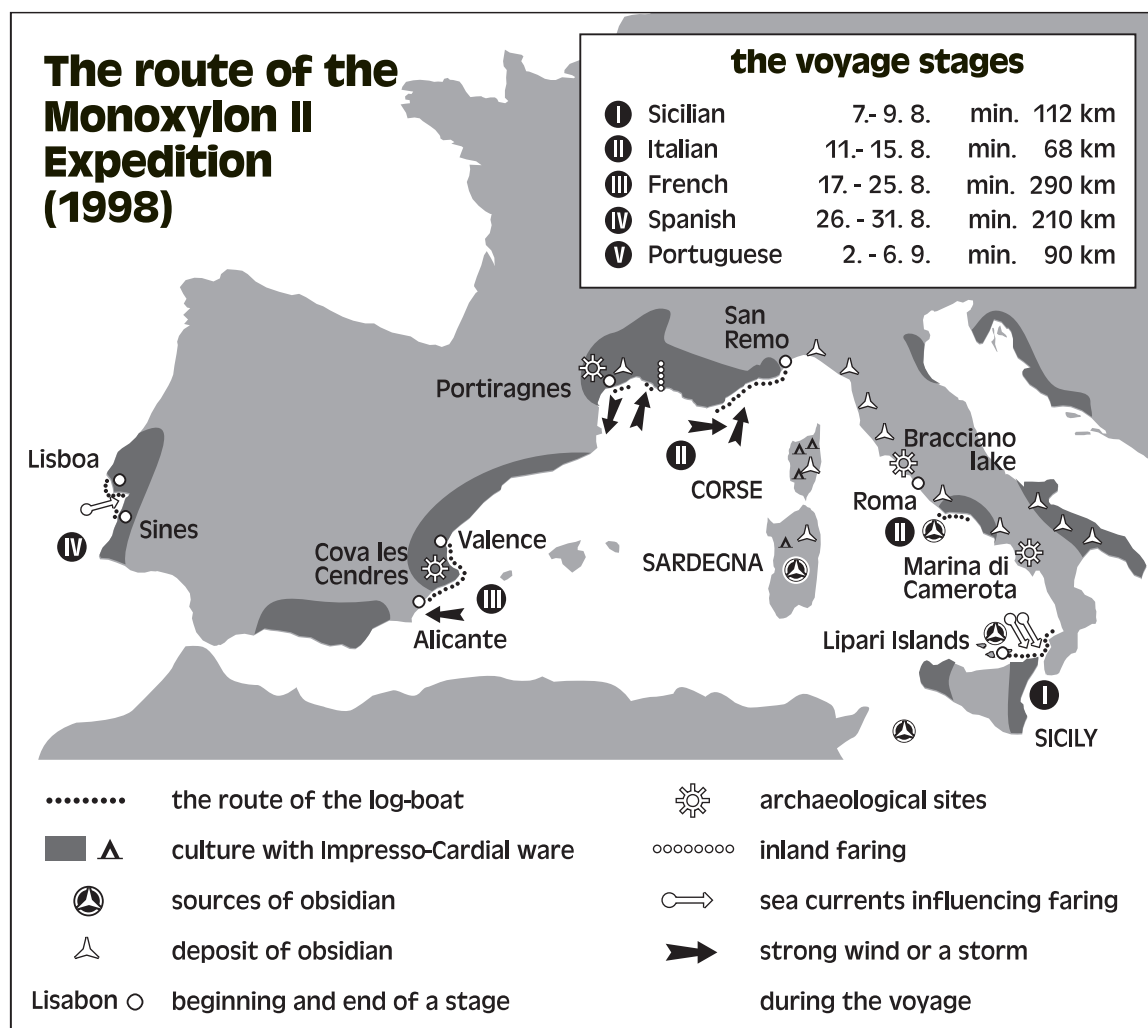
## 2. Method

Experiments with sea faring belong among the most popular. Their results are not always counted by archaeologists as a source of knowledge. It is necessary to differentiate. A voyage on an unproved although probable craft has different value from going on a replica of a concrete artefact found within an important context (place of manufacturing, possible port, presence of imported materials, dating to the early Neolithic). Although results of such an experiment don't certainly correspond with performance of prehistoric people we need to respect them. They give certain limits to our considering of sea faring and allow us to exclude some hypotheses. They also give us information about the nature of the craft.

In 1995 an experimental archaeology expedition concerning the beginnings of sea faring was organised after long preparation. A log-boat was chosen as an early type of a hypothetical craft. It was used at sea first in 1992 and was then further modified after tests inland on the rivers Orlice and Moldau, dam Rozkoš and lakes near Hradec Králové.

The hypothesis was that at the beginning based on the presence of woods in the Aegean region before advance of the Ancient Civilisation.. Also finds of wood working polished tools and finds of log-boats on the original sea coast at Tybrind Vig in Denmark. It was supposed that these early crafts could be used during the hypothetical early farming colonisation of Europe in the Neolithic (*Tichý 1994*) when the islands in the Aegean Sea were occupied. The find of a Neolithic log-boat in the Lake Bracciano near Rome in 1994 (*Fugazzola Delpino 1995*) became





**Obr. 2.3** The Monoxylon II Expedition: the route and the boat . ■



the decisive supportive factor. This also became the stimulus for the second expedition through the Western Mediterranean in 1998 and the building of a new boat, a replica of the Bracciano find.

The Monoxyton 1995 Expedition was named after the notes in Greek of Byzantium authors from the 6th century (*Havlíková 1991*) and language of the country where the expedition was taking place. We chose a route across the Aegean Sea across the thickest chain of the islands to compare to Nikolov's (1990) (**fig/obr. 2.4**) supposition of passive early faring along the sea coast. Exactly on the opposite site of sea there is documented the dense Neolithic occupation of the Eastern Greek Coast (*van Andel - Runnels 1995, Fig 1*). The object of the exercise was too emphasise the sea faring ability of the prehistoric inhabitants. The wooden craft proved itself well during the journey of nearly 300 km.

A different sea level and to a relatively different shape of the coast played a important role in Neolithic navigation. In the post-glacial era the sea level began to rise but it didn't reach the current level during the Neolithic (*Broodbank - Strasser 1991*). The mainland was bigger and the islands as well. The distances between them were shorter. On the expedition route (**fig/obr. 3.3**) that condition would show with the connection of some of the islands (for example Tenos and Andros) or islands and mainland (Samos and current Turkish mainland). There the travel was easier in the past and for this reason the Monoxyton Expedition started on Samos, which was in the Neolithic a peninsula. The second consequence of the sea level change is contemporary. There is possibly a number of Neolithic sites, unavailable below the sea surface. The Israelite site Atlit-Yam (*Galili 1993*) is an example.

The route of the 1995 voyage was planned to the South leeward sides of the islands. Most of the occupation is still situated there. The sea surface there can be completely calm. Between the islands there is a different situation. The greatest distance is more than 50 km (Ikaria - Mykonos), the rest is only about 25 km. Most of it was easily crossible in the log-boat. No influence of sea currents showed, not even in the places where they are supposed by V. Nikolov. Strong wind creating waves caused problems and on the open sea therefore there some places were very difficult to cross. We had to be tugged by an accompanying craft for 40 km between Ikaria and Mykonos as because of time reasons we couldn't wait for the weather to improve. According to the experience of local inhabitants this area is difficult to cross most of the year. Such areas I named for myself „zones of discontinuity“.

The Monoxyton II Expedition was through the Western Mediterranean (**fig/obr. 2.3**) where the Bracciano boat came from. Italian archaeologists suppose that it was used for sea faring. The voyage took place under different conditions from those in the Aegean Sea. We chose that to test the crossing to the Lipari Islands and coastal faring, the most probable early sea going in the area. We selected coastal areas with supposed relation to Neolithic coast that meant places where sea faring could have taken place in prehistory. Even here we had to remember that there was a different shape of coast in the Neolithic, especially in Northern and Central Italy, Southern France and Eastern Spain (*van Andel 1989, fig 3*).

The route of the expedition was divided into 5 stages (*Tichý 1999*). The main object was to observe the faring characteristics of the boat and influence of natural conditions as they are supposed by various theories and models.

### **3. Reconstruction of the crafts**

In contrast to the Monoxylon 1995 Expedition the boat for 1998 Expedition didn't have a hypothetical design (similar to model of a boat from Tsangli) but it was a reconstruction of a real Neolithic log-boat which was discovered in the Lake Bracciano in 1994. The boat belongs to the early Neolithic, it was found close to the sea coast and therefore it could be a sea going craft. It was studied from many perspectives, it survived relatively well and the site as a whole gives us number of interesting insights (evidence of distant contacts, models of boats, situation of a possible port and so on). We have a radiocarbon date for the layer which corresponds with the time of the work on the boat. The date was extracted from the post P765 (dated 6565 $\pm$ 64BP, calibrated 5450 BC), which was blocking the bow of the craft (*Fugazzola Delpino 1995, Fugazzola Delpino - Mineo 1995*).

Because our object was to build a craft able of faring and we wanted to test it on sea we tried to reconstruct the original look of the boat. We had to estimate some of the data because of the damage. The whole boat was dug from one trunk without any of the cracks or repairs which were on the original. We considered the free wooden parts as rope supports (maybe mast and sails?). We excluded a floater. The object was to build a stable craft not needing any supports that would slow it down.

The boat was powered with paddles but with retrospective we think that use of sail might be possible.

While building the reconstruction of the boat we used these parameters:

The length - was shorten by 1.25 m to 9.2 m because the used tree was rotten at its crown. Otherwise the size of the trunk corresponded with the presumed scale of the trunk from which the Bracciano boat was built. This didn't really influence the journey.

The number of cross-braces - with shortening the length the number decreased to 3 in comparison with the original 4.

The height of the sides - because of the damage to the original and because we were going to test it on the sea was increased to 90 cm. This proved very successful while going into waves.

The width of the sides and the bottom - smallest size on the reconstruction was 5 cm. The smaller sizes of the original (2 - 4 cm) were believed to be a result of changes in the wood. The scale corresponded. Our estimates were based on supposition that thinner sides would endanger the integrity of the craft. The drying on the land might be also dangerous then. The log-boat of the Monoxylon II Expedition was built according to the find from Bracciano. It is possible to consider it

as a replica more than a reconstruction. All the characteristics are very close to the original despite the shortening of the length because of the rottenness of the trunk. The biggest problem open to discussion is the thickness of the sides and the bottom. The original dehydrated by long term storage had very thin sides and bottom. We needed to keep them thicker otherwise the wood would crack in higher temperatures. On the other hand during the voyage it was clear that the mass was still slowing the speed of the boat. More thinning of the sides might mean that it wouldn't be possible to pull the boat from water because of possible damage. That seems to be the limits of the right parameters of the boat.

## 4. The Expeditions Routes

<b>Monoxylon I (1995):</b>				*) towed	
8/9	Ormos - Kirikos (Samos - Ikaria)	30 km	9,15 h	2 crews	
9/9	Kirikos - Nikolaos (Ikaria)	25 km	7 h	2 crews	
13/9	Nikolaos - O.A.Annas (Ikaria-Mykonos)	11 km + 40 km*)	14 h	2 crews	
14/9	O.A.Annas - Ormos Ornos (Mykonos)	11 km	4 h	1 crew	
15/9	Ormos Ornos (Mykonos - Tinos)	24 km	9,30 h	2 crews	
17/9	Tinos - Petrangathi (Tinos - Andros)	35 km	11 h	2 crews	
18/9	Petrangathi - Gavrio (Andros)	20 km	7 h	2 crews	
19/9	Gavrio - Karystos (Andros - Euboia)	14 km + 15 km*)	7 h	2 crews	
20/9	Karystos - Marmari (Euboia)	25 km	7,45 h	2 crews	
21/9	Marmari - cape (Euboia)	12 km	3 h	1 crew	
22/9	cape - Marathon (Euboia - Attika)	17 km	3,30 h	2 crews	
23/9	Marathon - Nea Makri (Attika)	7 km	1,30 h	1 crew	

<b>Monoxylon II (1998):</b>					
<b>Sicily</b>					
7/8	Milazzo - Vulcano:	31 km	12.30-20.45	1 crew	
8/8	Vulcano - Milazzo:	31 km	9.00-18.00	1 crew	
9/8	Milazzo - Bagnara:	51 km	17/19/15 km	5.15-21.30	4,15/4,30/3,45 h 3 crews
10/8	Bagnara - pulling the boat out				
<b>Central Italy</b>					
11/8	Mondragone - Sinnessa:	6 km	19.00-20.20	1 crew	
12/8	Sinnessa - Lido di Fondi:	50 km	6.45-20.05	3 crews	
		21/27/2 km	6/6/1 h		
13/8	Lido di Fondi - Terraccina:	12 km	8.05-10.30	1 crew	
	pulling the boat out				

to be continued on the next page >

## EXPEDICE MONOXYLON / Pocházíme z mladší doby kamenné

14/8	Rome - Museo L. Pigorini					
15/8	the Lake Bracciano	22 km	8/14 km	9.00-18.00	4/6 h	2 crews
Northern Italy - France						
16/8	San Remo	4 km		14.00-15.00		1 crew
17/8	San Remo - Nice	57 km	23/24/10 km	6.05-20.00	5/6,30/2,30 h	3 crews
18/8	Nice - Miramar	38 km	21/17 km	7.15-16.00	4/5 h	2 crews
	Mistral in the afternoon					
19/8	Miramar - Gigaro	58 km	19/21/18 km	6.45-20.45	4,15/5,45/4 h	3 crews
20/8	Gigaro - La Tour Fondue		43 km	7.30-18.20		2 crews
	Mistral in the afternoon		18/25 km	4,30/6,20 h		
21/8	La Tour Fondue - Port Niel		5 km	7.00- 9.00		1 crew
	Mistral - pulling the boat out					
22/8	Saintes Maries-de-la-Mer		Mistral			
23/8	Saintes M. - Ecluse de St Gilles	38 km	8.00-23.00			3 crews
		15/15/8 km	6/6/3 h			
La Pettit Rhone						
24/8	Ecluse St Gilles - la Grande-Motte	29 km	7.15-16.00			3 crews
	Mistral - pulling the boat out		14 /11/4 km	2,30/3,30/2,30 h		
25/8	le Cap d'Agde - Portiragnés	10 km	7.00-13.00			1 crew
Spain						
26/8	Valencia - Playa de la Dehesa	10 km	17.00-20.00			1 crew
27/8	Playa de la Dehesa - Piles	54 km	7.00-21.00			3 crews
		26/18/10 km		5,30/5,30/2,40 h		
28/8	Piles - Cala Blanca	38 km	12/17/9 km	7.50-16.30	2,30/3,30/2,30 h	3 crews
29/8	Cala Blanca - Altea	43 km	18/20/5 km	7.45-19.20	4,30/4,30/2,15 h	3 crews
30/8	Altea - Campello	37 km	20/17 km	7.20-16.30	5/4 h	2 crews
31/8	Campello - Alicante	16 km	8.20-12.10			1 crew
	pulling the boat out					
1/9	Sevilla - transfer					
Portugal						
2/9	Sines					
3/9	Sines - Setúbal	20 km	9.00-13.00			1crew
	+ tugging of the boat to Setúbal					
4/9	Setúbal - Sesimbra	29 km	9.00-17.15			1 crew
	pulling the boat out					
5/9	Cascais - Lisabon	30 km	8.45-12.45			1 crew
6/9	Lisabon - EXPO'98	10 km	9.45-11.15			1 crew

**Obr. Z.4** The route of the Monoxylon 95 and Monoxylon II Expeditions. ■



## 5. Possibilities of the crafts

A more concrete idea about nature of the Neolithic Mediterranean sea faring was published in 1988 by M. Korfmann in his theory about interrelations between the Eastern and Western Mediterranean (*Korfmann 1988*) (**fig/obr. 2.5**). For the Western Mediterranean there was formulated the Tyrrhenian filter model (*Lewthwaite 1986, 62, Phillips 1990, 229*) where islands or remote places function as filters in selections of elements of food preparation. J.-L. Roudil (*1990, 383-389*) explains the fast economic exchange and some motifs of pot decoration with the possibility of crossing hundreds of kilometres with help of rafts powered by paddling and sails along the coast from Italy to France, Spain and Portugal and maybe as far as the coast between Garonne and Loire. Bulgarian archaeologist V. Nikolov (*1989, 1990*) applied a theory of sea currents on the region the Aegean Sea. He explains spreading of painted ware and its makers from Southern Anatolia across the Aegean Sea to the Balkan with them (**fig/obr. 2.4**). C. Broodbank and T. Strasser (*1991, 233-245*) created a model of farming colonisation of islands in the Aegean Sea on the example of Crete. A place probably without preneolithic occupation could be colonised by a group of 40 people with the necessary minimum amount of domesticated animals and crops a total of 15 - 18 ton load. The load would be carried with 10 to 15 boats, each of them would take one to two tons. T.H. van Andel and C.N. Runnels (*1995*) published a route of advance of the first farmers to Europe based on the radiocarbon dates. The arrows showing directions are pointing across the Aegean Sea (*van Andel - Runnels 1995, Fig 11*). The authors modified original wave theory with a barrier theory where the barriers slowed down the movement. These barriers could be regions less suitable for farming lifestyle or it could be also sea areas.

The Greek expedition *papirella* (*Tzalas 1989*) was the only experiment comparable with the *Monoxylon 1995 Expedition* in the Aegean Sea. It chose a reed boat for its purposes. The voyage was supposed to imitate the Neolithic era, when obsidian was imported from Melos to Greek Mainland (cave Franchthi). The route from Lavrion in Attica to Melos took seven days because of delays with bad weather. The reed boat was chosen because of the oldest Egyptian depictions, climatic and geographical conditions, ethnographic data (still in use on Kerkyra) and the simplicity of involved technology, available already in the Mesolithic 10 000 to 11 000 years ago. Other craft would not according to Tzalas survived the voyage in aggressive the Aegean Sea. Since 1987 there was tested a smaller 3 m model. Only afterwards was there constructed a nearly 6 m long boat for 5 - 6 men crew and load.

## 6. Interpretation of the Experiment

The *Monoxylon Expeditions* brought three kinds of results. In the preparation phase it allowed for the estimation of the demands of boat building with use of two different technologies. They verified sea faring abilities of log-boats built to a hypothetical design and according to the original find from the Lake Bracciano. They researched the boat behaviour in concrete situations on selected sectors of the Mediterranean with evidence of early Neolithic occupation.

## **6.1 Building the crafts**

The first dug out canoe was from a poplar and was built in 1992 with help of fire setting. The log got its rough shape within 10 days. Another 100 hours were spent on cutting to the final shape.

Since January to May 1988 we were building the log-boat according to the original from the Lake Bracciano in The Centre of Experimental Archaeology in Vsestary. The boat was partly dug with polished stone tools (the front 3 m from the 8 m of inner space length). With one replica of a polished stone axe and an original Neolithic adze it was cut out space 72 cm deep, 80 wide and 300 cm long. The tools never worked together. There were usually 1 - 3 experimenters with variable experience. Most of the time they were using the axe, only while working the outer surface did the use of the adze. Together it was worked 100 hours, one fifth of it with the adze. The axe was sharpened once half way through the work. After 50 hours of work the axe handle cracked. With the axe they cut out chips up to 5 cm diameter and about 50 cm long or wider and shorter splinters. The adze was creating smaller splinters up to 2 cm while cutting across and big splinters to 10 cm while cutting the surface. In the upper part of the trunk a 20 cm thick layer of the surface was cut out with help of oak wedges. The full length of the boat is 9.2 m, width 1.0 - 1.2 m and height up to 1 m. The rest of the boat was worked with iron axes, adzes and wedges. The tree was cut down in December 1997 and all the time it had enough humidity necessary for working. The experimenters estimate the time demand for building the whole boat with stone tools to be 300 hours. That means at least a month of work for one person or at least 10 days for a three men group. In one moment more people could work and swapping allowed faster progress.

## **6.2 Sea going characteristics of the experimental crafts**

During the Monoxylon II Expedition the average day travel was 32 km in day and the crews worked on average 11 hours a day, once 15 hours and three times 14 hours. There were altogether 15 full days on sea. Others didn't mean a whole day journey usually because of pulling out the boat or putting it on water. Altogether about 800 km was covered in 200 hours giving an average speed of 4 km/h. Transfer over mainland between single stages or bad weather on sea took several days. The accompanying craft finished in Southern Italy and next changing of crews depended on landing by coast which was made difficult by modern built-up space. Wind of 2 Beaufort was probably the weakest we encountered. In France the wind reached in several places up to 7 - 9 Beaufort. The strength was verified by weather forecasts and reports from the port authorities. The boat went on in the end even in two metre high waves although this was not possible without bailing.

The boat of the Monoxylon II Expedition was stable. In contrast to 1995 we didn't need to use a side float that increased water resistance and decreased speed. During the whole time, even in the biggest waves we were never in danger of turning over.

That was because the centre of gravity was below the sea surface. The maximum speed was 5 km/h. It wasn't in the power of the crew to increase it without being exhausted. We were testing speed mostly on Bracciano where the going was easy. The speed of the craft was influenced only by sea currents, tide and wind. I would mark the wind as the most influential among them. If people were able to use it they achieved much. We don't know about beginnings of sails but if the square groove in the bottom of the Bracciano boat was a socket for mast and a bit of cloth found near by remain of a sail then it had to be very early. We felt the strength of head wind in Miramara in France where it was catching leaves of our paddles and decreased our speed to a minimum.

The mass of the craft helped to cut the waves. The influence of sea sickness seemed to be stronger on the modern yacht but that wasn't general. The mass was increased by a massive bow and stern that hold together a thin shell of bottom and sides. The same function was played in the Bracciano boat by the 4 cross braces. Because they are found in many prehistoric and historic European log-boats there was a lot of discussion about their function. According to our experience from building, through manipulation both on land and in water to faring I believe they were there to reinforce the boat. The mass also influenced the possibilities of steering. We can barely presume a more complicated helm than a big paddle, as we can see still on the pictures from the Aegean Early Bronze Age. For the paddle to work it was necessary to keep the boat moving. Problems started in 2 m waves when the helm was leaving the water.

The load capacity is an important parameter to consider for the possibilities of Neolithisation and transfer of materials. The crew of the log-boat could be made of at maximum 15 people. Although it was more than meter shorter than the original, the original length wouldn't increase this number by more than two people. There were usually 9 - 11 people paddling, one was a steersman. There was still plenty of space for load. During the expedition we were carrying only obsidian, dinkel wheat and water supplies but in the mentioned number of crew there was still plenty of space left. The transport of obsidian was optimal the load functioned as ballast. We loaded more than 100 kg of the stone which we carried from Sicily as far as Portiragnes. It would be possible to carry more. Even our amount would be enough for making a large number of knapped tools. Two linen bags of dinkel wheat were from the load point of view no burden. One of them was left in Portiragnes and about a half of the other one was sown in March 1999 and it germinated 100 %. An area about two to four metres means space with amount of wheat sufficient to provide after a second sowing harvest for the new cereal colony. The width of the boat would allow you to carry a much bigger load.

Some experience relate also to observing the boat on dry land. The necessity for protection from sun might be well documented also by the supposed boat shelter found at Bracciano. The swelling of wood should probably be balanced with the braces left in the bottom. During our handling of the boat on sea and on dry land it was possible to see the vibrations of wood. The cross braces were functioning as

armatures. This feature clearly shows the experience of Neolithic boat builders. The log-boat from Bracciano could have had several generations of predecessors.

This experience is also a reason why to look in different way at the ethnological and ethnographic parallels. In the case of Bracciano the log-boat gained thanks to different material (oak) completely different qualities. The building of the craft in the original scale showed its hugeness. I think personally it would be pointless to build such a big boat just to go over a lake. That also supports the view of Dr Mario Mineo from L. Pigorini Museum that these boats were used for sea faring.

### **6.3 Interpretation of the Expeditions routes**

Practical result of the voyage in Greece in 1995 seems to be ambiguous. It was possible to cross most of the sections quite easily with exception of some parts where the unfavourable natural conditions rule most of the year. In September 1995 T.H. van Andel and C. N. Runnels published their work about first farmers in Europe. It is encouraging that the directions of farming spreading point across the Aegean Sea (*van Andel - Runnels 1995, Fig 11*). They are in the direction of the Monoxylon 1995 Expedition route.

As the reach ability of islands is concerned the expedition tested faring between the Greek islands from Samos to Attica (**fig/obr. 3.3**) and to the Lipari Islands, over 30 km from Sicily. The voyage to the Lipari islands took only a half a day and therefore the daily reach could be set to about 50 km distance. Night faring or higher speed would be necessary for higher kilometrage. Higher speed might be reached with for example sails. In the Mediterranean there are distances of 100 km without possibility of over stop. That's for example distance from Corfu or the East Adriatic coast to the Italy peninsula, the route from the Valencia peninsula to Balears, from Sicily to Africa through Pantelleria, from Southern Italy to Malta or straight to Sardinia.

The possibility of landing and anchoring is an important characteristic of the coast. We don't know anything about ports and anchoring during the Neolithic if Bracciano itself wasn't such a port. The look of the coast certainly changed so we don't have a firm base for our presumptions. It is only possible to say that a certain type of coast is represented by the Greek islands rocky coast. There it is necessary to pick a place for landing. Another possibility is the Central Italian sandy coast where the soft sand makes landing difficult. In France the line of the coast was broken and it was necessary to look for a port. It was possible to suppose suitable places in big bays. The main problem was the infamous mistral that can enforce several days break in voyage. In extreme conditions when we were testing the boat when others would barely set on sea. In the area of Spanish Valencia the coast is again very sandy. In combination with breakers it creates an unfavourable landing situation by bank and even less suitable situation for anchoring or fastening the boat to the bank. We used to bail sand and water in the morning but it's not too elegant. But in Spain there are inland lakes connected to sea. They could have been suitable ports.



Faring along the Atlantic coast of Portugal was a separate task. There we tested part of the coast between today Sines and Sado estuary which connected two concentrations of Neolithic occupation. There is a strong tide which demands anchoring in ports. One of them could have been hidden on the rocky promontory in Sines where it would precede its famous medieval successor. We can suppose the next landing possibility only 90 km to the North in the estuary of the Sado River. Between them there is a long sandy beach hammered with breakers. The conditions couldn't be better in the past as the evidence as the Roman settlement swept by an Atlantic tidal wave shows. That would again mean higher speed or night faring to cover the distance.

## 7. Discussion

The model of sea pioneer colonisation model seems to be the leading model of the Neolithisation in the Western Mediterranean. It is characterised by coastal colonisation that missed out some of the regions where the Mesolithic inhabitants continued (*Zilhao 1997, 1*). In the Eastern Mediterranean it would be the barrier model of wave spreading (*van Andel - Runnels 1995*). Again it prefers certain direction farming advance to selected areas with specific quality of soil.

While researching the origin of farming it is necessary to consider two fundamental parameters - time and space (*Guilaine 1996, 53*). The chronological inaccuracy is the biggest weakness of our knowledge (*Guilaine 1996, 64*) and also the geographical borders of occupation are not known enough (*Guilaine 1996, 54 - 57, Lewthwaite 1986, 64*). Crossing time and space (possibilities of transport) are a very important quantity.

Thinking about Neolithisation concerns mostly the role played by the alien elements, the way they infiltrated into the area and the part played by the local foragers in the way of accepting farming way of life. The effort to stress the role of hunter-gatherers originates from rightful view that we are not right to judge the culture, economic system and level of life of foragers as retarded. These people certainly had the abilities to adapt and to react creatively to new impulses. But it's necessary to consider if these impulses didn't endanger the Mesolithic culture. Then they wouldn't be accepted so radically. Or under what conditions its possible to ensure accepting Neolithic technologies, keeping their procedures. Local independent development of foragers to farming cultures is according to present research little probable. The presence of alien animals and plants in home culture shows it the best. The homogeneity of early farming cultures is also pointed out very often. The homogeneity probably wouldn't be reached with local and therefore supposed variant culture development.

In other cases very fast and contemporary spread of farming culture is considered as an evidence of common „ripening“ of conditions for the start of farming when the outer influence played its role (animals and plants, pottery technology) but they could have been accepted without presence of farming colonies, for example with

help of economic and social net (Lewthwait's model). That means a transfer of ideas without the presence of people. Then there is occurring a problem how the local inhabitants learned to use these new parts of the culture. Certain explanation could be the trades part in Neolithisation (*Runnels - van Andel 1988, Runnels 1989*), that also supposes personal contact.

The argument is getting to a different level. It is at the same time about migration of alien human groups and the active role of local groups in Neolithisation although acculturation could be lengthy and in the beginning geographically restricted. The situation can be shown with different horizons of pottery under layers of pottery decorated with Cardium (*Binder 1990, Pavlů 1996*) or with differentiating between Neolithic, Mesolithic and mixed knapped industry on archaeological sites. The model describing this process is then called dualistic or interaction model (*Bernabeu-Auban 1996, Pavlů 1996*). The traditional migration model describing movement of farming populations triggered by demographic pressure is losing its position.

While considering this or other hypothesis of Neolithisation of the Western Mediterranean it's necessary to remember the scale of the space we are talking about. If the beginning of the farming culture is found in the same time horizon (for example *Guilaine 1979, Zilhao 1990, 457*) then any model of acculturation, interaction or migration depends on crossing distances. The speed of transfer becomes more important. Probably we hadn't succeed to prove archaeological the original „farming colonies“ (according to migration - interaction theory) or the beginning of idea transfer of farming culture elements and products (social model). We know only the consequences. In this case also the absence of evidence is not a proof of absence (*Zilhao 1997*).

Although we can't exclude other types of crafts (reed, leather) on crossing distances the log-boat is currently the only documented craft in the Mediterranean Neolithic (*Fugazzola Delpino - Mineo 1995*). Experimental archaeology shows the high speed of wooden boats. The Greek expedition crossed in its reed boat in 7 days approximately 150 km with a load of about 500 kg (*Tzalas 1989*) while the Monoxylon II Expedition crossed more than double these kilometres with load of nearly one ton and unused reserve. The log-boat is a craft with higher transport capacity. As it was shown (*Broodbank - Strasser 1991*), speed and transport capacity were fundamental parameters while settling islands and therefore also in coastal transfers. Testing conditions of sea faring removes some and modifies other views which were published in relation to some Neolithisation models.

J.F. Cherry (1990, 191, 176, 193, 200) presumes in accordance with G. Camps that to reach islands like Pantelleria and Lampedusa there were necessary good navigation abilities and crafts more complicated than log-boats or simple rafts. He doesn't doubt that the filter effect while spreading domesticated species to islands can't be put down to the problems with transport of big animals because they were overcome in the same time on Crete and Cyprus. The Greek papirella showed according to him a relatively easy although not fast transport of a family to islands in epipaleolithic.

He thinks that the main problem with settling islands were wind and sea currents, navigation abilities of colonist could also play a positive or negative role.

According to the results of the Monoxyton Expeditions prehistoric faring was much less dependent on sea currents or on chains of islands as places of over stops (*van Andel - Runnels 1982*). Voyages over long distances (Pantelleria, Lampedusa, Sardinia) would be difficult for reed boats because of their speed. On the other hand log-boats thanks to their higher capacity and speed could cover these distances and took their place in running of the supposed island filter.

The theory of M. Korfmann (1988) (**fig/obr. 2.5**) supposes interrelations between Eastern and Western Mediterranean with help of sea currents regularly aiming East-West along the Northern coast of the Mediterranean sea in summer. He deduces the day speed of Neolithic boats from their speed. That doesn't exceed 22 km in a day. The result of the Monoxyton Expeditions is refute of the fundamental importance of sea currents. A much bigger barrier on the whole voyage through the Western Mediterranean was head wind, which was slowing down the advance or even completely stopped it. The daily speed commonly exceeded 50 km. V. Nikolov (1990) counted similarly with influence of sea currents in the Aegean Sea. Even there the Expedition 1995 didn't confirm it.

J. Roudil (1990) supposes well-steered navigation with rafts powered by oars and wind. That way it was possible to cover hundreds of kilometres. The faring had to take place in both directions and without visible stages. He even suggested that the furthest reach of such navigation could be coast between Garonne and Loire. Coastal faring could comprehensively explain a quick economic exchange. The speed of spreading could be fast although the archaeology can't determine it. To this model the Monoxyton Expedition brought complementary data. It could be the used craft, more efficient than rafts but simpler than the considered but not proved batten boats and its speed. The voyage to the French Atlantic coast might be presumed according to our experience as very demanding.

Jean Guilaine (1979, 1996) supposed as first that the technology of pottery making started in the Western Mediterranean independently. Since the beginning the pottery shows its own originality. Its early and fast spread is documented with radiocarbon dates. They put its beginning to the time about 6000 bc accordingly for Italy, Southern France and Spain. That presumes weak cultural connections among early Neolithic groups in the Western Mediterranean leading to doubts about influence from Near East where pottery became regular element only in the beginning of the 6 millennium bc, that means it is at most only few centuries earlier than the Western Mediterranean one. The realistic estimate of time necessary to cross the whole Western Mediterranean along coast with a few months according to the Monoxyton Expedition. Although there is very little probability that it could have ever happened so fast it is impossible to exclude fast dissemination of technologies under the condition of fulfilling social and economic prerequisites. The current research on the French territory admits influence of sea spreading into coastal areas but it presumes acculturation in inland regions.

J. Lewthwaite (1986) worked the considerable role of local hunters on the creating of cardial culture in his theory of social model and Tyrrhenian filter model. He supposes that Tyrrhenian islands functioned as filter for Southern France and the Iberian peninsula. Transfer of new elements didn't take place along the West coast of Italy but across the sphere of the Tyrrhenian sea (Sardinia, Corsica) and the arch of coast from Toulon to Tiber. In certain stages there were elements of Neolithisation temporarily missed out. The main problem is just the demanding sea route to Sardinia and from Corsica to Provence. If the main reason for creating this model is just an absence of archaeological evidence we have to wait for future results. In addition, the coast from Southern Italy up to the Tiber River is just the area where the Neolithic coast might be flooded because the rocky slopes fall today straight to the sea. A. Cazzella (1988, 89) has a different view on the spreading of domesticated species. He supposes diffusion of sheep and goat to Corsica and Sardinia through Central Italy. The results of the excavation of the Neolithic settlement in the Lake Bracciano also document presence of domesticated species and South Italian Neolithic pottery. This settlement is marked as the earliest in the Western Mediterranean (*Fugazzola Delpino - Mineo 1995, Cassoli - Tagliacozzo 1995*).

We had a chance to observe that the current Neolithisation models don't accurately correspond with the possibilities of sea contacts. On the basis of archaeological finds it is impossible to decide unambiguously about autochthonic or migration origin of farming in Western Europe (*Whittle 1999, 289-294*). In both cases sea faring would play an important role. If we keep to facts we can complement at least the following data.

- 1.** The finds from the Lake Bracciano proved that there were still growing bulky trees (oaks) in the Western Mediterranean in the Neolithic. They could have been used for building wooden boats. Next development didn't need to be influenced by lack of suitable material for some time yet. The clay boat models found also at Bracciano show the possibility of development towards more complicated wooden boats already in that time. If the number of big trunks was decreasing than it was necessary to put together a craft from several wooden parts. Somewhere there would be the beginning of batten boats.
- 2.** If the lake was an inland sea port than it explains at least one type of landing. Others could be straight on the coast the look of which we'll hardly be able to reconstruct exactly. But they would surely be in sheltered bays or on firm capes.
- 3.** Early evidence of domestication and dating of the Bracciano settlement among the oldest in the Western Mediterranean are giving us an idea about a „Neolithic colony“. But it doesn't need to be a primary settlement or a principal settlement. Such settlements probably haven't been found.
- 4.** The position of Bracciano in Central Italy and the South edge of Lewthwaite's zone of Tyrrhenian filter can document coastal connection between Southern and Northern Italy. If the domesticated species of animals and plants are found in this settlement than they could aim further to the North along the



coast without being restricted with any filter. That doesn't mean that such filter didn't function on the Tyrrhenian islands. The probability of coastal faring is shown by transport of obsidian. It went from the Lipari Islands along the Italian coast as far as French Portiragnes. On this route there was another connection documented by presence of Ligurian pottery. But we don't know the length and time span of these stages. And we can't suppose that archaeology will be able to determine them. Even accurate absolute dates will stay only a skeleton of time scale of prehistory.

**5.** We can't refuse any more that the fast transfer along the coast was possible. We also can't refuse the diversity of pottery in single regions. We can barely ever succeed to find pottery of the first colonists. The look of the next made pots could have been but didn't need to be influenced by local environment. It would be necessary to research more of its social, economic and religious background.

**6.** There is still the question of the range of faring between islands. According of the Monoxylon Expedition experience it is possible in one day in optimal conditions to cross 50 km across open sea. But we can't exclude use of sails because of finds from The lake bracciano (remains of textile close to the boat, the square groove in the bottom of the boat).

## 8. Conclusions

**a)** In 1995 we managed to cross the Aegean Sea in a log-boat but not ambiguously. By coincidence these results were supported by a theoretical research in the time when the expedition took place (van Andel - Runnels 1995). Both experiment and theoretical research support existence of barriers in spreading of farming from Asia Minor to Europe. The Monoxylon II Expedition in 1998 in the Western Mediterranean didn't meet any similar barriers. The only problem was wind which passed after some time. In the Atlantic the faring was difficult because of strong tide making impossible landing outside of sheltered ports.

**b)** We can't exclude log-boats from one trunk as an early sea faring craft. Their existence is proved by the find from Bracciano (Fugazzola Delpino - Mineo 1995). The mastering of technology was supported by single experiments and was proved by the find of the Bracciano boat with the evidence of building in the early Neolithic settlement. While building the boats for the Monoxylon Expeditions we tested technology of setting fire (10 days) and cutting out (about 500 hours). Building would surely have an important social impact (more people taking place in the building).

**c)** Both expeditions tested the influence of natural conditions (sea currents, wind, navigation) and excluded the influence of sea currents on prehistoric faring as it's presumed by Korfmann (1988) and Nikolov (1990). The influence of wind causing high waves did slow down the advance of the boat. But it was possible to go even in 2 m waves with wind of strength of 7 - 9 Beaufort.



**d)** Testing a real craft in real condition can also modify our views of possibilities of transport in the Neolithic (*Broodbank - Strasser 1991*). The replica built according the find from Bracciano proved itself to be very good on the sea. The main parameters was stability and capacity of the boat (12 people, 100 kg of obsidian, water supplies, dinkel wheat, unused reserve). The average speed on the 800 km of the route was 4 km/h which meant mostly covering a distance of more than 50 km in a day. The boat was powered by paddles. In the Aegean Sea simple sail for rear and reaside wind didn't prove practical. The wind came only from the side. It wouldn't be possible to use it even on the voyage through the Western Mediterranean because of head winds. But we can't reject its possible importance.

Finds of 4 clay models of boats in the Lake Bracciano document together with the clay model from Greek site Tsangli importance of sea faring. One of the Bracciano models shows even a more complicated boat with protrusion on its bow and stern. The views differ but it is possible to presume maybe a batten boat. The tradition and experience with building are shown by the advance construction of the Bracciano log-boat with inner cross-braces protecting the boat from deformation.

**e)** The leading views among Neolithisation theories are migration of farmers, acculturation of the local Mesolithic or so called dual (interaction) model. The concrete manifestations are supposed influence of so called „Tyrrhenian filter“ (*Lewthwaite 1986*), importance of trade (*Runnels - van Andel 1988, Runnels 1989*), coastal faring of migrants (*Roudil 1990*) or independent local development towards farming and making pottery (*Guilaine 1979, Zvelebil 1986*). The Neolithic settlement in Bracciano with its presence of domesticated species, cardial, painted and incised ware cast doubts on the necessity of connection through the big islands block instead of coastal faring. Was it also a „colony“ as seen by J. Roudil in the Portiragnes site? Consideration of possibilities of faring is important not only for this one but for each one of the mentioned views. T. H. van Andel (2001) for example considers importance of sea migration already in the Mesolithic.

In case it is possible to say that in the Neolithic Mediterranean the Neolithisation would be slowed down because of types of crafts known at the time. Everywhere it was only a question of days to wait for better weather. Anchoring could present a problem (breakers). The inland port on the Lake Bracciano could be an evidence of optimal solution of it with approaching the sea from river. Similar ports could have been situated in near sea lakes sheltered river estuaries. On the other hand it would be possible to travel the whole coast of the Western Mediterranean up to Sicily in at most several months of persistent going. There had to be different mechanism stopping so fast advance. That could be solved only by field archaeology. Till that time it is necessary to consider consequences of the mentioned experiments for all Neolithisation hypotheses.



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# Appendix 2

## Project Borek. Contribution to learning about the issue of cultural transfer

### 1. Introduction

The first University Centre of Experimental Archaeology worked between the years 1994 and 1998. It was a monothematic project for the reconstruction of life in the Neolithic with technological and functioning experiments. A special emphasis was given to observing processes of destruction of structures and artefacts discarded in natural way. Long term observation of these processes was allowed by the presence of experimenters was organised (long term stays in summer and short term stays in other seasons as a part of an optional seminar on experimental archaeology).

A site situated in open countryside near to Hradec Kralove was selected for the project. It was a mild slope facing South above confluence of two streams. In the years 1994 - 1996 there was built the foundations of a Neolithic settlement area: a house of post structure with building pits, a clay pit, hearths, a storage pit, ovens, a roasting oven, a well and small test fields. Replicas of Neolithic tools were used in number of the building works.

The project was finished, because of legal reasons, in 1998. The site was researched, bits of surviving replicas were collected. The archaeologisation of structures was being observed till 1999. In the beginning of year 2000 the whole site was destroyed by JCBs.

In the following text I'll concentrate on the evaluation of buildings of the area from point of view of used technology, function and time demands. The built structures were tested. The system was based on the possibilities of archaeology, therefore I decided to sort the following description under structures.

The reconstructed structures belonged to LBK. A project conceived this way doesn't have analogy in experimental archaeology of the Neolithic. Till now there were mostly reconstructed an independent single structures - Houses (*Böhm - Weny 1990, Luley 1990*), ovens (*Pfaffinger - Pleyer 1990, Werner 1990, Kunnemann 1990, Kaufman - Heege 1991*), hearths (*Ludtke - Dammers 1990*), wells (*Lobisser 1998, 177-192*) or material quarrying (*Pleyer 1991, Holsten - Martens 1991*). In some cases more complex projects hadn't been finished (for example Těšetice-Kyjovice). I see the importance of describing the project not only in the complexity of the approach and ambitious use of tool replicas but also in the conditions of its course, when the experimenters had to solve problems of food supplies and had to deal with weather.



## 2. Method

There is a well-known and published group of settlements from the early and middle Neolithic with large amounts of finds from the Czech territory (Bylany, Březno, Roztoky). Not even these finds are enough to create a model of a Neolithic man world. It is necessary to complement them with small but well-preserved context situations.

The model settlement area „Borek“ (**fig/obr. 7.13 - 7.18**) was created this way. Beforehand, in the same time and additionally we did activities that exceeded the settlement area borders (for example gaining materials, transport). They are partly described in this article, part of them will be published in more detail later. We didn't pay any attention to some domestic activities (burying, breeding animals) although they also could have aspects for the experiment.

A house is the basis of a Neolithic settlement (*Hodder 1990*). The reconstruction of a house from Mohelnice published in PDM (*Podborský a kol 1993, 84*) was selected as a model for the project. It was marked there as an early Neolithic type of house. Later the author of this article found that this house excavated in Mohelnice in 1957 probably belongs to MMK. Despite this the reconstruction might show a small version of a Neolithic long house. The building pits were chosen along the longer sides of the house. Inside the house there were placed a shallow hole for a storage pot and hearth presumed according to finds of daub (*Soudský 1966*).

A group of ovens was another structure. It was placed at a chosen distance from the house according to the situation excavated in Mohelnice 1958. That way there was created a heap of soil and a clay pit. One of the ovens was used before the building of the house to create a situation of uncontemporary horizontal stratigraphy. This structure ceased to exist soon and became part of the clay pit. At a selected distance from the house there was dug a storage pit (*Fig 7*). On the settlement at Brezno u Loun the distance between storage pits and houses is 7 - 8 m (*Pleinerová - Pavlů 1979, 62*). Near the house there were other pits used as a clay pit, rubbish pit and for fire. Such small pits are found commonly on Neolithic settlements together with single post holes.

A well was placed a longer distance from the house on the confluence of the two streams. A well was documented also in Mohelnice 100 m from the settlement (*Tichý 1998a*) and in Most (*Rulř - Velimský 1993*). The hypothetically presumed test fields (**fig/obr. 7.13 - 7.18**) and an animal grave was placed at a similar distance. The burial ground in Vedrovice was placed at about 100 m from the settlement (*Podborský a kol 1993, 87*).

There were problems with placing other manufacturing activities, presumed „workshops“ play an important role among them. These spaces are not possible to place straight into pits. They were activities done on the then surface. Sometimes (*Ondruš 1975/76, 133-139*) some activities got to close pits and part of waste later became part of the infill. The workshop for making bone objects (*Fig 2.27*) from

Roztoky (*Rul'f 1984*) belongs among such lucky finds or the workshops for making stone tools (*Fig 2.28, 29*) from Humenne (*Vizdal 1989*) and Chotěbudice (*Popelka 1994, 17*). Handling pottery waste was also tested (*Neústupný 1996*). It was hidden in bushes or placed on a path. There was also hypothetically supposed a zone of making pottery in a shady place behind the house close to hearths.

### 3. Conclusions

During our experiments we tried adopting Neolithic technologies. Although we had our disposal the results of archaeological research it showed very clearly that outside knowledge of objects is not enough. It was necessary to know the contents of mixtures (daub, pottery) or nature of material (stone for polished tools, working soil with wooden tools) and characteristics generally (germination and harvest of dinkel wheat). Getting to the core of things wasn't perfect even with our possibilities for research. What than of the hunting populations?

According to our experience we got convinced there had to be at least personal contact between hunting and farming populations to make the transfer of the farming culture possible. It also results from that, that Neolithic culture had to be spread only with colonisation or with transfer on hunting population in the presence of at least a minimal number of farmers. The process of learning could take place only through personal contact (especially in family or community) and aside of that it is necessary to suppose it's a long-run process (for example in the case of passing the ability to grow crops at least one year).

In the considered model we have to necessarily suppose the presence of farming colonists. The possibility of sustaining small communities as presumed for the early phase of LBK in Central Europe is difficult to recognise. E. Neústupný (*1983, 85*) suggests that the communities while moving as a whole or only as parts over long distances had problems with entering into marriages. In that case there could be accepted single persons from the hunting population. We can never certainly exclude or make exact number of kidnapped women, found children or economic and social domination as a source of stability of the incoming farming populations. Possible archaeological and anthropological evidence of such relations is the find of the grave H11 in Těšetice-Kyjovice. There was buried an adult woman, about 30 - 40 years old, with classical early LBK grave goods. She was anthropologically very different from the Mediterranean type. (*Koštuřík - Lorencová 1989-90, 103-125*).

I think that the farming technology (sowing, harvest and storage of products), technology of making pottery (preparation of ceramic mixture, baking and pot use), building of complicated and permanent dwellings and maybe also making of different knapped industry wouldn't be possible without the presence of those who were using these features in their everyday life. Many times we found out in experimental archaeology that we were often missing basic experience with technological problem. On the other hand the finding of the solutions meant an easy next advance, which would be impossible to think out or describe in words. The

most effective and fastest way to learn is the natural process of watching the activity - so called active presence. If we allowed the necessity of migration it didn't need to be numerous, wide spread or of a demographic importance. It could be a penetration by isolated farming communities getting into neighbourhood of foragers groups. Than an integration of both systems could have happened. There is a possibility of neighbourhood coexistence, mixed marriages, captivity in the opposite culture group, economic exchange, including exchange of know-how. It is necessary to consider following course (spatial and temporal) in single regions.

The functional and technological experiences show us how demanding it is to work one's way into making of artefacts and building of structures. The current experimental archaeology should concentrate on positive gaining of experiences comparable with prehistoric reality rather than just stating negative results. In any case the mentioned demands show the problems of the hypothesis of accepting Neolithic culture by Mesolithic hunting populations. Such transfer is possible only within living culture during at least one year (farming cycle).

We can observe the gradual merging of hunting and farming world outside anthropology also through archaeology if we are prepared to see such natural processes behind material remains as a gradual and long-term merging of two different worlds. In Central Europe there is for example of certain impact appearing already in the culture with stroke ware (*Mazálek 1953, 203-211*) and if it wasn't for the proximity of the Lengyel cultures the merging would be even faster. In the beginning of Aeneolithic, at the time of the arrival of the funnel beaker culture, it doesn't make sense any more to speak about farming or hunting population. The development moved somewhere else although we can still suppose islands of hunters (*Vencl 1982*). It was already clear that all the new elements of farming cultures were accepted in different ways. There couldn't have been any unbeatable demands in the process of learning and adapting. The cultures of hunters and farmers learned to live along each other.

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