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**ISLAND ARCHAEOLOGY AND THE ORIGINS
OF SEAFARING
IN THE EASTERN MEDITERRANEAN**

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In memory of John D. Evans

Eurasian Prehistory Guest Editors:

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THE ORIGINS OF MAMMALS ON THE MEDITERRANEAN ISLANDS AS AN INDICATOR OF EARLY VOYAGING

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Abstract

This chapter aims to show how the progresses of biological knowledge allows archaeology to take advantage of the paleontological and archaeozoological documentation accumulated during the last 40 years on the islands, to increase its set of evidence – admittedly indirect – on the early seagoing in the Mediterranean. It presents a brief review of the geographical and paleogeographical frameworks as well as the basics of island biogeography and focuses on the different ways in which mammals were able to colonize remote islands. The review of the extinctions and immigrations of mammals since the Late Glacial on the five larger Mediterranean islands, which have stayed isolated since that time, highlights the major role that human beings played in the construction of modern mammalian communities on these islands. In turn, this phenomenon is a remarkable source of information for investigating early seafaring in the Mediterranean. Four main aspects of this subject are further developed: (1) there was little or no frequentation of these large islands during the Upper Palaeolithic suggesting that, for unknown reasons, voyaging started later in the Mediterranean than in South East Asia; (2) based on the introduction of early domesticates on the islands, fast improvements in voyaging skills are visible between the beginning of the first steps toward the Neolithic of the Eastern Mediterranean (11th millennium cal. BP) and its arrival in the Western Mediterranean (8th millennium cal. BP); (3) the colonization of the islands by the small mammals is a good proxy for measuring the intensity of early seafaring and the degree of sophistication of the architecture of early boats; (4) one of the major issues that the early voyagers had to resolve is the transportation of the ruminants, which cannot lay down tied at the bottom of a boat more longer than 3 to 4 hours, suggesting that boats were not only big and stable enough but already fast enough at the beginning of the Neolithic transition and rising the question, in turn, of whether or not sails were already in use at the time.

Key words: Mediterranean islands, Early Holocene, Late Glacial, early seafaring, early voyaging, mammal biogeography, archaeozoology

INTRODUCTION

During the last 30 years, the origins of seafaring in the Mediterranean have been mainly investigated through the earliest appearance of human beings on the islands or else the circulation of obsidian. The appearance of new animal species on an island, mostly due to overseas transportation by people, has been taken into consideration as well (e.g., Cherry, 1990; Broodbank, 2006; Ammerman, 2010). However, it has been underexploited. The boat-introduction of mammal populations

and their sustainable establishment in the new territory – both restricted and isolated – entails a range of biological constraints, which include the time and the modalities of the immobilization of the animals during transportation, the minimal number of founder individuals reaching a given island and the intensity of gene flows coming from the mainland. Thus, in the absence of any early prehistoric wreck or the representation of Early Neolithic boats in the Mediterranean world, the transportation of animals makes it possible to estimate (admittedly roughly) not only the

times of the earliest voyaging and the distances that were involved but also such things as the durations of the trips, the speed of the boats, their loading capacity, and even some general features of their structure (for instance, those linked with their ability to hide small stowaways; Vigne, 1999, 2009; Vigne and Cucchi, 2005; Cucchi and Vigne, 2006; Cucchi, 2008).

The task assigned to me in the opening session of the Wenner Gren Workshop on *Island Archaeology and the Origins of Seafaring in the Eastern Mediterranean* was to introduce and review what we can learn about these two subjects by studying the island biogeography of mammals, and this is now the aim of my chapter in the proceedings as well. It begins by going over rapidly some of the basics of palaeogeography in the Mediterranean as well as the general principles of biogeography, and some of main trends in the biology of mammals when it comes to swimming or their boat transportation. This chapter will focus on the large Mediterranean islands, which have been continuously separated from the continent by a significant expanse of sea since the time of the last maximum Pleniglacial regression.

GEOGRAPHY AND PALEOGRAPHY: THE “TRUE” ISLAND

The geography of the Mediterranean basin fluctuated a great deal over the course of the millennia due to the combined effects of global sea level variation linked with climate change (especially the pulsed Late Glacial and Holocene transgressions) and of the strong tectonic and neo-tectonic activities at the fringe of a series of large or smaller continental and oceanic plates. In particular, most of the some 370 Mediterranean islands that we know today (with the exception of islets having an area of less 0.1 square kilometers) were once part of the continent (or else part of a larger island) during the time of low sea level, and they only became islands recently (for a review of this topic, see Vigne, 1994). Consequently, in the study of early voyaging on the basis of archaeological evidence, we have to focus on the islands which were separated from the mainland throughout the Late Glacial and the Holocene. These are not only oceanic

islands in the geological sense of the term (such as Cyprus, which rose up from the bottom of the sea (Henson *et al.*, 1949; Held, 1989), but they can also be small continental sub-plates (such as Corsica-Sardinia, which drifted together from the Iberian continental plate long before the late Quaternary period (Oggiano *et al.*, 2009). Since the geological vocabulary is not really well suited to the issues at hand, I have proposed the term “true” island for an island separated from the mainland for a substantial period of time (Vigne, 1999). Of course, the list of “true” islands in the Mediterranean varies according to the time frame that we take into consideration. In the Aegean, for example, numerous coastal islands such as Euboea are “true” islands for the last ten centuries but not if we go back to the start of the Holocene when it was connected by dry land with the mainland. The time frame adopted in this chapter is the long one, spanning the Holocene and Late Glacial. This reduces the number of island/archipelagos, which can be investigated for our purpose to about 20 (Petit-Maire and Vrielynck, 2005).

Only five of these “true” islands are large enough to provide sufficient palaeontological or archaeozoological evidence to reconstruct the history of mammals over this long period. From East to West, they are: Cyprus, Crete, Sardinia, Corsica and Mallorca. We shall not take Sicily into consideration for three reasons: (1) because the minimum distance to Calabria is quite small (just 3 km), (2) because the Strait of Messina is a very active tectonic area, and (3) because Sicily has probably been connected with the mainland at least once during the maximum Würm regression and perhaps even during the Late Glacial (D’Amore *et al.*, 2009; see Manning in this issue). In short, the main trends of the biogeographical history of mammals of Sicily may have little to do with early voyaging.

GOING TO AND COLONIZING ISLANDS: BIOLOGICAL AND BIOGEOGRAPHICAL CONSIDERATIONS

In their famous book called *Theory of Island Biogeography*, MacArthur and Wilson (1967) make the following claims: (1) for a given group of taxa, there is a linear correlation between the

logarithm of the species richness of an island and the logarithm of its area as well as between the logarithm of the species richness and the distance to the nearest continent or large island; (2) there is a constant flux of propagules (that is, any organ of dissemination and reproduction of a living organism) from the mainland to a given island; (3) consequently, the effective colonisation of an island by a new taxon is necessarily connected with the extinction of one pre-existing taxon on the island itself. Conversely, the extinction of one taxon opens a series of niches, which will allow the immigration of one new taxon.

While this theory has been considerably refined over the last 40 years, it has not been fundamentally modified, except in the case of strong human impacts. In such situations, which are, in fact, quite common, human beings can be viewed not only as a new species able to cause extinctions, but also as a factor of strong intensification in the flux of propagules (i.e., thus increasing the probability of immigration, as if the island were suddenly larger or nearer to the mainland (Blondel and Vigne, 1993). Such a situation tends toward an increase in the species richness, which becomes much higher than predicted by the theory of MacArthur and Wilson. In particular, this was soon shown to be the case for some of Mediterranean islands and archipelagos (Alcover, 1980; Vigne, 1983, 1987; Cheylan, 1984, Davis, 1984).

In order to ascertain whether or not an introduction is the consequence of human behavior, it is necessary to know the conditions under which a natural immigration occurs. Non-flying terrestrial mammals cannot reach "true" islands without swimming, floating or rafting. This is why the Pleistocene mammalian faunas of the large "true" islands in the Mediterranean are all composed of the same kind of species (for example, good swimmers such as deer and hippos; Sondaar, 1977), even though their taxonomic compositions vary to some extent from one island to the next. There are no clear data about the maximal distance, which can be crossed by a swimming mammal. However, the numerous reports of wild boars caught in fishing nets off the Mediterranean coasts of Provence and Spain suggest that they are not able to swim more than a couple of kilometres – in any case, less

than 10 km. This is why the Pleistocene phases of large mammal turnover on the Mediterranean islands are connected closely with major marine regressions. For small rodents, the natural flow recorded on islets off Corsica shows that the distance that they can cross by swimming is less than a few hundred meters (Cheylan and Granjon, 1989). But rafting allows them to travel much further. For large and small mammals (and for humans too), the probability of a successful sea crossing is constrained not only by the distance from the mainland, the surface of the island, and the course taken, but also by currents which can facilitate or else hold back movement. Moreover, as noted by Held (1989:12; see Vigne *et al.* in this issue), one has to take into account the geometric properties of the island: such things as the occurrence of small stepping stones island, the morphology of the coastline, and the "target size" of the island (that is, "angle which an island subtends on the horizon when viewed from the staging area for colonization").

However, the sea crossing itself is just one aspect of a successful colonization. Of course, the good swimmer should be a pregnant female or else the number of swimmers should be large enough so that two of them, of opposite sex, can mate. In addition, the genetic diversity of their offspring must be large enough within a population for them to be able to adapt to new and different environments on the island (that is, to reduce the risk of extinction because the species lacks the genetic capacity to cope with restricted ecological diversity; Blondel, 1986). It should be recalled that Van Valen (1973) proposed that large mammals, which would not have been able to reduce their sizes rapidly on islands by means of genetic drift alone, might find themselves in a poor position to survive in the context of environmental change. In effect, size reduction, by allowing the fragmentation of the biomass of a species and accordingly increasing its number of individuals, would act to increase its survival expectancy in the face of environmental or climatic change. However, more recently, Raia and Meiri (2006) convincingly make the argument that "dwarfism in large herbivores is an outcome of the fitness increase, resulting from the acceleration of reproduction in low-mortality environments." Thus, it follows that ungulate

dwarfism is a consequence of insularity rather than a pre-condition for having a long life on an island.

In any event, the probability for a successful colonization, even for a good swimmer (or rafter in the case of small mammals) is very low. It can be roughly estimated for the large true Mediterranean islands based on the number of new mammal species successfully arriving per 10,000 years during the Upper Pleistocene. It ranges from a value of 0.00 (Majorca) to 0.92 (Sardinia) – with intermediate values for Cyprus (0.42), Corsica (0.50) and Crete (0.58) (Vigne, 1999). These values may slightly underestimate the actual rate since the known paleontological record for a given island may offer less than a complete picture of its total biodiversity. Conversely, the immigrations, which are taken into account in estimating such rates, occur mostly during times of marine regressions. For this reason, they may slightly overestimate the rate in comparison with those for the late Glacial and Holocene situations, when sea levels stood much higher than during the strongest Pleistocene regressions. In short, a rate of less than one new taxon per 10,000 years can be taken as a good estimate of the probability of natural immigration of terrestrial non-flying mammals to the Mediterranean islands in natural conditions (that is, without voyaging or seafaring by human beings).

THE HOLOCENE MAMMAL TURNOVER ON THE FIVE LARGE ISLANDS

Paleontological knowledge with regard to the Pleistocene mammalian fauna of the five large “true” islands of the Mediterranean has not changed much over the last 15 years, except in the case of Cyprus (Vigne *et al.*, 2009, 2011, 2012). In other words, the review of the date that I presented in 1999 has not changed significantly. It shows the same basic pattern for Cyprus, Crete, Sardinia, Corsica and Majorca (Fig. 1). The literature used in producing this figure can be found in Vigne (1999); it will not be repeated here except for new evidence that has modified the picture or else is of special importance for our present purposes.

All the native endemic large mammal taxa of the five islands became extinct before the

Neolithic period (except the Majorcan *Myotragus*, which seems to have got extincted because of the activities of the earliest human colonizers of the Balearic islands; Alcover, 2004). Altogether, this makes a total of 5 to 7 species: *Phanourios minutus* and *Elephas Cypriotes* for Cyprus, one or two species of *Candiacervus* and perhaps *Elephas creuzburgi* for Crete, and *Megaloceros cazioti* and *Cynotherium sardous* for Sardinia and Corsica. It has recently been shown that “degeneration” or rickets did not played a role in these extinctions (Robert-Attard and Reumer, 2009). However, with the exception of the Balearic Islands, it is still not clear whether the extinctions are due to these islands being frequented by small groups of hunters who engaged in the overkill of naive preys (Martin, 1984; Brook and Bowman, 2004), or whether they are to be explained in terms of the numerous drastic climate changes during the Late Glacial. Here it is important adding, even if it may seem rather surprising, that there is little or no convincing evidence for the Late Glacial presence of human beings on any of these five large islands (that is, unquestionable Upper Palaeolithic sites that included associated archaeological features and direct radiocarbon dating of organic materials recovered by excavations; see discussions and references in Vigne, 1999; and also Vigne *et al.*, 2011). Conversely, the tight correlation of the extinction of *M. cazioti* in the stratigraphy of the Gritulu cave on Corsica with drastic environmental changes, which can now be radiocarbon dated to the very onset of the Holocene, argues clearly for climatic extinction at least in this case (Vigne, 2000, 2005). However, the persistence of dwarf endemic elephants on Tilos (Theodorou *et al.*, 2007) indicates that at least some species made it through this time of pronounced climate change. Not all the large mammal extinctions were necessarily due to the same factor.

In contrast with the large mammals, the 11 endemic small mammal species all managed to survive the onset of the Holocene: *Mus cypriacus* (Cucchi *et al.*, 2006) and perhaps *Genetta plesictoides* (Vigne *et al.*, 2012) for Cyprus; *Mus minotaurus* and *Crocidura zimmermanni* for Crete; *Prolagus sardus*, *Rhagamys orthodon* and *Tyrrhenicola henseli* for Corsica and Sardinia; *Episoriculus similis* for Sardinia; *E. corsicanus* for Corsica; and *Hypnomys morpheus*

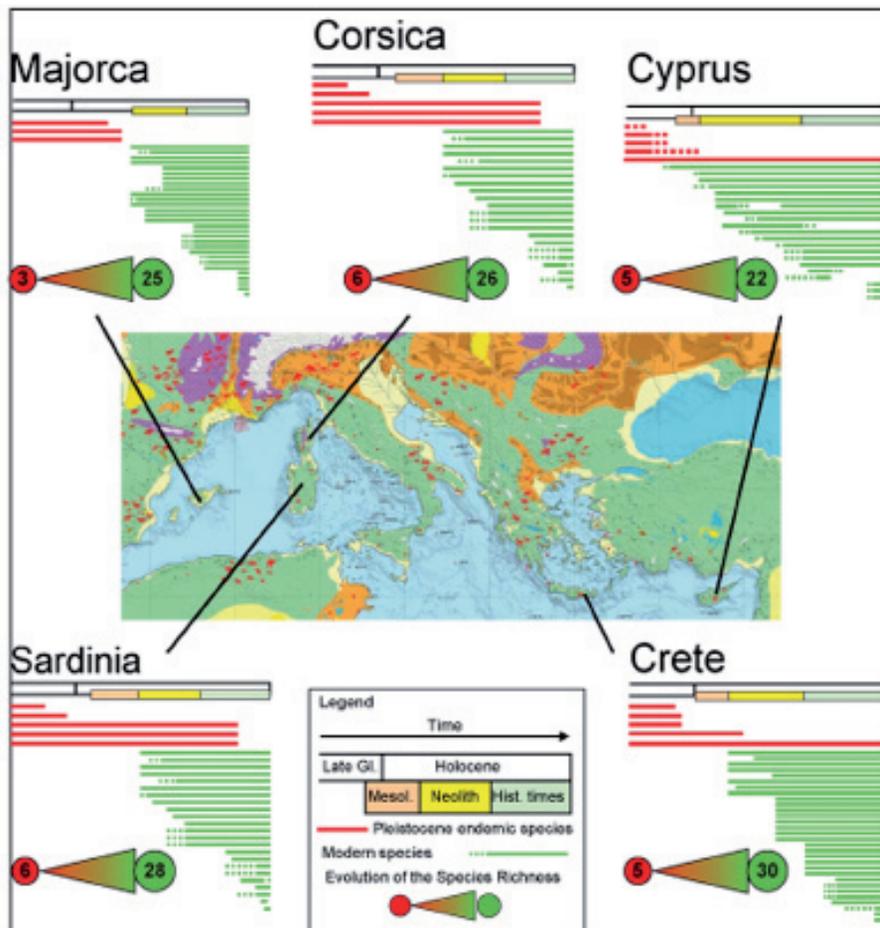


Fig. 1. The Holocene mammal turnover on the five large “true” Mediterranean islands, based on the updated data after Vigne (1999). The central map is the Late Glacial maximum map after Petit-Maire and Vrielynck (2005)

and *Episoriculus hidalgo* for Majorca. With the exception of *E. hidalgo*, *M. minotaurus*, and maybe *G. plesictoides* (Vigne *et al.*, 2012), they have all been found in association with Neolithic or more recent archaeological levels. On Corsica, the four species are attested even as late as the 1st millennium AD, when they became extinct because of competition with invasive species (mostly *Rattus rattus*) in combination with the massive extension of cultivated areas in the interior of the island (Vigne and Valladas, 1996). For many years, *Prolagus sardus* was considered to have survived on the Tavolara islet until the 17th century, but it now seems that this was based on a mistaken interpretation of the zoological

reports of Francesco Cetti (Wilkins, 2000). In any case, two of these species are still living today: *C. zimmermanni* in mountain refuge areas on Crete (considered to be “vulnerable”; Vohralík, 2008); and *M. cypriacus*, which is still frequent on Cyprus (Cucchi *et al.*, 2006). Together with the Sicilian shrew (*Crocidura sicula*), which lives on Sicily, Ustica, Gozo, and the Egadi islands (but it did extinct on Malta; Amori and Hutterer, 2008), they are the only endemic mammal species still alive today. Even if human activities appear to have played a major role in the extinction of the endemic small mammals, the observations made here indicate that, much like the case of the large mammals, the extinction of 80% of them

(9 species out of 11) was not the consequence of any one factor – either natural or anthropogenic – and that the extinction of the small mammals probably took place for different reasons on the various island.

The third main component of the Late Quaternary turnover of the mammalian communities of the “true” Mediterranean islands, which is the one of major interest to us here, is a massive immigration of new species coming from the near continents (Fig. 1), for a total of 60 to 70 successful introductions. These immigrations are characterized by three main trends.

(1) The rate of immigration varies from 9 (Majorca) to 17 (Sardinia) per 10,000 years: it is some 20 times higher than the rate for the Upper Pleistocene natural immigration rate, discussed above. According to the theory of MacArthur and Wilson it points to a considerable increase in the flow of the propagules (as if the islands were suddenly brought nearer to the continents; Alcover, 1980).

(2) In so far as they are well dated, these immigrations waves start later and later as one move from the east to the west across the Mediterranean Sea (Fig. 2): the end of the late glacial in the case of Cyprus (Vigne *et al.*, 2011, 2012), ca. 8,800 cal. BP in the case of Crete, ca. 7,700 cal. BP for Sardinia and Corsica, and then around ca. 5,500 cal. BP for Majorca. This means that this drastic change in biogeographical regime

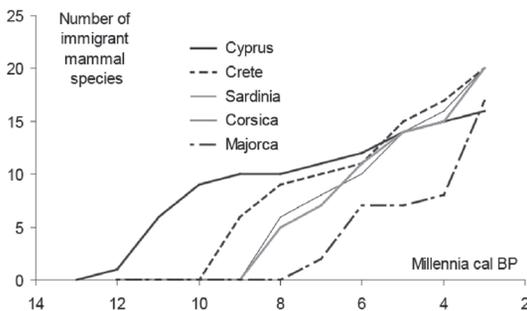


Fig. 2. Evolution of the number of immigrant non-flying terrestrial mammal species through times on the five large “true” Mediterranean islands (the data come from Vigne, 1999, updated)

is not connected with climate changes, since they occur at more or less the same times everywhere in the Mediterranean basin. What these five dates correlate with are the times of Neolithic transition in the respective parts of the Mediterranean world. In short, the pattern is more likely connected with this major change: the wave of the shift from hunting and gathering as a way of life to that of early farming (Vigne, 1988a, 1992, 1999; Cherry, 1990; Zeder, 2008).

(3) The new modern species are all domestic, feral deriving from the domestic immigrants, commensal (probably introduced as stowaways), anthropophilous species, prestige game (*kynegetization*; Vigne, 1993), or animals with high symbolic value for Neolithic people such as foxes or hedgehogs (Vigne, 1988b, 1999, 2011; Pascal *et al.*, 2006). Species that do not live within the anthroposystem are absent from this immigration wave, as well as most of the competitors (or predators) of human beings. The immigrant mammal communities are very different from the Pleistocene “deer-hippo” fauna (best swimmers or rafters; Sondaar, 1977). They are strongly marked by their connection with the human niche.

These three trends clearly show that most or even all the modern species were voluntarily or unconsciously introduced by human populations with the first steps toward the domestication of plants and animals in the Eastern Mediterranean and then their spread westward in what is sometimes called the Neolithization of the Mediterranean.

In addition, it worth noting that, for the five islands, the 60-70 immigrations concern only 35 taxa: that is, 11 of them have been introduced to all five islands, 8 of them occurred in the case of at least two islands, and only 10 of them involved just one of the five islands. When none of the species of the Upper Pleistocene fauna are shared between two of the islands or else between one island and the continent, one finds that 71 percent of their modern species are common to at least two of the islands, and 100% are also found to be living on the near continent. While these introductions entailed a drastic increase in species richness of each island (oversaturation in terms of the language used by MacArthur and Wilson 1967; Cheylan, 1984; Vigne, 1987), they did not increase the global

biodiversity of the whole Mediterranean Basin. On the contrary, biodiversity on the whole decreased because of the human-induced extinctions of nine of the 11 endemic small mammals, and perhaps human beings may have contributed directly or indirectly to the extinction of some of the 6-8 endemic large mammals.

CONSEQUENCE FOR THE ORIGINS OF SEAFARING

This scenario that I have just summarized has at least four consequences when it comes to the question of beginnings of voyaging in the Mediterranean basin.

The absence, during the Late Glacial, of any massive wave of extinction within the endemic faunas and of any anthropogenic introduction (including dogs, which were first domesticated more than 17,000 years ago and should have been introduced at that time by hunters; Pionnier *et al.*, 2011) is congruent with the absence of a reliable record for the presence of human populations on these islands at such an early time. Surprisingly, in the present state of knowledge, it appears that human being did not intensively frequented the large “true” Mediterranean island before the very end of the Late Glacial (the Younger Dryas) or the beginning of the Holocene.

Secondly, for all of islands except Majorca, the first introduction of domestic mammals occurred without delay in terms of what was happening on the nearby mainland (Fig. 3; Vigne, 1999, 2008; Vigne and Cucchi, 2005). The Neolithic way of life and the early domesticates are attested as early on Cyprus, if not earlier, than it is in Central Anatolia (Vigne *et al.*, 2011). They arrived on Crete just as early as on the mainlands in the case of both sides of the Aegean Sea (Perlès, 2001). After a slowing down of the Neolithic transition between Greece and southern Italy (Guilaine, 2003), the fast spread of early farming to the northwest reached Corsica and Sardinia by around 7,800 cal. BP: that is, at more or less the same time as the first *Impressa* cultures appeared in Liguria, Languedoc, the Ebro valley and Catalonia (Zilhão, 2001; Guilaine *et al.*, 2007; see Zilhão in next issue). Only Majorca seems to fall outside of this pattern of development. This, along

with the wide use of obsidian from island sources at Early Neolithic sites in the Aegean world and in southern Italy (Ammerman, 2010), means that early Neolithic people were already voyagers who could transport large mammals over the sea and manage them well enough so that they then thrived in their new island environments. The inference to draw here is that voyaging was part of the Mediterranean “Neolithic package” (Bar-Yosef, 2001). At the same time, it is worth adding here that more long-distance voyaging may only have emerged in the western basin of the Mediterranean during the 9th millennium cal. BP; by contrast, voyages may well have been initially limited to shorter distances in the eastern basin and in the Aegean Sea during the 11-10th millennia cal. BP.

The third point concerns the 47 identified transportations of non-flying, small mammals to the five islands. In line with what is said above, it is reasonable to infer that most of them (and perhaps even all of them) were the consequence of the transportation of stowaways. Even if the time of their arrivals is often not precisely known due to the lack of the systematic collection and study of small vertebrates in island archaeology so far, it appears that they are not evenly dispersed in time (Fig. 4): 60 percent of them occurred during the 7-6th millennia cal. BP, and 80 percent between the 7th and the 5th millennia (Vigne, 1998, 1999; Vigne and Cucchi, 2005). In other words, there was not much transportation of them before the 7th millennium, then, many introductions occurred in a rather short span of time in the case of all five of the islands, as if a threshold had been crossed. Of course, the intensification of exchanges between the mainland and the islands, no doubt, played a role in this phenomenon. Here I would like to propose that this threshold was linked with new developed of boat architecture such as the increasing use of boats with decks, allowing small mammals to hide themselves aboard more easily and frequently (see Vigne *et al.* in this issue). This observation highlights the importance of technical improvements in boat making and methods of voyaging over the course of more than four millennia, as the Neolithic package moved from east to west across the Mediterranean Sea. To put it another way, the boats that were in use at the western end of the Mediterranean during the

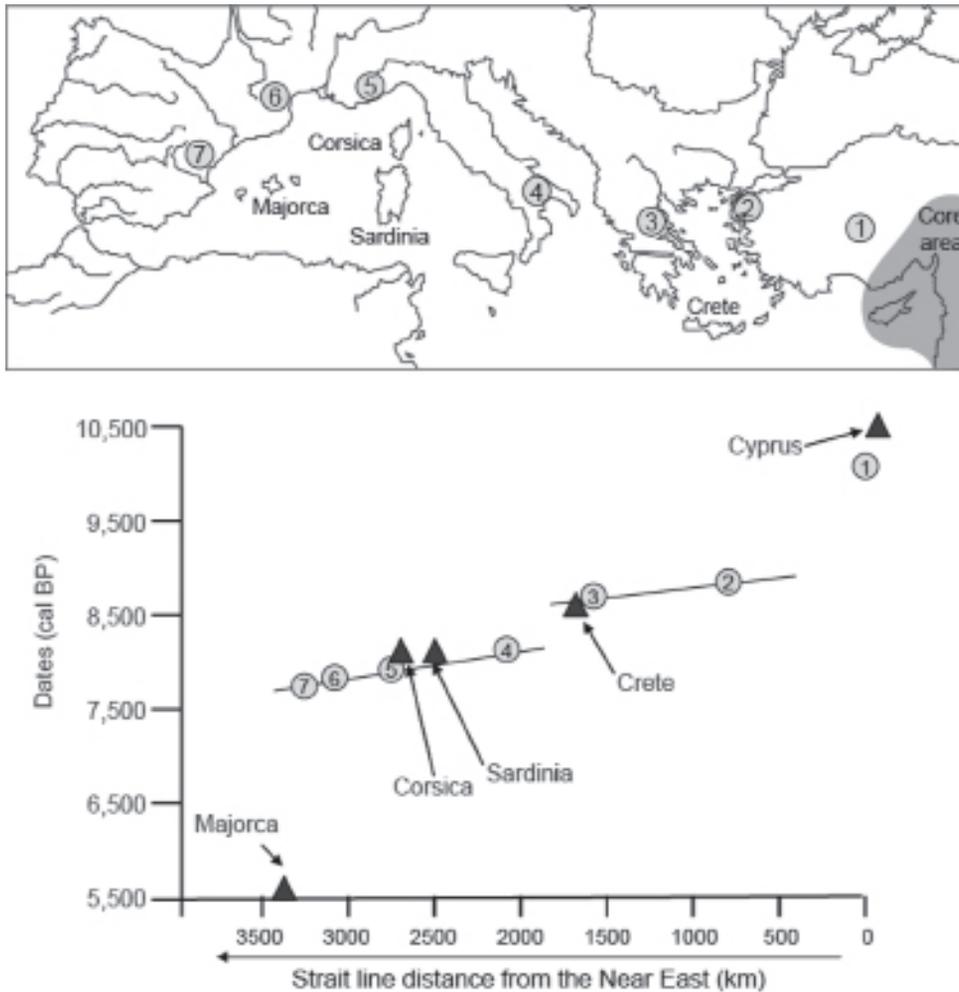


Fig. 3. Dates of arrival of early domesticates in different continental and island regions of the Mediterranean (after Vigne 2008, modified according to the “arythmic” model of Guilaine 2003)

8th millennium cal. BP were probably not the same one in terms of their architecture as those first used at its eastern end during the 12th millennium cal. BP.

The last point concerns the transportation of large ruminants from the mainland to the islands as early as the middle of the 11th millennium cal. BP in the case of Cyprus, the very beginning of the 9th millennium cal. BP in the case of Knossos on Crete, and the 8th millennium cal. BP for Corsica and Sardinia. Even though one could easily imagine that the Neolithic people would have chosen to transport young animals rather

than larger adult sheep, goat, fallow deer, cows or bulls, they could not have introduced unweaned kids, lambs or calves except if they were able to milk them, which is unlikely. The boats must have been big and stable enough to carry on very long distances and on rough waters calves that were more than 9 months old (the weaning age for the Neolithic; Balasse and Tresset, 2002) and thus weighting in the range of 120 to 150 kg. In addition, in order to keep of the animals from being thrown off balance in small boats and hurting themselves, it would have been useful to tie them up and lie them in the bottom of a

boat, as frequently done for deer making short trips in Indonesia in recent times (Clutton-Brock, 1981:fig. 18.6). However, this must have been a major issue for the voyagers, since after lying down for 3-4 hours, without moving, the ruminants are subject to what is called “downer cow syndrome”, which is characterized by a series of pathologies, including myoglobinuria, ischemic necrosis of the hind limbs, nerve inflammation and a series of physiological disorders which lead to permanent recumbency (Cox *et al.*, 1982; Cox, 1988; Ferrouillet and Carrier, 2003; Anonym, 2008). This is due to the fact that, for the ruminants, moving is necessary to evacuate the large amount of gas produced by the bacterial digestion of cellulose. If the ruminants cannot do this, they rapidly inflate, which causes tissue compression (Cox, 1982). Of course, the loss of an animal during or after transportation was probably not a rare event in early times. Indeed, it was still a problem in the transportation of deer in Northern Europe in the 17th and 18th centuries (MacGregor, 1992). Of course, this did not discourage Neolithic people from making trips of this kind. However, it would have placed a strong constraint on the voyager who had to face the challenge of transporting ruminants. No doubt, it would have influenced the size and the architecture of early boats used for this purpose. More will be said about this question in Zilhão in the next issue. Suffice it to say here that this is why I previously put forward the ideas that early voyagers in the Eastern Mediterranean were already using the winds and probably sailed as early as the 11th millennium cal. BP, and their early boats may have included a wooden deck attached to a pair of deep dugouts or any other kind of device (Vigne, 2009).

CONCLUSION

Though limited to five large Mediterranean islands, this review demonstrates how important is to take into consideration the animal bones (and the plant remains) of archaeological sites in the debates on early seafaring in the Mediterranean world. Owing to the more and more accurate knowledge of island ecology and biogeography, which has accumulated over the last 30 years, and because

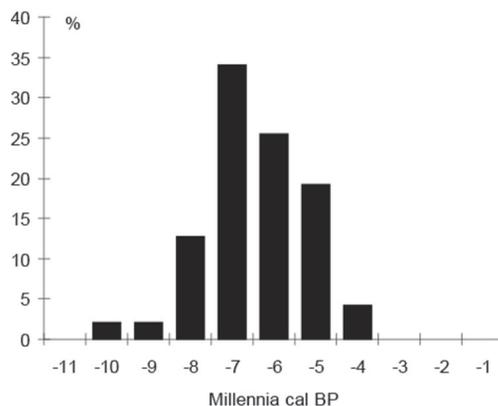


Fig. 4. Frequency of the immigration of non-flying small mammals cumulated for the five large “true” Mediterranean islands per millennium BP. Based on 47 occurrences. After Vigne (1999)

of the increasing amount of archaeozoological data on the islands and on the mainland as well, archaeology can now use this new evidence as a powerful tool in deciphering the history of island colonization and early seafaring. What this means in a larger sense is that, even though the Mediterranean islands have been massively settled only at a comparatively late date in comparison with the history of Southeast Asia (colonisation of Sahul ca. 50 000 BP), its last hunter-gatherers and its first farmers were more skilled voyagers and their boats were, in all likelihood, much less primitive ones than we had previously thought.

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