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The spread of farming in the Eastern Adriatic

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ABSTRACT – *The beginning of farming in the Adriatic is a topic ripe for a new discussion and synthesis. Several lines of evidence suggest that immigration played a major role in the process. It involved, however, both the actual movement of people and the active participation of the local population, and probably unfolded somewhat differently in different parts of the region. There is provocative evidence that the transition to farming occurred in a two-stage process. There was an initial stage of very rapid dispersal, perhaps by exploratory parties along the coast in the southern Adriatic. During the second stage, the eastern Adriatic littoral was probably colonized by farming communities, while the hinterland remained an agricultural frontier zone.*

IZVLEČEK – *Začetek poljedelstva na področju Jadrana je tema, ki omogoča diskusije in nove sinteze. Predstavljamo dokaze, da je glavno vlogo pri procesu igralo priseljevanje. V regiji se je proces odvijal različno, vključeval je tako selitve ljudi, kot tudi aktivno udeležbo lokalnega prebivalstva. Dokazujemo, da se je prehod h kmetovanju odvijal v dvostopenjskem procesu. V prvi stopnji je prišlo do hitre razpršitve, morda izvidnikov, vzdolž obale južnega Jadrana. V drugi stopnji so skupine kmetovalcev verjetno kolonizirale obalne predele vzhodnega Jadrana, medtem ko je zaledje ostalo mejno področje kmetovanja.*

KEY WORDS – *Neolithic; farming; Croatia; Adriatic; colonization*

Introduction

Recent years have witnessed major advances in our understanding of the spread of farming in Europe, through the refinement of theoretical models (*e.g. Price 2000; Thomas 1999; Whittle 1996; 2003*), through the integration and comparison of archaeological, linguistic, and genetic evidence (*e.g. Bellwood & Renfrew 2002; Ammerman & Biagi 2003*), and through the characterisation of human diets and population movements by studying stable isotopes in human bones (*e.g. Milner et al. 2004; Richards et al. 2003; Price et al. 2002*). The eastern Adriatic coast lies along a major route into Central Europe from the southeast, but our state of knowledge about the spread of farming in the region remains relatively undeveloped. Maps offering sophisticated models for the spread of farming into Europe can leave the eastern Adriatic region blank (*Barker 1985.Fig. 21; Renfrew 1987; Tringham 2000.Fig. 2.1; Whittle 1996.Fig. 8.2; Zvelebil & Lillie 2000.Fig. 3.1*) or merge it with one of the neighbouring regions (*e.g. Zvelebil & Lillie 2000.Fig. 3.4*). In this brief paper we hope to put the eastern Adriatic region 'on the map' through a summarized review of the available evidence and the presentation of a new model of the spread of farming in the region (Fig. 1).

Models for the transition to farming

The transition to farming in Europe has been explained by a wide variety of models, ranging from a com-

pletely autochthonous process where local foragers turn to farming, to a completely exogenous process where foreign farmers migrate into Europe and replace the indigenous population (*Barker 1985; Perlès 2001; Price 2000*). Claims for a completely independent domestication of plants and animals in Early Neolithic Europe have been thoroughly refuted on genetic (*Jones 2002.94, 107, 130*), morphological (*Rowley-Conwy 1995; Zohary 1996.143–144*) and taphonomic grounds (*Zilhão 1993*), while models that rely primarily on migrating farmers (*e.g. Ammerman & Cavalli-Sforza 1973; 1984*) are now thought to underestimate the contribution of Mesolithic foragers to the process, whether considered in terms of the modern-day gene pool (*e.g. Richards et al. 1996; Richards et al. 2002; Jones 2002.160–161*) or the indigenous adoption and transmission of parts of the 'Neolithic package' (*e.g. Price 2000; Tringham 2000; Zilhão 2000; Zvelebil 1986; 2002*). The Mesolithic-Neolithic transition can no longer be considered in terms of a simple dichotomy between indigenous adoption and foreign migration.

The major early domesticates were introduced into Europe at the start of the Neolithic. Since the crops could not have spread naturally into Europe, and domestic animals are very unlikely to have done so, we must consider at least some form of population transfer. Zvelebil and Lillie (*2000.62*) have recently listed six different forms of population transfer that may have been important in the transition to agriculture in Europe. We use these processes to frame our discussion of the transition to farming in the Eastern Adriatic; their definition and archaeological signatures are listed in Table 1.

Much of the Adriatic literature still tends to see population change – that is, migration – lurking behind every major change in pottery style, let alone the introduction of the earliest pottery (*e.g. Benac 1979–1987; Dimitrijević et al. 1998*). The migrationist view is echoed in syntheses by Chapman et al. (*1996.259*) and Biagi & Starnini (*1999*), who note the rarity of Late Mesolithic occupation in the region and an abrupt shift from wild to domestic animals at the Mesolithic-Neolithic transition. Others have undermined the unity of the 'Neolithic package' in the region, arguing that there is no necessary association between the appearance of ceramics and domestic plants and animals (*Tringham 1971; Trump 1980*). Tringham (*1971*) makes the strongest case for continuity of economic practices and lithic use from Late Mesolithic to Impressed Ware, citing evidence of wild fauna associated with impressed ceramics. More recently, Budja has proposed a model of 'Neolithisation' in the region that acknowledges the acceptance by the autochthonous population of a limited number of innovations, while rejecting any form of migration (*Budja 1993.177; 1996.69; 1999*).

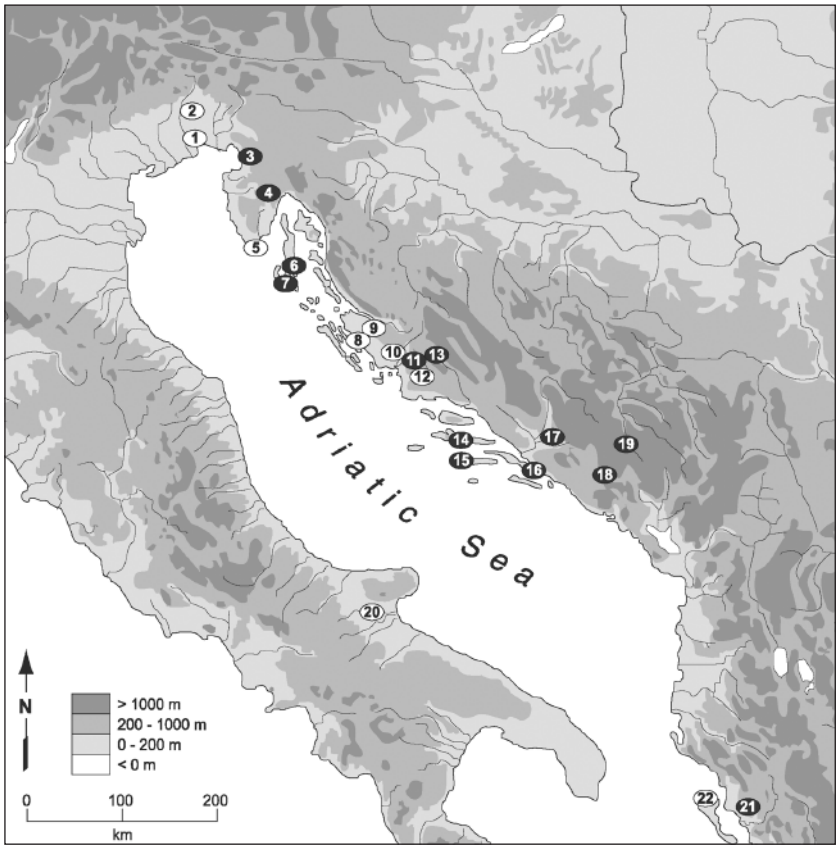

Fig. 1. Some of the sites discussed in the text. Black number on white: open-air sites; white number on black: cave sites. 1. Piancada 2. Sammardenchia 3. Selected caves of the Triestine Karst (Edera, Mitreo, Benussi, Ciclami, Vlaška) 4. Pupićina 5. Vižula 6. Jami na Sredi 7. Vela spilja (Lošinj) 8. Tinj 9. Smilčić 10. Pokrovnik 11. Škarin Samograd 12. Danilo 13. Gospodska 14. Grapčeva 15. Vela Spila (Korčula) 16. Gudnja 17. Zelena pećina 18. Crvena Stijena 19. Odmut 20. Selected open-air sites of the Tavoliere (Masseria Giufredda, Scramella San Vito, Ripa Tetta, Coppa Nevigata, Lagnano da Piede, Villa Comunale, Masseria Candelaro, Masseria Santa Tecchia, Masseria Fontanella Ulivetto) 21. Konispol 22. Sidari.

Process	Description	Archaeological expectations
Demic diffusion	Demographic expansion of farming population leads to daughter groups budding off and colonizing new areas. Migration not directional; slow rate of migration.	Full Neolithic package moves; abrupt change; slow spread (1 km/year)
Folk migration	Directional movement of population from old area to new. Not necessarily driven by demographic expansion. Similar to leapfrog colonization.	Full Neolithic package moves; abrupt change; rapid spread
Elite dominance	Penetration of area by numerical minority who subsequently seize control and impose culture/language on indigenous majority.	Piecemeal adoption of Neolithic package by socially central individuals, perhaps through feasting; gradual change
Infiltration	Gradual penetration of new area by small groups/individuals who are subordinate or perform specialist tasks for majority.	Piecemeal adoption of Neolithic package by socially peripheral individuals.
Leapfrog colonization	Selective colonization of areas only marginally exploited by indigenous foragers, creating enclave settlements from which further dispersal of farming proceeds. Often movement by seafaring.	Full Neolithic package moves; new settlements separate from Mesolithic; little interaction with indigenous people; abrput change; rapid spread
Individual frontier mobility	Individuals or small groups linked in social/economic exchanges between forager and farming communities. Direction and pace of change depends on existing social frameworks and communication routes and/or those established between forager and farming communities.	Piecemeal adoption of Neolithic package; innovations adopted within existing Mesolithic settlements; much interaction between indigenous and colonizing peoples

Tab. 1. Expectations of different models of the Neolithization Process. Descriptions and expectations based on Barnett (*2000*); Zvelebil and Lillie (*2000*).

Zvelebil and Lillie (*2000.68–71*) have recently suggested that 'Neolithisation' in Dalmatia involved the introduction of pottery into local forager communities during an 'availability phase' along the agricultural frontier. Similar models have been proposed by others, although each puts a different degree of emphasis on population movement and local adoption (*Barfield 1972.204; Skeates 2000.171–172; Zvelebil 2001.2–6*). Zvelebil's 'integrationist' model remains the most elaborate, taking into account social contexts of exchange (subsistence and otherwise) and intermarriage, and their effects on the movement of populations across agricultural frontiers. Before developing a new model for the 'Neolithisation' process in the eastern Adriatic, we summarize evidence about the pattern of change in the region.

Farming and pottery in the eastern Adriatic

The recognition of prehistoric farming sites in the eastern Adriatic region traditionally relies on the presence of pottery (*e.g. Bagolini & von Eles 1978. 46; Batović 1979; Chapman & Müller 1990.128, 132; Müller 1994; Skeates 2000.171; Sordinas 1969. 407*), although such a simplified approach overlooks the possibility of hunter-gatherer groups obtaining pottery through exchange or adoption (*Budja 2001. 40, 41*). Over a decade ago, Chapman and Müller (*1990.132*) concluded that in Dalmatia, an integrated Neolithic 'package' consisting of four critical innovations – domesticated plants and animals, ceramics, and polished stone – was identifiable only at lowland open air sites. However, a reduced version of the Neolithic 'package' – domesticated animals, pottery and prismatic blade technology – is well attested at a much larger number of sites, many of which are caves, throughout the eastern Adriatic region. By contrast, convincing evidence of domesticated animals or pottery in Mesolithic contexts is extremely rare. It follows that, although far from perfect, pottery is still the most useful 'proxy measure' for exploring the spatial and temporal spread of farming in the eastern Adriatic.

Recent work in caves shows some variety in the type of contact. The appearance of pottery may be associated with assemblages dominated by wild taxa (Crvena Stijena, Odmut, Zelena pećina, Mala Triglavca); in other caves there is a fairly even representation of wild and domestic taxa (Edera, Konispol, Azzura, Zingari), while domestic animals dominate the assemblages in a third group of caves (Pupićina, Mitreo, Podmol, Vela spila, Spila Nakovana; for references and detailed discussion, see *Forenbaher & Miracle 2006; Miracle & Pugsley 2006*). Seeds of domesticated plants have not been reported from any of the recently excavated caves where the use of flotation to recover plant remains was standard prac-

tice. This holds true not only for Early Neolithic levels of those sites, but also for all later periods, when the cultivation of domesticated plants is not in doubt. Caves are rarely located near major tracts of arable land, but are often conveniently positioned for herders – either at, or on the way to, seasonal pastures. Such a contrast between open-air and cave sites has important implications for the process of 'Neolithisation' in the region.

The Mesolithic/Neolithic 'gap'

A number of well-documented and dated northern Mediterranean sequences show a hiatus between the Mesolithic and Neolithic occupations of at least several centuries, if not several millennia (*Biagi and Spataro 2000.48; Pluciennik 1997*). The timing and duration of this Mesolithic-Neolithic gap is not synchronous, but varies widely from site to site. To examine this pattern in greater detail, we briefly discuss sequences from six sites in the Eastern Adriatic (Fig. 2, Tab. 2).

In the Triestine Karst and Istria, the age difference between the youngest Mesolithic and oldest Neolithic dates at Pupićina Cave, Edera, and Ciclami is from 1100 to 1800 years. The similarity in timing and duration of the stratigraphic gaps is striking, at first glance suggesting that caves were not being visited by Late Mesolithic bands in this area, because of a change in settlement pattern, depopulation, or both. Other evidence, however, argues against a simple demographic explanation. Nine sites from the Triestine Karst are reported to contain evidence of Late Mesolithic occupation (*Montagnari Kokelj 1993.74*). Furthermore, at Benussi, there is a sequence of three radiocarbon dates associated with Late Mesolithic assemblages (*Montagnari Kokelj 1993.70*), the youngest of which overlaps the oldest Neolithic dates from Edera and Pupićina at 2 s.d. Late Mesolithic people were clearly in the region immediately prior to the first appearance of Neolithic pottery.

In the south, only three sites have dated Late Mesolithic and Early Neolithic components. Taken at face value, dates from Odmut Cave (*Marković 1985; Srejović 1974*) show a continuity of occupation from the latest Mesolithic to the earliest Neolithic. There are, however, problems with both the dates and the stratigraphy of Odmut (*Forenbaher & Miracle 2006*), and there may, in fact, be a gap between those layers with pottery and those without pottery of at least 300 years. At Konispol Cave, the dates suggest a gap of some 130 years between the latest Mesolithic and earliest Neolithic dates (*Harrold et al. 1999*), but the stratigraphy and fauna fill this gap (*Russell 1998; Schuldenrein 1998*). The open air site of Sidari provides provocative evidence of an in situ adoption of ceramics by indigenous Mesolithic people (*Perlès 2001*). There is no stratigraphic break between the latest Mesolithic and the earliest Neolithic horizon, and the latter contains abundant plain ceramics, stone tools made using a 'Mesolithic' technology, and some sheep/goat. There is, however, a significant sterile layer between this 'earliest Neolithic' and 'Early Neolithic' (Impressed Ware) occupation of the site (*Sordinas 1969*).

To summarize, three of six sites with dated sequences (Ciclami, Pupićina, and Odmut) show a stratigraphic break and temporal gap between the Mesolithic and Neolithic. At Edera there is a temporal gap of about 1100 years, but not a stratigraphic break. The two sites (Konispol and Sidari) with dated stratigraphic evidence of continuity come from the southern

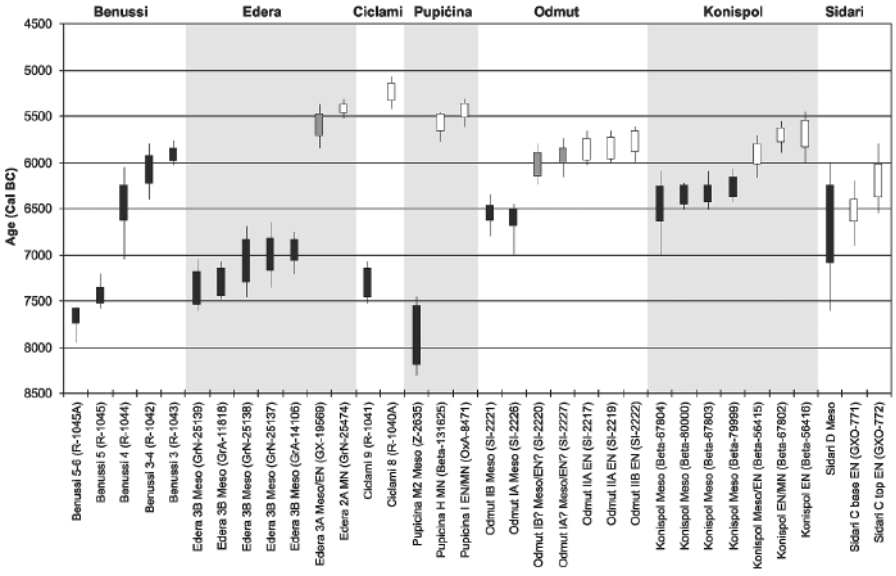

Fig. 2. Calibrated radiocarbon dates from sites with Late Mesolithic (Benussi) or Mesolithic and Neolithic assemblages in the Triestine Karst, Istria, Montenegro, Albania, and Corfu. Black symbols: Mesolithic; grey symbols: uncertain association; white symbols: Neolithic pottery.

Site and context	Lab no.	bp	s.d.	Cal BC 1 s.d. range		Cal BC 2 s.d. range		Attribution	Ref.
Benussi 5–6	R–1045A	8650	70	7750	7580	7950	7570	Mesolithic	1
Benussi 5	R–1045	8380	60	7540	7350	7580	7200	Mesolithic	1
Benussi 4	R–1044	7620	150	6640	6250	7050	6050	Mesolithic	1
Benussi 3–4	R–1042	7230	140	6240	5920	6400	5800	Mesolithic	1
Benussi 3	R–1043	7050	60	5990	5840	6030	5770	Mesolithic	1
Edera 3B	GrN–25139	8350	120	7550	7180	7600	7050	Mesolithic	2
Edera 3B	GrA–11818	8250	50	7450	7140	7480	7080	Mesolithic	2
Edera 3B	GrN–25138	8110	90	7310	6830	7450	6700	Mesolithic	2
Edera 3B	GrN–25137	8060	70	7180	6820	7350	6650	Mesolithic	2
Edera 3B	GrA–14106	8045	40	7080	6830	7200	6750	Mesolithic	2
Ciclami 9	R–1041	8260	60	7460	7140	7520	7080	Mesolithic	3
Pupićina M3	z–2635	8710	170	8200	7550	8300	7450	Mesolithic	4
Odmut IB	SI–2221	7720	85	6640	6460	6800	6350	Mesolithic	5
Odmut IA	SI–2226	7790	70	6690	6500	7000	6450	Mesolithic	5
Odmut IB	SI–2220	7150	100	6160	5890	6230	5800	Mesolithic?	5
Odmut IA	SI–2227	7080	85	6020	5840	6160	5740	Mesolithic?	5
Konispol	Beta–67804	7630	140	6650	6260	7000	6100	Mesolithic	6
Konispol	Beta–80000	7550	80	6470	6250	6510	6220	Mesolithic	6
Konispol	Beta–67803	7510	90	6440	6250	6510	6100	Mesolithic	6
Konispol	Beta–79999	7410	80	6390	6160	6430	6080	Mesolithic	6
Sidari D		7770	340	7100	6250	7600	6000	Mesolithic	7

References: 1. *Montagnari Kokelj 1993*; 2. *Biagi & Spataro 2000*; 3. *Biagi & Voytek 1994*; 4. *Miracle 2001*; 5. *Srejović* 1974; 6. *Harrold et al. 1999*; 7. *Sordinas 1969*.

Tab. 2. Radiocarbon dates associated with Mesolithic assemblages from the Triestine Karst, Istria, Montenegro, Albania, and Corfu.

edge of the Adriatic. How might we explain the recurrent gap in cave stratigraphies? Its time-transgressive nature, as well as the thick Late Mesolithic levels at several sites in both the northern and southern Adriatic, argue against a climatic cause of region-wide reduced sedimentation or erosion. In the Northern Adriatic the first pottery users visited caves that had long been abandoned. This abandonment more likely reflects a shift in settlement pattern (from caves to open air sites) than a decrease in population during the Late Mesolithic. In the two dated sequences from the south, in contrast, there appears to be a continuity of occupation from the Mesolithic to Neolithic; and pottery use appears to have been incorporated into a pre-existing strategy. We suspect that this geographic contrast in the continuity of occupation from the Mesolithic to Neolithic may correlate with a contrast in the processes involved in the adoption of pottery and farming in the two regions.

The introduction of pottery into the Adriatic

Since Chapman and Müller's (*1990*) discussion of the pattern of radiocarbon dates for the Eastern Adriatic Neolithic, there has been a slow but steady accumulation of radiometric dates from secure contexts (Fig. 3, Tab. 3). The basic pattern that they identified still holds; after the initial appearance of pottery on Corfu at the mouth of the Adriatic at ca. 6500 Cal BC, dates become progressively younger as one moves up the coast towards the northeast to the head of the Adriatic, where pottery makes its first appearance 1000 years later at about 5500 Cal BC.

Poorly fired, mostly plain pottery appears just south of the Straits of Otranto around 6500 BC (*Sordinas 1969. 401, 406, note 14*). It is roughly contemporaneous with, or only slightly later than, the earliest pottery found elsewhere in Greece (*Perlès 2001.94–95*). Around (or soon after) 6200 BC, a characteristic pottery style known as Impressed Ware emerges somewhere on the northern Ionian coast (possibly, on Corfu), and then spreads rapidly into the immediate hinterland (Albania), up the Adriatic to southern Dalmatia, and to southeastern Italy (*Sordinas 1969; Skeates 2000*). Over the next few centuries, Impressed Ware spreads deeper into the Adriatic, reaching northern Dalmatia by around 5900 BC,

and southern Istria by around 5750 BC. By that time it also reaches the deep hinterland of the eastern Adriatic (*Marković 1985*). On the Italian side of the Adriatic its spread is somewhat delayed, reaching Abruzzo by 5750/5650 BC and Eastern Romagna by 5300 BC (*Skeates 1994*).

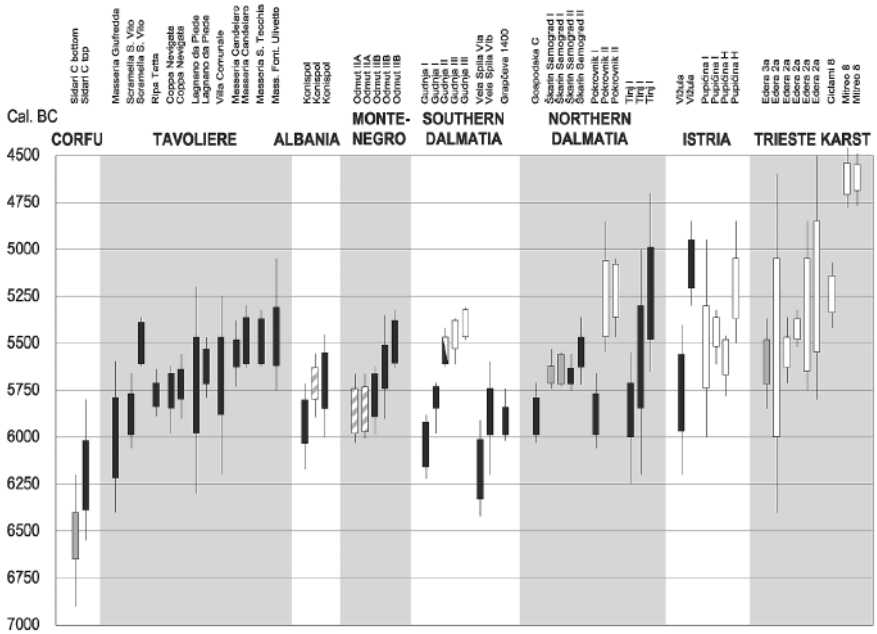

Fig. 3. Calibrated radiocarbon dates associated with Early and/or Middle Neolithic pottery from sites from Corfu, the Tavoliere, Albania, Montenegro, Dalmatia, Istria, and the Triestine Karst. Black symbols: Impressed Ware; grey symbols: plain pottery; white symbols: Danilo/Vlaška pottery; striped symbols: other Neolithic pottery.

Impressed Ware was the earliest pottery to appear almost throughout the length of the eastern Adriatic (*Batović 1979; Müller 1994*). It seems, however, that it never reached the extreme north-western part of that region – northern Istria and the Triestine Karst (*Forenbaher et al. 2004; Velušček 1997*). Some time around 5600 BC, a new style known as Danilo (or Danilo/Vlaška) emerges in the eastern Adriatic, where it soon replaces the Impressed Ware. Only at that point does Danilo-like pottery reach the interior of Istria and the Triestine Karst, and as far to the northwest as Sammardenchia in Friuli (*Pessina & Rottioli 1996. 85, Fig. 6*), where it merges with pottery styles derived from western Adriatic traditions.

Calibrated radiocarbon dates allow us to consider the rates at which the pottery was spreading (Fig. 4). It took about 1000 years for pottery technology to move from Corfu to the Triestine Karst, a straight-line distance of roughly 875 km. This gives a rate of spread of about 0.9 km/year, which is close to the 1 km/year rate of the 'wave of advance' proposed by Ammerman and Cavalli-Sforza (*1973*). If, however, these were sea-faring people, for whom there is good evidence (*Bass 1998; Forenbaher 1999*), 1 km/year seems like a fairly leisurely pace.

If, on the other hand, we consider the spread of Impressed Ware in some detail, a somewhat different pattern emerges. It took only about a century for Impressed Ware to move from Corfu to Korčula, a straight-line distance of roughly 460 km. This gives a considerably quicker rate of spread of about 4.5 km/year. Moving further to the north, it took about 300 years for Impressed Ware to move from Korčula to Istria, a the straight-line distance of roughly 300 km. The rate of spread has fallen to only 1 km/year.

Furthermore, the early dates from southern Dalmatia come from caves only, while those from northern Dalmatia and Istria come from both caves and open-air sites. From these admittedly scanty data, we suggest that the spread of the Neolithic along the eastern Adriatic was not a smooth and continuous process. There may also have been a shift in settlement from short-term visits to caves in the very earliest phase to the longer-term occupation of open-air sites in the later phase.

The processes of change

The archaeological record thus testifies to temporal and spatial variability in the cultural practices associated with the first pottery and the apparent speed with which it moved up the Adriatic, whether piecemeal or as part of a package. It suggests that several different processes were important across the Mesolithic-Neolithic transition along the eastern Adriatic.

Beginning with the southern edge of the Adriatic, Sidari and Konispol provide the most compelling evidence of the adoption of pottery and domestic animals by small groups of seasonally mobile 'Mesolithic' hunter-gatherers. The first pottery found at Sidari in Layer C base at about 6500 BC is apparently

Site and context	Lab no.	bp	s.d.	Cal BC 1 s.d. range		Cal BC 2 s.d. range		Attribution	Ref.
CORFU									
Sidari C bottom	GXO-771	7670	120	6650	6400	6900	6200	Plain ware	1,2
Sidari C top	GXO-772	7340	180	6390	6020	6550	5800	Impressed Ware	1,2
TAVOLIERE									
Masseria Giufredda	MC-2292	7125	200	6220	5790	6400	5600	Impressed Ware	3
Scramella S. Vito	R-350	7000	100	5990	5770	6060	5660	Impressed Ware	3
Scramella S. Vito	R-351	6540	65	5610	5390	5620	5360	Impressed Ware	3
Ripa Tetta	Beta-47808	6890	60	5840	5710	5890	5640	Impressed Ware	3
Coppa Nevigata	OxA-1475	6880	90	5850	5660	5980	5620	Impressed Ware	3
Coppa Nevigata	OxA-1474	6850	80	5800	5640	5900	5560	Impressed Ware	3
Lagnano da Piede	UB-2271	6790	255	5980	5470	6300	5200	Impressed Ware	3
Lagnano da Piede	UCLA-2148	6700	100	5720	5530	5790	5470	Impressed Ware	3
Villa Comunale	MC-2291	6750	220	5880	5470	6200	5250	Impressed Ware	3
Masseria Candelaro	OxA-3684	6640	95	5630	5480	5730	5380	Impressed Ware	3
Masseria Candelaro	OxA-3685	6510	95	5610	5360	5630	5300	Impressed Ware	3
Masseria S. Tecchia	BM-2414	6520	70	5610	5370	5620	5320	Impressed Ware	3
Mass. Font. Ulivetto	BM-2415	6490	150	5620	5310	5750	5050	Impressed Ware	3
ALBANIA									
Konispol	Beta-56415	7060	110	6030	5710	6170	5800	Impressed Ware	10
Konispol	Beta-67802	6830	80	5790	5560	5890	5630	Early/Middle Neolithic	10
Konispol	Beta-56416	6800	140	5840	5450	6000	5550	Impressed Ware	10
MONTENEGRO (SOUTHERN HINTERLAND)									
Odmut IIA	SI-2217	6985	100	5980	5660	6030	5740	Starčevo	9
Odmut IIA	SI-2219	6955	100	5970	5660	6010	5730	Starčevo	9
Odmut IIB	SI-2222	6900	100	5890	5620	5990	5660	Impressed Ware	9
Odmut IIB	z-412	6740	130	5740	5510	5900	5350	Impressed Ware	9
Odmut IIB	SI-2223	6530	80	5610	5380	5630	5320	Impressed Ware	9
SOUTHERN DALMATIA									
Gudnja I	GrN-10315	7170	70	6160	5920	6220	5880	Impressed Ware	4
Gudnja I	GrN-10314	6935	50	5850	5730	5980	5710	Impressed Ware	4
Gudnja II	GrN-10311	6560	40	5610	5470	5620	5420	Impressed Ware–Danilo	4
Gudnja III	GrN-10313	6520	40	5530	5380	5610	5370	Danilo	4
Gudnja III	GrN-10312	6415	40	5470	5320	5480	5310	Danilo	4
Vela Spila VI bottom	z-1967	7300	120	6330	6010	6420	5910	Impressed Ware	5
Vela Spila VI middle	z-1968	7000	120	5990	5740	6200	5600	Impressed Ware	5
Grapčeva 1400	Beta-103488	7030	60	5990	5840	6020	5740	Impressed Ware	6
NORTHERN DALMATIA									
Gospodska C	z-579	7010	90	5990	5790	6030	5710	Impressed Ware	7
Škarin Samograd I	HD-12094	6750	60	5715	5620	5740	5530	Plain ware	7
Škarin Samograd I	HD-11773	6740	50	5720	5560	5730	5550	Plain ware	7
Škarin Samograd II	HD-11950	6780	50	5720	5635	5750	5560	Impressed Ware	7
Škarin Samograd II	HD-11952	6600	100	5630	5470	5720	5360	Impressed Ware	7
Pokrovnik I	?	7000	100	5990	5770	6060	5660	Impressed Ware	7
Pokrovnik II	z-895	6300	150	5470	5060	5550	4850	Danilo	7
Pokrovnik II	HD-12842	6290	65	5360	5080	5470	5050	Danilo	8
Tinj I	GrN-15236	6980	160	6000	5710	6250	5550	Impressed Ware	7
Tinj I	GrN-15237	6670	260	5850	5300	6200	5000	Impressed Ware	7
Tinj I	GrN-15238	6280	210	5480	4990	5650	4700	Impressed Ware	7
ISTRIA AND THE TRIESTINE KARST									
Vižula	HD-12093	6850	180	5970	5560	6200	5400	Impressed Ware	7
Vižula	HD-11733	6140	70	5210	4950	5300	4850	Impressed Ware	7
Ciclami Layer 8	R-1040A	6300	50	5340	5140	5420	5070	Danilo/Vlaška	11
Edera Level 3a	GX-19569	6700	130	5720	5480	5850	5370	Plain ware	12
Edera Level 2a	GX-19568	6615	390	6000	5050	6400	4600	Danilo/Vlaška	12
Edera Level 2a	GrN-23129	6590	100	5630	5470	5710	5360	Danilo/Vlaška	13
Edera Level 2a	GrN-25474	6480	40	5480	5370	5520	5320	Danilo/Vlaška	13
Edera Level 2a	GX-19567	6445	210	5650	5050	5750	4850	Danilo/Vlaška	12
Edera Level 2a	GX-19022	6305	285	5550	4850	5800	4500	Danilo/Vlaška	12
Pupićina Horizon I	z-2575	6600	240	5740	5300	6000	4950	Danilo/Vlaška	14
Pupićina Horizon I	OxA-8471	6495	60	5520	5360	5610	5320	Danilo/Vlaška	15
Pupićina Horizon H	Beta-131625	6680	100	5670	5480	5780	5460	Danilo/Vlaška	15
Pupićina Horizon H	Beta-131624	6270	120	5370	5050	5500	4850	Danilo/Vlaška	15

References: 1. *Sordinas 1967*; 2. *Sordinas 1969*; 3. *Skeates 2000*; 4. *Chapman 1988*; 5. *Čečuk & Radić 2001*; 6. *Forenbaher & Kaiser 1999*; 7. *Chapman & Muller 1990*; 8. *Biagi & Voytek 1994*; 9. *Marković 1985*; 10. *Harrold et al. 1999*; 11. *Gilli & Montagnari Kokelj 1992*; 12. *Biagi 1995*; 13. *Biagi & Spataro 2000*; 14. *Miracle 1997*; 15. *Miracle & Forenbaher 2006*.

Tab. 3. Radiocarbon dates associated with Neolithic pottery assemblages from Corfu, the Tavoliere, Albania, Montenegro, Dalmatia, Istria, and the Triestine Karst.

unique to the region. The presence of only parts of the 'Neolithic package' and their appearance within an existing Mesolithic site suggests adoption through social interaction and exchange – probably 'individual frontier mobility' (Tab. 1). These cultural novelties were not moving between Mesolithic populations. Neither pottery nor domestic animals are present only 35 km away across the Strait of Corfu in Late Mesolithic layers dating to ca. 6500–6200 BC at Konispol Cave. It is only with the appearance of Impressed Ware that the Neolithic starts to move in the region.

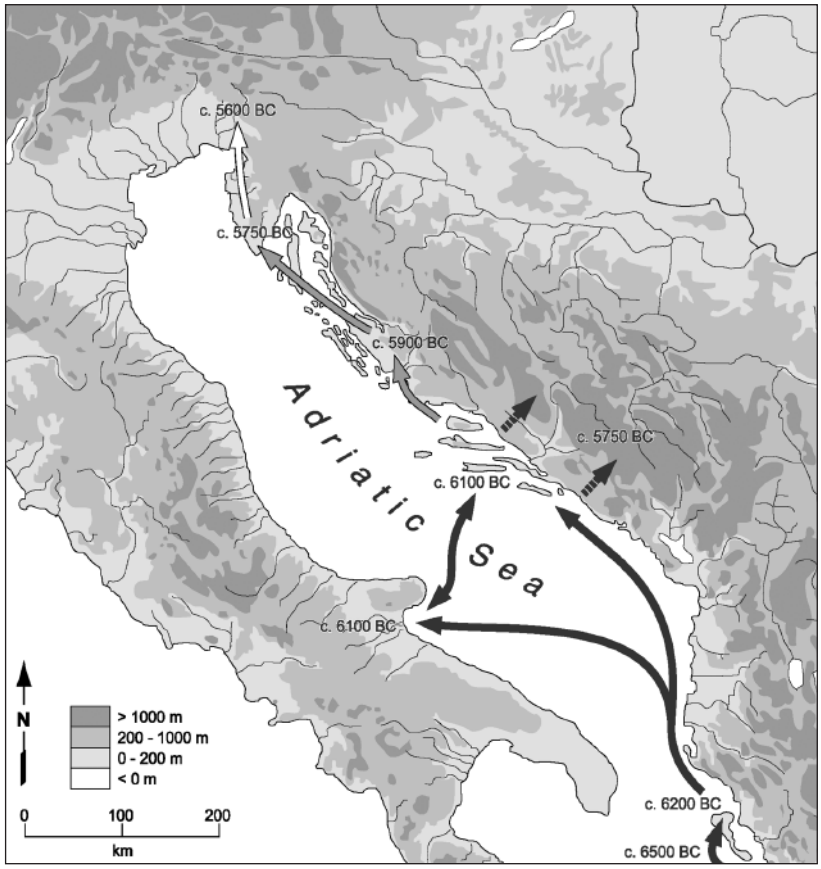

Fig. 4. Model of the spread of farming and herding in the Eastern Adriatic region. Black, solid lines: first phase of rapid 'leapfrog colonization' associated with Impressed Wares. Grey lines: second phase of slow 'agropastoral expansion' associated with Impressed Wares. White lines: third phase of 'agropastoral expansion' associated with Danilo/Vlaška pottery. Black, dashed lines: adoption of herding and farming through 'individual frontier mobility'.

The earliest radiometrically dated Impressed Ware appears at Sidari Layer C top at about 6200 BC. There is little indication, however, of cultural continuity between this and the underlying Layer C base; there is a major stratigraphic and chronological gap (ca. 300 years) between them. Impressed Ware at Sidari is associated with the full suite of domestic animals and other changes in lithic technology and typology (*Perlès 2001.49–50*). The identity of the inventors of Impressed Ware style remains elusive. Were they from the indigenous population, who perhaps acquired or invented new pottery making techniques during the several centuries when they were not occupying the site, or were these new immigrant agropastoralists from the southeast, who brought pottery with them? We doubt that there will be a satisfactory answer to this question any time soon. Rather, we think it is more productive to try to understand how and why Impressed Ware started to move.

The coastal distribution of Impressed Ware sites and their presence on most of the eastern Adriatic islands, including a number of isolated islets far from the mainland (*Bass 1998; Forenbaher 1999*), indicates clearly that maritime communication was the key ingredient of its dispersion. Seafaring was not necessarily a Neolithic invention. There is indirect evidence of pre-Neolithic (11th Millennium BC) seafaring from Franchthi Cave (*Perlès 2001.28, 35*), as well as the Mesolithic colonisation of Corsica and other Mediterranean islands during the early Holocene (*Costa et al. 2003*).

The radiocarbon dates indicate that Impressed Ware and domestic animals took less time to move almost 500 km up the Adriatic to the Middle Dalmatian islands than they took to move 35 km across the Strait of Corfu to Konispol Cave. The former pattern is compatible with the model of 'leapfrog maritime colonisation' by small seafaring communities (*Zilhão 1993.37, 50; Zvelebil 2001.5*), although the lack of dated open-air sites (permanent villages) associated with the earliest Impressed Ware in the southern Adriatic undermines the fit. We may have early Neolithic 'colonists' without evidence of their colonies. Without more information about the Late Mesolithic in the coastal region it is difficult to exclude an alternative hypothesis: that local Mesolithic foragers acquired pottery and other innovations, and then dispersed them by sailing up and down the Adriatic.

Beyond the coastal strip in the southern Adriatic and Albania, Impressed Ware and other innovations were introduced through contact between agricultural and hunter-gatherer groups. Radiocarbon dates suggest a piecemeal adoption of parts of the 'Neolithic package' at Konispol, Odmut, Crvena Stijena, and Zelena pećina, slightly after the initial spread of Impressed Ware up the Adriatic. Some of these sites are located in areas unsuitable for agriculture, in remote parts of the hinterland separated from the coast by high mountain ranges; others overlook valleys with good agricultural potential. Only at Konispol do we have detailed enough data to discuss the process of adoption of pottery and domestic animals. Russell (*1998.149*) suggests that cattle were relatively important in the transitional assemblages at Konispol and that these animals may have been provided to the hunter-gatherer inhabitants as bride-wealth. Cattle and other domestic animals may have also been important in feasts. Without further information about the social contexts of consumption and use of food and pottery, the process by which these novel resources were adopted by the Mesolithic hunter-gatherers remains vague. For the time being, a variant of Individual Frontier Mobility would appear to be the most likely process.

After 6000 BC, Impressed Ware made its way up the northern Adriatic, reaching southern Istria by ca. 5750 BC. Along the way, our Impressed Ware potters started to live in open-air sites that look like more permanent villages. Faunal assemblages, whether from caves or open-air sites, are dominated by domestic animals. Direct evidence about plant foods is scarce, although site locations show a preference for land suitable for agriculture. Although the evidence is patchy at best, we suggest that it is only at this time that we have the assembly of the entire 'Neolithic package'.

Why did the pace of pottery adoption change after 6000 BC? The northern Adriatic may have supported larger and more successful groups of native hunter-gatherers, who resisted the immigration of farmers. Some evidence for this model comes from the large number of Mesolithic sites at the head of the Adriatic, and the delay in the appearance of agriculture in the region. On the other hand, the relative population densities might have been reversed (relatively lower in the north and higher in the south), suggesting that social leveling mechanisms in relatively small indigenous populations in the northern Adriatic undermined the acquisition and spread of prestige items like pottery and domestic animals. Regardless of whether Impressed Ware was carried by migrating farmers or passed among resident hunter-gatherers, the density and social organization of Late Mesolithic people is key to our understanding of the process.

A two-stage model of dispersal

We are thus proposing a two-stage model for the dispersal of Impressed Ware, in which there is an initial stage of pioneer exploration followed by a later stage of colonization (*Fiedel & Anthony 2003*). The first stage occurs rapidly and is limited to the islands and the coastal strip of the southern Adriatic. Rather than establishing permanent settlements, these people may have made short-term, seasonal camps in caves and the open-air. They apparently brought domestic animals with them, and may have seeded islands with flocks in anticipation of future visits. The Impressed Ware 'pioneers' rapidly explored the southern Adriatic, establishing contacts with indigenous hunter-gatherer groups in the hinterland, and probably relying on these native groups as a source of information and perhaps marriage partners. The initial Impressed Ware occupations at Vela Spila and Gudnja may be evidence of these first 'scouts'.

During the second phase of Impressed Ware expansion, settled farmers became established. There was less reliance on native hunter-gatherers for information and other resources, and in any case, those that held on in the region had probably been decimated by the loss of personnel to farming, disease, through marriage, or conflict. Exceptions might have been the hinterland of Montenegro, where important elements of the foraging lifestyle continued into the Middle Neolithic (Crvena Stijena) or even Late Neolithic (Odmut). Farming eventually reached the head of the Adriatic about 5600 BC, now associated with Middle Neolithic Danilo/Vlaška pottery.

Conclusion

Archaeological evidence suggests that immigration played a major role in the introduction of farming into the eastern Adriatic. This is not to say that this was a one-sided affair in which indigenous foragers were passive recipients. It must have been a complex process that involved both the actual movement of people and the active participation of the local population. There is no reason to believe that this process unfolded along identical lines throughout the region. There is provocative evidence that the transition to farming occurred in a two-stage pro-

cess. An initial stage of very rapid dispersal, perhaps by exploratory parties along the coast in the southern Adriatic, was followed by a second stage, during which the eastern Adriatic littoral was probably colonized by enclave-forming farming communities. The hinterland, and perhaps also parts of the coast, remained an agricultural frontier zone for a while.

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