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Early Neolithic pottery dispersals and demic diffusion in Southeastern Europe

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ABSTRACT – *The ^{14}C gradient of pottery dispersal suggests that the sites in the southern Balkans are not significantly older than those in the northern and eastern Balkans. A gradual demic diffusion model from south to north and a millennium time span vector thus find no confirmation in the set of AMS ^{14}C dates and associated contexts that mark pottery dispersal within Southeastern Europe. The first 'demic event' that was hypothesised to reshape significantly European population structure and generate a uniform process of neolithisation of southestern Europe has no confirmation in frequency of Y-chromosome subhaplogroups J2b and E3b1 distribution within modern population in Southeastern Europe.*

IZVLEČEK – *^{14}C datumi prve keramike kažejo, da zgodnje neolitska najdišča na jugu Balkana niso starejša od onih na severu. AMS ^{14}C datumi ne potrjujejo modela postopne demske difuzije od juga proti severu in tisočletni časovni zamik pri širitvi keramike. Prvi 'demski dogodek', ki naj bi domnevno preoblikoval evropsko populacijsko sestavo, v jugovzhodni Evropi pa povzročil proces enovite neolitizacije, ni potrjen s pogostostjo pojavljanja Y-kromosomskih haploskupin J2b in E3b1 pri sedanjih populacijah v jugovzhodni Evropi.*

KEY WORDS – *Southeastern Europe; Early Neolithic; pottery; AMS ^{14}C dates; Y-chromosome haplogroups*

Introduction

Pottery has become archaeologically conceptualized by an interpretative triad suggesting that in the context of human social evolution, 'lower barbarism' (Neolithic) can be distinguished from 'upper savagery' (Mesolithic) by the presence of vessels (*Morgan 1878*), that territorial distributions of pottery types reflect 'sharply defined archaeological cultural provinces' (*Kossina 1911.3*), and that the invention of ceramic technology and pottery making was 'the earliest conscious utilization by man of a chemical change... in the quality of the material... the conversion of mud or dust into stone' in the Neolithic (*Childe 1951.76–77*).

It is worth remembering that pottery distributions became highly ideologized and politicised after *Lex Kossinae* formalized the 'cultural province', an entity defined not from regional geography, but an inductive category deriving from regional distributions of 'Linear' and 'Corded' pottery that 'correspond, unquestionably, with the areas of particular people or tribes'. These people were hypothesised Proto-Indo-Europeans of 'Neolithic Germany' who migrated from the area between the North Sea and Baltic Sea and colonized the rest of Europe (*Kossina 1911; 1936*). Childe agreed that Neolithic pottery was a universal indicator of both, 'cultural identities' and 'distributions of ethnic groups' (*Childe 1929.v–iv*). But he strongly disagreed that its invention and primary distribution can be found within the Europe. He actualized an old Montelius' 'normative principle to prehistorians in Western Europe' that postulates European prehistory as 'a pale reflexion of Oriental culture' (*Childe 1939.10*). There was no room either for technological innovations, or for structural changes in economy and ideology that could have occurred

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in Europe autonomously and that could have been linked to the Mesolithic-Neolithic cultural transformations at the 'Dawn of European Civilization' (*Childe 1925; 1928*).

Childe (*1939.25–26*) postulated a Neolithic zonal model in which, along with 'true cities and little townships in the Orient', in "*Thessaly, Macedonia and the Morava-Maros region beyond the Balkans, Neolithic villages are permanently occupied by experienced farmers who are content to do without metal... North of the Maros Körös, herdsmen and Bükkian troglodytes are grazing and tilling patches of löss and then moving on; still farther north, Danubian I hoe-cultivators are shifting their hamlets of twenty-odd huts every few years to fresh fields till they reach the confines of the löss... Beyond these, on the North European plain are only scattered bands of food-gatherers hunting, fowling and fishing and collecting nuts or shell-fish...*". Because of interrelated assumptions that all cultural innovations must have originated in those areas where civilizations flourished at the earliest date (Orient), and that they were diffused in the area where cultural continuity was attested (Europe), he denoted this model diffusionist.

However, in the same year (*1939*) Coon introduced the migration model. He postulated the gradual invasion of the 'Danubian agriculturalists of the Early Neolithic' that brought a 'food-producing economy into central Europe from the East'. These people were 'Mediterranean', a new population in Europe that originated in western Asia in a Natufian cultural context. The model was grounded on the metrical and morphological characteristics of skeletal remains of Neolithic 'Danubian immigrants' and on the distribution of 'Danubian painted pottery', that shows 'definite Asiatic similarities'. Both, the invasion of farmers and pottery dispersal were supposed to have occurred from Eastern Mediterranean 'up the Danube Valley' into the Carpathian basin, Central Europe and further to the west, to the Paris basin.

One of his basic interpretative premises relates to interaction between essentially different populations on the agricultural frontier. He relates it to a continuous blending of populations, suggesting that, "*When the food producers entered the territory formerly occupied by Upper Palaeolithic hunters, the former were much more numerous than the latter, who either retired to environmental pockets economically unfavorable to the food producers, or were absorbed into the ethnic corpus of the latter. The adjustment of the earlier population element to the new conditions and their re-emergence through the Mediterranean group made a combination of the two basic racial elements in a genetic sense necessary.*" (*Coon 1939.647*) (Fig. 1a).

It is worth remembering the frontier thesis had been entertained since Herodotus identified it as the agri-

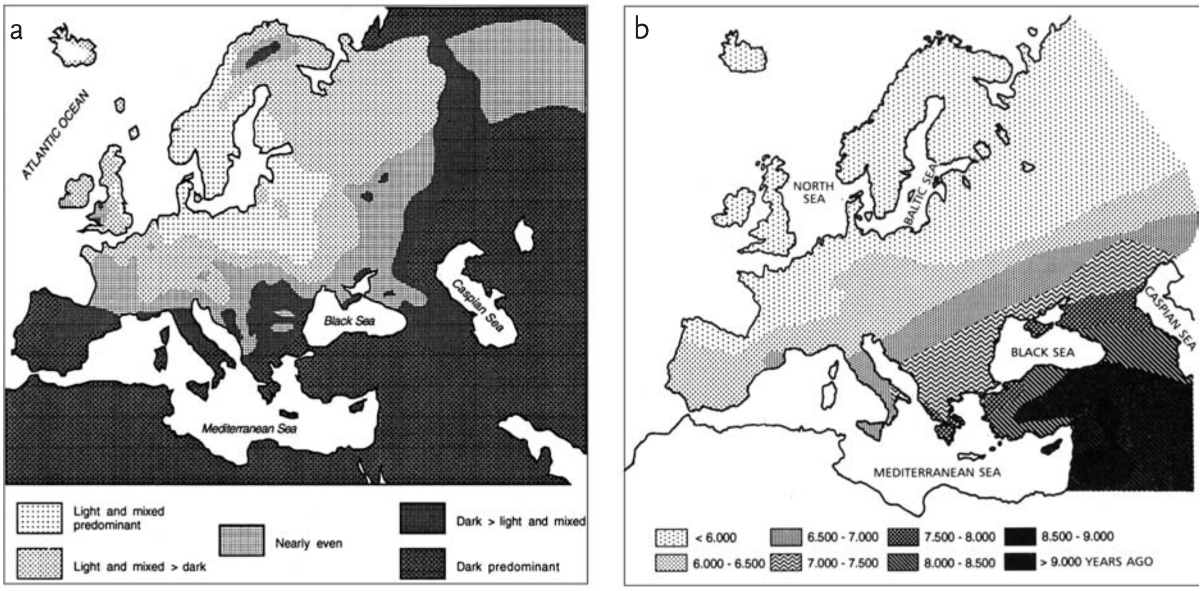


Fig. 1. The map of frequency distribution of morphological and anthropometric characteristics and associated physical types (a) that was hypothesised to corresponds with the Neolithic invasion of Mediterraneans in Europe and with the process of 'Dinaricization' (**Coon 1972.Map 8; Cavalli-Sforza, Menozzi, Piazza 1994.Fig. 5.4.1*****), and the map of genetic landscape (b) of the first principal components that was hypothesised to corresponds with Neolithic 'demic diffusion' (*****Cavalli-Sforza, Menozzi, Piazza 1994.Map 4*****).***

cultural boundary and the meeting point of the civilized and barbarian worlds. Turner (*1893*) introduced a similar notion, referring to the American frontier and colonial conquest of America's Great West thus "*The first ideal of the pioneer was that of conquest. It was his task to fight with nature for the chance to exist... Vast forests blocked the way; mountainous ramparts interposed; desolate, grass-clad prairies, barren oceans of rolling plains, arid deserts, and a fierce race of savages, all had to be met and defeated.*" (*cfr. Klein 1997.81*; see also *Zvelebil and Rowley-Conwy 1986; Zvelebil 2000*).

The interaction between the populations of Mesolithic hunter-gatherers (the Alpines) and Neolithic newcomers (the Mediterraneans), was believed to be determined by a 'dinaricization' process in which the 'Mediterranean type seems to be a brachycephalized by some non-Mediterranean agency'. A new phenotype appeared that can be recognized in modern populations in Europe by its modified craniofacial morphological characteristics: the 'occipital flattening and, the nasal bridge that become prominent'. The process was completed by the end of the Neolithic and, there were remained no other populations than the 'Dinaric' in most of Europe. The 'Mediterraneans' survived on the Iberian Peninsula, and the 'Alpines' in northern Scandinavia (*Coon 1939.647–648*).

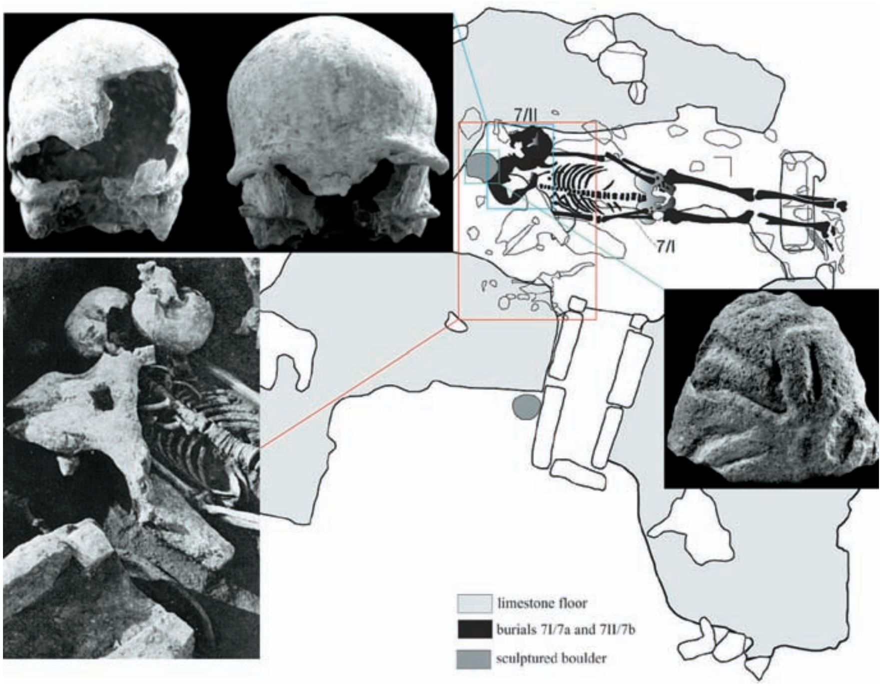
The interpretative spiral

Coon's biologically determinate migration model was never recognized in archaeology, although the migration of Mediterraneans, the concept of blending populations, and the cultural and populational frontiers have remained focal points in interpreting the European Neolithic. The repeated waves of migrations from Asia Minor and the establishment of Neolithic diaspora and colonial centres of Neolithization have been hypothesised in rich catchments in the Balkans and central Europe (*Weinberg 1965.308; Ammerman and Cavalli-Sforza 1984; van Andel and Runnels 1995; Bogucki 1996; Özdoğan 2008*). The colonist's physical remains were suggested to be found in marginal areas of the Danube Gorges, where 'small and gracile male individuals' were buried together with the 'robust indigenous foragers' (*Mikić 1980; Menk and Nemeskeri 1989*; for comments, see *Roksandić 2000*). The Mediterraneans were hypothesised as having married in to the Danube Gorges from 'outside', from agricultural communities (*Chapman 1993*), and the appearance of new burial practices in the gorges, it was suggested, 'can only be explained in terms of either acculturation or immigration' (*Bonsall 2008.271*).

Pinhasi indeed suggests morphological affinities between the Balkan and Anatolian Çatal Höyük populations, but, surprisingly, not with earlier Levantine Pre-Pottery Neolithic populations (*Pinhasi 2003; 2006; Pinhasi and Pluciennik 2004; Pinhasi, Fort, Ammerman 2005*). In a recent interpretation based on a 'null evolutionary model of isolation-by-geographic and temporal distance' and on the correlation of Mesolithic and Neolithic craniometric data with the classic genetic marker dispersal within modern European populations, Pinhasi and von Cramon-Taubadel (*2009*) suggest that crania metric data support the continuous dispersal of people from Southwest Asia to Europe. They found, contrary to Coon, no strong support for a significant admixture of contemporaneous Mesolithic and Neolithic populations in Europe. They suggest that their results 'best fit a model of continuous demic diffusion' into Europe from the south-western Asian, and that the indigenous Mesolithic hunter-gatherers in Europe played almost no role in the Mesolithic-Neolithic transition in Europe.

An excellent illustration, however, of the mixing of 'crania metric characteristics' in a funerary context is shown in the trapezoidal structure 21 at Lepenski Vir (Fig. 2). Apart from the extended inhumation inside the burial pit cut through the floor, there was a disarticulated human skull placed on the left shoulder and facing the deceased. Next to the right side, aurochs and deer skulls with antlers were placed. A sculpted boulder had been placed on the building floor, above the skull. A comparison of human skull morphology reveals that they are very different in terms of size and robustness. While the disarticulated skull is decidedly robust and has been traditionally attributed to a very robust Mesolithic population, the adult man's skeleton in the burial pit was recognized as gracile and has been attributed to a Neolithic population (for a discussion, see *Borić 2005.24*). Both the skeleton and the disarticulated human skull are dated – after a correction for the freshwater reservoir effect – to an overlapping age range from 6216–5884 and 6080–5728 calBC at 2σ – (*Borić and Dimitrijević 2009*). Stable isotope $\sigma^{15}N$ values indicate that the skulls show differences in dietary practices. While the isotopic signature of the 'robust' one indicates a diet heavily based on riverine resources, the 'gracile' one shows a mixed diet based on terrestrial and riverine resources. These differences, however, cannot be easily interpreted as

Fig. 2. Lepenski Vir, trapezoidal structure No. 21. An extended inhumation of an adult man, placed in a burial pit cut through the floor ('gracile' skull, left). The disarticulated human skull ('robust' skull, right) was placed on shoulder of the deceased. Aurochs and deer skulls with antlers were placed next to his right side. A sculpted boulder had been placed on the building floor, above the skull (after Srejović 1969.Fig. 69; Radovanović 1996.Fig. 4.3; Borić 2005.Fig. 3.3; Babović 2006.Figs. 313, 314*).*



marking a clear break between Mesolithic and Neolithic subsistence (*Borić et al. 2004; Borić 2005*). The materiality of this Lepenski Vir burial context suggests that both 'cranial phenotypes' participated in a funeral rite, and that ancestral principle may have played a key role.

Parallel to Coon's[1] racial taxonomy and human phenotype dispersals, the distribution of pottery types and ornaments has been discussed in archaeology in the context of the colonization of southeast Europe in the Early Neolithic. The pottery was recognized 'as the most accessible manifestation of the material culture available, without any breaks, for the comparative study of development' (*Theocharis 1973.39*), and also as 'the most obvious diagnostic element' for tracing 'waves of migrations' from Asia Minor (*Schachermeyr 1976.43–46*).

In the most influential interpretation in the sixties, Southeastern Europe was recognized as a 'western province of the Near Eastern peasant cultures', created by the processes of colonisation and acculturation' (*Piggot 1965.49–50*; see also *Roden 1965*). This assertion was grounded on the identification of 'common traditions in pottery styles' between the regions and in the distribution of 'oriental stamp-seals' and female figurines, and 'sometimes of animals, which may relate to religious cults'. Nandris (*1970.193, 202*) suggested that this dispersal marks Early Neolithic 'cultural unity', which was 'greater than was ever subsequently achieved in this area of southeast Europe, down to the present day'. In this context, Greece was suggested as being the location of the 'foundation' and 'construction of the main features of Neolithic culture' in Europe (*Theocharis 1973.58*). The reconstruction of colonizing and acculturating logic was reduced to identifying the geographical distribution of 'monochrome' and painted pottery. Both achieved paradigmatic status as cultural and ethnic markers of the Neolithic diaspora, in which farming 'oriental' communities dispersed across the Peloponnese and Thessaly on the southern tip of the Balkan Peninsula. By the end of the Aegean Early Neolithic, the diaspora was hypothesised as having spread to northern regions, and farming communities were established in the Balkans and Carpathian basin. A wave of migrations along the Vardar and Morava rivers, marked by the spread of white and red painted pottery, was hypothesied. Differences in decorative motifs and ornamental composition constituted clusters of cultures 'Anzabegovo-Vršnik' 'Starčevo', 'Körös', 'Criş', 'Kremikovci', and 'Karanovo' in neighbouring areas (*Nandris 1970; Garašanin 1979*).

The rate of diffusion was first calculated from the small series of ^{14}C dates available at the time. It was recognized as 'a pure scientific approach in the chronological determination of the expansion of farming culture', based on the 'radiocarbon dating of materials from the actual settlements of the prehistoric

1 The last reprint of his book 'The Races of Europe' was published by Greenwood Publisher, Connecticut in 1972.

cultivators themselves' (*Clark 1965a*). Clark allocated dates to three temporal zones running from Near East to Atlantic Europe: (i) earlier than 5200 BC, (ii) between 5200 and 4000 BC, and (iii) 4000 and 2800 BC. He suggested that decreasing values of these dates be arranged in a southeast-northwest gradient, and that the sequential settlement distribution reflects 'the gradual spread of farming culture and the Neolithic way of life from the Near East over Europe'. The second zone, however, was associated with the 'expansion of Neolithic culture north of the Mediterranean' (*Clark 1965b.66*).

Genetic gradients

A few years later, Ammerman and Cavalli-Sforza (*1971; 1973*; see also *Gkiasta et al. 2003*) gave an average speed of diffusion of about 1 km/y. At the same time, they were the first to emphasize the role of demic diffusion and to point out the strong agreement between the calculated average rate of spread of the Neolithic and that predicted by the demic wave-of-advance model. The model, borrowed from the population biology, proposed that active population growth at the farming frontier, in combination with local migratory activity, would have produced a population expansion that moved outwards in all directions and advanced at a relatively steady rate. They also postulated the mixing of Neolithic and Mesolithic populations on the agricultural frontier that may have led to genetic gradients with extreme gene frequencies in those areas with the oldest Neolithic sites.

The demic 'wave-of-advance' model was first introduced in 1978. The geneticists Menozzi, Piazza and Cavalli-Sforza shifted the focus from phenotype to genotype, from cranial characteristic to classic genetic markers, from races to populations. They linked the first principal component of 38 gene frequencies of 'classic', non-DNA marker dispersal (allele frequencies for blood groups, the tissue antigen HLA system, and some enzymes) in modern European populations with the distribution of Early Neolithic farming settlements in south-western Asia and Europe. A similar 'southeast-northwest gradient or cline' of geographical distribution was suggested to support the spread of early farming in Europe, and that it was 'a demic spread rather than a cultural diffusion of farming technology' (*Menozzi, Piazza and Cavalli-Sforza 1978.786*). Six years later, Ammerman and Cavalli-Sforza (*1984.xv, 137*) postulated, similar to Coone, that 'cultural events in the remote past played a major role in shaping the genetic structure of human populations'. In Europe, they continue, 'the Neolithic transition forms the backbone of the geographic distribution of genes'. Different clines of contour maps of three principal components distributions show, they hypothesised, a sequence of three 'major demic events'. They linked the first to the migration of Neolithic farmers from Near East. The second and third, they guessed, 'can perhaps also be interpreted in terms of population movements other than the spread of early farming', and can be associated with migrations 'of groups of pastoral nomads' in the third millennium BC from central Asia, and with the 'expansion of Indo-European speaking people from the north of the Black Sea'.

The first 'demic event' has become legitimized archaeologically by the definition of the catalogue of artefacts recognized as being brought into Europe by migrating farmers. White and red painted pottery has retained an axiomatic interpretative position (*Renfrew 1987.Fig. 7.9*; see *Budja 2005*).

The new synthetic map of the first principal component in classic genetic markers of 95 gene frequency dispersals across Europe and the Near East appeared in 1993. It has perpetuated the legitimacy of the Neolithic ancestry of modern Europeans, and the question 'Who are the Europeans?' that Alberto Piazza (*1993*) addressed in this context was not at all rhetorical. A more sophisticated interpretation of this synthetic map became available a year later in the monumental volume The History and Geography of Human Genes (*Cavalli-Sforza, Menozzi and Piazza 1994*). In a palimpsest of seven principal components and associated genetic landscapes, the first was linked to the Near East, which was recognized as an ancestral homeland for the current population in Europe. The authors hypothesised that the transition to farming in Europe correlates with a massive movement of population from the Near East, without substantial contact with local Mesolithic populations. The elimination of the European hunter-gatherer population was assumed, despite only a 27% total variation in classical marker frequencies attributed to Neolithic populations across Europe. Only some clear outliers, such as Basques and Lapps were shown to have emerged from this homogeneous Neolithic entity as relic Palaeolithic hunter-gathers.

It is noteworthy that phenotype replacement with genotype, and the concept of race with the concept of population, has been an increasingly significant issue, with serious implications for physical anthropology, population genetics and archaeology. Research into human genetics has highlighted that more genetic variation exists within than between populations, where those groups are defined in terms of linguistic, geographic, and cultural boundaries (*Wierciński and Bielicki 1962; Lewontin 1972; Serre and Pääbo 2004; Rosenberg et al. 2002; 2005; Li et al. 2008*). In 1996, the American Association of Physical Anthropologists issued the political statement that "*Pure races, in the sense of genetically homogenous populations, do not exist in the human species today; nor is there any evidence that they have ever existed in the past*"[2]. After the abolition of the concept of race and in the context of a political and scientific battle between the new physical anthropology and genetics to classifying humans, Coon's approach was labelled as 'scientific' racism and the last gasp of an outdated scientific methodology (*Cavalli-Sforza, Menozzi and Piazza 1994.267*; see also *Barbujani 2002*). The contour maps of classic human genetic marker distribution have replaced the frequency map of the distribution of morphological and anthropometric characteristics. It was suggested recently, however, that the magnitude of the relative regional proportion of human phenotypic variance in crania correlates with the magnitude of regional molecular genetic variance (*Rosseman and Weaver 2007*). This led Pinhasi and von Cramon-Taubadel (*2009*), as noted above, to build a 'hypothetical' interpretative model to update demic diffusion and waves of advance by correlating the Mesolithic and Neolithic craniometric data with the gradient of the first principal component of classic genetic markers within modern European populations.

Since the revolution in the study of the human genome, the debate has shifted from the classic markers of certain genes to the loci in humans – the mitochondrial DNA present in both sexes, but inherited only in the maternal line; and the Y-chromosome present only in males and inherited exclusively through males. Because they are non-recombinant and highly polymorphic, they are seen as ideal for reconstructing human evolution, population history, and ancestral migration patterns. The analyses of uniparentally inherited marker systems allow population geneticists to study the genetic diversity of maternal and paternal lineages in various Eurasian populations, as well as the environmental and cultural processes that might have been involved in the shaping of this variety. Thus different human nuclear DNA polymorphic markers of modern populations have been used to study genomic diversity and to define maternal and paternal lineage clusters – haplogroups – and to trace their (pre)historic genealogical trees, and chronological and spatial trajectories. In human genetics a haplogroup is a group of similar haplotypes that share a common ancestor with a single nucleotide polymorphism (SNP) mutation. These special mutations are extremely rare, and identify a group of people – all the male descendants of the single person who first showed a particular mutation, over a period of tens of thousands of years. The SNP markers allow the construction of intact haplotypes and thus male-mediated migration can be readily recognized.

The phylogenies of the human Y-chromosome as defined by unique event polymorphisms and the geographic distribution of haplogroups have ultimately replaced the classic genetic markers and associated contour maps of principal component distributions.

Semino *et al.* (*2000*) and Rosser *et al.* (*2000*) hypothesised that, because of the southeast-northwest cline of frequencies of the haplogroups Eu4, Eu9, Eu10 and Eu11 (J2, E3b1 and G)[3] within the modern populations in south-western Asia and Europe, and calculated expansion time, they represent the male contribution of a demic diffusion of Levantine farmers to European Neolithic. The authors suggest that the European gene pool was of Palaeolithic origin, as the Neolithic lineages comprise only ~22% of the variation. A reanalysis of the data two years later by the maximum-likelihood admixture estimation method, claimed an average Neolithic contribution of 50% across all samples, 56% for the Mediterranean subset, and 44% in non-Mediterranean samples (*Chikhi et al. 2002*; see also *Dupanloup 2004*). In later studies of the origin, differentiation and diffusion of the Y-chromosomal Neolithic haplogroups E3b and J, it becomes evident that the history of the European population was certainly more complex – and the expansions from the Middle East toward Europe – regardless of whether the coalescence dating calculated for a generation time of 25 or 30 years 'most likely occurred during and after the Neolithic'

2 American Association of Physical Anthropologists. Statement of biological aspects of race. Am. J. Phys. Anthropol. 101: 569–570 (*1996*).

3 The haplogroup's nomenclature was changed after the introduction of the Y-chromosomal binary haplogroup nomenclature system (*Hammer 2002*). For the human Y chromosome haplogroup tree, nomenclature and phylogeography see also Hammer and Zegura (*2002*). For revised phylogenetic relationships and nomenclature see Sengupta *et al.* (*2006*). For the most recent version of haplogroup tree Karafet *et al.* (*2008*).

(*Semino at al. 2004.1032*). The findings of the many biallelic markers which subdivide the haplogroups J and E suggest that the large-scale clinal patterns cannot be read as markers of a uniform and time limited spread of people from a single parental Near Eastern population, but a multi-period process of numerous small-scale, more regional population movements, replacements, and subsequent expansions overlying previous ranges. The consensus on the proportion of these lineages in Europe is at around 20% (*Di Giacomo et al. 2004. 36; Cinnioğlu et al. 2004.133–135; Peričić et al. 2005; 2006; Luca et al. 2007; Novelletto 2007*).

The haplogroup J become archaeologically instrumentalized by correlating the frequency distribution of its genetic marker (M172) within the modern European and Asian populations, and the Early Neolithic distribution of painted pottery and ceramic female figurines within the same area. King and Underhill (*2002.714*) postulated that "*The Eu9 haplogroup is the best genetic predictor of the appearance of Neolithic painted pottery and figurines at various European sites*".

Parallel to this interpretative postulate, ceramic female figurines have been noted as specific markers of an oriental 'expansionist' religion that became a powerful social force in the Levantine Pre-Pottery Neolithic (*Cauvin 2000*). Cauvin postulated an interlinked economic and religious transformation, which explains why hunter-gatherers in villages outside the Levant did not develop subsistence production for themselves: their failure to 'humanise' their art and adopt new deities would have prevented them from making the transition to a new type of economy. Accordingly, Europe could not have become Neolithic until the 'wave of advance' and ceramic female figurines had reached the Balkans.

However, the invention of ceramic and the introduction of ceramic female statuettes and animal figurines was certainly not within the cultural domain of earlier Levantine hunter-gatherer societies, nor did they only appear on the 'eve of the appearance of an agricultural economy', as Cauvin (*2000.25*) suggested.

Knowledge of ceramic technology had been an element of Eurasian hunter-gatherer cultures for many millennia before the appearance of food-producing agricultural societies. We must also note two other facts: first, that the making of ceramic figurines predates the making of pottery, and second, that pottery was not necessarily associated with the emergence of farming, as ceramic vessels had been made before early agriculture appeared in East Asia.

The tradition of making ceramic figurines can be traced back to the Central European Pavlovian cultural context, and then across the Russian Plain into southern Siberia, and ultimately back to the Levant and North Africa. It is now clear that the clay-figurine-tradition was deeply embedded in pre-existing Eurasian hunter-gatherer social and symbolic contexts and that the dates of these figures begin as early as 26 000 years BP (*Verpoorte 2001; Einwögerer and Simon 2008*).

If we look more closely at the contexts in which early hunter-gatherer ceramics were produced, we may assume that they were of social significance. In Central Europe, a total of sixteen thousand ceramic objects – over nine hundred figural ceramics – have been found in Gravettian and Pavlovian hunter-gatherer camps, which indicates that ceramic production, was widespread. At Dolní Věstonice there was an oven-like hearth in the centre of a hut-like structure in which 'two thousand pieces of ceramics, among which about one hundred and seventy-five with traces of modelling' were dispersed. In addition, other ceramic finds had been deposited near a single male burial, around a triple burial, and in the vicinity of a large hearth. The available statistics indicate that almost all the figurines and statuettes were deliberately fragmented, although many of the pellets and balls which comprise a large quantity of the ceramic inventory were found intact (*Soffer et al. 2000; Verpoorte 2001.56, 128*).

Early pottery first occurred in Eastern Eurasia in the context of small-scale sedentary or semi-sedentary communities, in southeast China (Yuchanyan Cave), where it has been dated to as early as 18 300 to 17 500 calBP (*Boaretto et al. 2009*). Later pottery assemblages on the Japanese archipelago and in southern Siberia are dated to the fourteenth and thirteenth millennia calBP (*Kuzmin 2006; Kuzmin and Vetrov 2007*).

We may postulate that the ceramic female figurines are thus as much 'predictors', to paraphrase King and Underhill, of Palaeolithic Gravettian hunter-gatherers' haplogroups, as of Neolithic farmers (*Semino et al. 2000; Budja 2005*).

The postulate that the geographically overlapping distribution of Early Neolithic artefacts and allele frequency clines reflects an individual and time limited demic diffusion of farmers that resulted in the colonization of Europe and the replacement of populations has lost its interpretative, or any other, power. Recent studies of the Neolithic paternal haplogroups E (M78) and J1 (M267) and J2 (M172) strongly suggest continuous Mesolithic, Neolithic and post-Neolithic gene flows within southeast Europe, and between Europe and the Near East in both directions.

The Neolithic haplogroup E (M78) is represented in Europe by its internal lineages E3b1a and E3b1a2 (E–V13 polymorphism). It constitutes about 85% of the European E–M78 chromosomes, with a clinal pattern of frequency distribution from the southern Balkan Peninsula (19.6%) to west Europe (2.5%). This haplogroup reached the southern Balkans after 17 000 calBP and its phylogeny reveals signatures of several demographic population expansions within Europe. Cruciani *et al.* (*2007*), Pompei *et al.* (*2008*) and King *et al.* (*2008*) agree that the earliest expansion was linked to Mesolithic demographic expansion from western Asia into Europe, and that the later series of Neolithic and Bronze Age expansions were restricted regionally within southeast Europe. Thus the first demographic expansion within Europe, from the Peloponnese to Thessaly and Greek Macedonia, was calculated at 8600 calBP (*King et al. 2008.211*). All of the demographic expansion within the Balkans of the later haplogroups, E3b1a and E3b1a2, post-date the transition to farming in the region.

The haplogroup J is subdivided into two major subhaplogroups, J1 (M267) and J2 (M172). The latter was hypothesised as representing an important signature of Neolithic demic diffusion and to have been associated with the appearance of painted pottery and figurines. It became clear recently that it mainly constitutes the signatures of several post Neolithic expansions within Europe, and not demic diffusion into Europe. The J2 subclade frequencies in southeast Europe show two distinct clusters. While the J2a (M410) subclades are frequent in the Peloponnese, Crete and Anatolia, but rare in the Balkans, the J2b (M12) subclades are, conversely, the most frequent in the Balkans and in the Mediterranean (*King et al. 2008; Battaglia et al. 2009*). The expansion time for the J2b (M12) subhaplogroup and associated migration from the southern Balkans toward the Carpathian basin is consistent with the Late Neolithic (*King et al. 2008.209*). The geographical origin of the J2b subclade remains unknown, although it shows a trend of decreasing frequency from the Balkans (7–9%) to Anatolia (1.7%) (*King et al. 2008*). Interestingly, in the region where the PPNA–C sites at Çayönü, Göbekli Tepe and Hallan Çemi are located, the 4.7% clade frequency is significantly lower than those in the Balkans.

Barać *et al.* (*2003*) and Peričić *et al.* (*2005; 2006*) recently observed that a lower frequency of subhaplogroups J2b and E3b1 significantly distinguishes the populations of the western Balkans and the Adriatic (7.9%) from neighbouring populations of the Vardar-Morava river system in the eastern Balkans (21.9%). This corresponds with the recently identified pre-Neolithic I haplogroup and its subclade I1b* (I2a2 –M423 after *Underhill et al. 2005*) with a frequency distribution that reaches a maximum in the western Balkans, the Adriatic (52%–64%), and the central Balkans (<70%). Haplogroup I is the only haplogroup almost entirely restricted to the European continent. It appeared in Europe, probably before the Last Glacial Maximum, with frequency peaks of reached in two distinct regions – in the Nordic populations of Scandinavia, and in the Balkan populations of Southern Europe. Subhaplogroup I1b* expanded from a refuge in southeast Europe before the Neolithic, and a gene flow from the Balkans to Anatolia has also been suggested (*Semino et al. 2000; Barač et al. 2003; Rootsi et al. 2004; 2006; Cinnioğlu et al. 2004; Peričić et al. 2005; 2006; Battaglia 2009*).

Geneticists suggest that the peopling of Europe was a complex process, and that the view of the spread of the Neolithic in Europe as a result of a single, unique and homogeneous process is too simplistic. The paternal heritage of Southeastern Europe reveals that the region was both an important source and recipient of continuous gene flow. In addition, the low frequency and variance associated with I (M423) and E (V13) in Anatolia and the Middle East support the European Mesolithic origin of these two clades. The Neolithic and post Neolithic component in the gene pool is most clearly marked by the presence of the J (M241) lineage and its expansion signals associated with Balkan micro-satellite variation. Its frequency in south-east European populations ranges from 2% to 20%. The remaining genetic variations are associated with pre-Neolithic hunter-gatherer haplogroups E, I, and R.

Pottery distribution gradients

Since Childe (*1929; 1939*) introduced a ceramics diffusion gradient from the Middle East to Europe, pottery has remained a multifunctional, chronological, cultural and ethnic vector in interpretations of the

European Neolithic. Parallel to the gradual spread of pottery from the Near East to Europe – whether based on 'typological comparability and comparative stratigraphy' (*Milojčić 1949; Parzinger 1993*) or standard ^{14}C dating (*Breunig 1987*) – cultural and ethnic distinctions were suggested. While red and white painted pottery was believed to indicate an Anatolian population and culture, coarse pottery was perceived as something so local to the Balkans that "*we do not believe that this primitive pottery was introduced from Asia Minor*" (*Theocharis 1967. 173; cfr. Thissen 2000.163*).

Pottery assemblages with 'impresso' decoration made with the fingernail and shell impressions, or by pinching clay between finger and thumb, and 'barbotine' pottery with the application of a slip in the form of thick patches or trails that comprise the most popular types of pottery in the Balkans were explained simply as showing 'a clear regression in pottery production' (*Milojčić 1960.32*). In Thessaly, this pottery was linked to an interruption in the 'painted ware tradition' (*Nandris 1970.200*). Milojčić, von Zumbusch and Milojčić (*1971.34, 151*) have suggested the interruption was associated with 'barbarian local production' brought into the region by a migrating population from the 'north', and marked by 'burnt layers' and settlement destruction in northern Thessaly at the end of the Early Neolithic.

Meanwhile, it was suggested that white painted pottery marked 'a breakthrough' by Anatolian 'ethnic components' and Early Neolithic culture from Thessaly to the Northern Balkans and the Carpathian Basin (*Garašanin 1979; Pavlu 1989; Garašanin & Radovanović 2001.121–122*). A similar migratory event was hypothesised in a 'leapfrog' or 'salutatory' demographic model that suggests migrations from one suitable environment to another. Van Andel and Runnels (*1995*) hypothesised that Anatolian farmers had moved towards the Danube and Carpathian basin after reaching demographic saturation in Thessaly, which they had settled first. The Larissa plain in Thessaly was believed to be the only region in the southern Balkans that provided a reasonably assured and large enough harvest for the significant population growth that led to the next migratory move north. It was calculated that farmers needed 1500 years to reach saturation point and to migrate to the northern Balkans.

The interpretative paradigm constructed around the dichotomy 'civilized/barbarian' continued to be highly significant in the context of academic controversy over the Neolithisation process in southeast Europe. It was embedded in both interpretative models – the 'Balkan-Anatolian cultural complex' and the 'frontier model' – determining differences between European and Oriental materiality and potential, and postulating a frontier between indigenous Mesolithic societies and the incoming farmers from surrounding areas. Both models maintain a perception of an allochthonous Anatolian population in association with a well-developed farming economy and pottery technology, and an autochthonous Balkan population able to produce only simple and coarse pottery that selectively adopts crop production and animal husbandry (*Benac, Garašanin, Srejović 1979; Todorova 1998.; Garašanin & Radovanović 2001; Perić 2002; Tringham 2000; Zvelebil and Lillie 2000; Lichardus-Itten and Lichardus 2003; Borić and Miracle 2004; Sanev 2004; Boroneanţ and Dinu 2006*).

The distributions of material items, such as female figurines, sometimes exaggerated in form, stamp seals, anthropomorphic, zoomorphic and polypod vessels, which indeed connect south-east Europe and west Anatolia, continue to support the perception of migrating farmers and the gradual distribution of the Near Eastern Neolithic package (*Lichter 2005; Özdoğan 2008*). We cannot ignore, however, different regional patterns in the use of cereals within these areas. Cyprus is believed to relate culturally to the Levant, but their archaeobotanical assemblages have much less in common. The differences between the varieties of Neolithic wheat compositions recovered on mainland Greece and those on Crete are well known. The Karanovo, Starčevo and Körös cultures in the Balkans and the southern Carpathian Basin are recognized as forming a homogenous Neolithic cultural complex, but the composition of the plant suites found in the Balkan regions could hardly be more different (*Perlès 2001.62; Colledge et al. 2004; Kreuz et al. 2005; Coward et al. 2008*).

It is worth remembering that the beginning of the Neolithic in Southeastern Europe was marked neither by ceramic female figurine nor painted pottery dispersal. When the figurines appeared in the Balkans, they remained highly schematised, sometimes to the extent that their identification as anthropomorphic is debatable (*Vajsov 1998; Perlès 2001*; for a general overview, see *Hansen 2007*).

Unpainted vessels were clearly the first to appear in Europe. Since coloured ornaments were attached to the pots in northern Balkans and Carpathians at approximately 6000 calBC at 1σ, a dichotomy of colour and motif perception in the European Early Neolithic becomes evident. Red and brown geometric and floral motifs were limited to the Peloponnese and the southern Balkans; white painted dots and spiral motifs were distributed across the northern and eastern Balkans and southern Carpathians. None of them appeared in the Early Neolithic on the eastern Adriatic (*Schubert 1999; 2005; Müller 1994; Budja 2001*).

We mentioned above that the standard ^{14}C dating model postulates a gradual spread of farmers and pottery, and suggests an interval of a millennium between the initial pottery distributions in the Aegean and Danube regions, respectively. A similar time span vector has been integrated into the demographic model of the Neolithic transition and population dynamics (*Pinhasi et al. 2005*).

The earliest pottery in Thessaly is chronologically contextualized within a 1σ range of 6500–6200 calBC, with a high peak at about 6400, and one slightly less high at *c.* 6200 calBC. In general terms, the Early Neolithic (EN I) settlements and associated pottery assemblages with monochrome pottery, and 'a very limited use of painting' at Argissa, Sesklo, Achilleion and Nea Nikemedeia, were founded at about 6400–6300 calBC (*Perlès 2001; Thissen 2005; 2009; Reingruber and Thissen 2009*).

As already pointed out by several authors, there is now abundant evidence from AMS ^{14}C dating to show that pottery distribution in the northern Balkans and south-western Carpathian basin can be traced from *c.* 6200 calBC at the latest (*Whittle et al. 2002; Tasić 2003; Borić and Miracle 2004; Biagi and Spataro 2005; Biagi et al. 2005; Reingruber and Thissen 2005; Bonsall 2008; Luca et al. 2008; Luca, Suciu 2008; Borić and Dimitrijević 2009; Thissen 2009*). The earliest pottery assemblages from the northern Balkans "*... differ in important aspects from these NW Anatolian potteries, and foremost in their categorical structure, as well as in essential details, signifying differences in manipulation and positioning of the vessels. NW Anatolian features such as flat bases and two differing handle sets do not occur in the Danube sites, nor are the large dishes with roughened exteriors, so typical for the SE European sites, part of the Anatolian repertoire...*" (*Thissen 2009.10*).

Pottery from Lepenski Vir and Padina in the northern Balkans was contextualized within trapezoidal structures having lime-plastered floors, while some were associated with pairs of stone sculptures and neonatal and infant burials. The context is traditionally interpreted as Late Mesolithic, and associated with hunter-gatherers' symbolic behavioural and funeral practices. Recently, it was recognized as Early Neolithic (*Borić and Dimitrijević 2009*). The trapezoidal structures 4, 24 and 36, and at Lepenski Vir, and 17 at Padina are dated within 6213–6093 (6226–6068), 6213–6092 (6231–6060), 6394–6072 (6411–6022) and 6228–6099 (6353– 6054) calBC at 68,2% (95,4%) probability (Tabs. 1 and 2).

At Grivac, a well stratified Early Neolithic settlement in central Serbia, the monochrome pottery was contextualized in a pit dwelling dated to 6219–6031 (6368–5979) calBC at 68,2% (95,4%) probability.

An even earlier context, with monochrome pottery ranging from 6441–5989 (6462–5923) calBC at 68,2% (95,4%) probability, is the well known Poljanica-Platoto Early Neolithic settlement in north-eastern Bulgaria. The pottery assemblages consist of 'monochrome' and impressed pottery. The pottery is associated with 'typical trapezes' and only two (einkorn and lentil) of the ten crop species cultivated in Neolithic Bulgaria (*Todorova 1989.11–12; 2003; Kreuz et al. 2005.243; Weninger et al. 2006.415*).

In a contemporary context at Poljna (Blagotin) settlement in the West Morava valley in Serbia, pottery analysis shows that 91% of the total quantity of ceramics is undecorated. Of the remaining 9% of the decorated pottery, the impressed ware is predominant, at 43% of all decorated pieces. Barbotine ornaments comprise 5%, and painted pottery, 0.2% (*Vuković 2004*). The assemblage is chronologically embedded in time span 6400–6030 (6430–6018) calBC at 68,2% (95,4%) probability. The dates relate to ritual contexts, marked by a red deer skull deposited in the pit, and to a new born infant skeleton buried in an ashy layer within the same building context (*Nikolić and Zečević 2001.6; Whittle et al. 2002.66*).

The later pottery assemblage at Lepenski Vir continues to be associated with funeral practices and symbolic behaviour. A globular vessel with a pair of plastic spirals on opposite sides was deposited in the 'ash-place' in a centrally positioned trapezoidal built structure No. 54 (*Garašanin and Radovanović 2001. 119*). It was associated with newborn and infant burials at the rear of the structure, the secondary burial of the mandible of a mature woman within the rectangular hearth, with a mortar and a pair of coloured stone sculptures behind it. The context is dated to 6015–5811 (6085–5720) calBC at 68,2% (95,4%) probability.

Within this chronological horizon, white painted pottery was embedded for the first time in settlement contexts at Divostin (6090–5809 [6241–5713]) in the northern Balkans, at Donja Branjevina (6062–5635 [6100–5571]) and Magareći Mlin (6060–5926 [6203–5880]) in the southern Pannonain Plain, and at Gura Baciului in the Southern Carpathians (6054–5988 [6084–5911]) calBC at 68,2% [95,4%] probabi-

Lab code	Context	Conventional radiocarbon age (BP)	Cal BC age range 68,2% probability	Cal BC age range 95,4% probability	Summed probability distributions cal BC	Pottery	
 Bln-1571 Bln-1613 Bln-1613A Bln-1521	**Poljanica-Platoto** horizon I, Qu. 49 horizon I, Qu. 153 horizon I, Qu. 153 horizon I, Qu. 153	 7535±60 7380±60 7275±60 7140±60	 6461-6274 6371-6123 6213-6076 6066-5927	 6476-6248 6392-6093 6242-6019 6205-5889	*68.2% probability* 6441 (14.2%) 6372 BC 6251 (53.2%) 5989 BC *95.4% probability* 6462 (92.9%) 5979 BC	'monochrome'	*Weninger et al. 2006. Tab. 11.*
 Bln-740a Bln-740b	**Lepenski Vir** trapezoidal structure 36, floor	 7310±100 7360±100	 6331-6059 6366-6101	 6392-6011 6428-6054	*68.2% probability* 6349 (9.5%) 6311 BC 6262 (58.7%) 6072 BC *95.4% probability* 6411 (95.4%) 6022 BC	'monochrome'	*Tissen 2009. Tab. 4.*
OxA-16084	**Lepenski Vir** trapezoidal structure 4, floor	7285±37	6213-6093	6226-6068	*68.2% probability* 6213 (53.3%) 6133 BC 6117 (14.9%) 6093 BC *95.4% probability* 6226 (95.4%) 6068 BC	'monochrome'	*Borić and Dimitrijević 2009. 36. Tab. 1.*
OxAX-2176-18	**Lepenski Vir** trapezoidal structure 24, floor	7285±45	6213-6132	6231-6060	*68.2% probability* 6213 (50.6%) 6132 BC 6121 (17.6%) 6091 BC *95.4% probability* 6231 (95.4%) 6060 BC	'monochrome'	*Borić and Dimitrijević 2009. 35. Tab. 1.*
 Bln–653 Z–143 KN–407 Bln–738 Z–115	**Lepenski Vir** trapezoidal structure 54 hearth hearth hearth hearth	 7040±100 7300±124 7280±160 7225±100 6984±94	 6015-5811 6339-6031 6354-6006 6212-6016 5981-5771	 6085-5720 6427-5930 6452-5846 6355-5899 6031-5676	*68.2% probability* 6230 (38.7%) 6008 BC 5986 (29.5%) 5893 BC *95.4% probability* 6380 (95.4%) 5746 BC	'monochrome'	*Garašanin and Radovanović 2001. 119.*
OxA-11103	**Padina** trapezoidal structure 17, hearth	7315±55	6228-6099	6353-6054	*68.2% probability* 6228 (68.2%) 6099 BC *95.4% probability* 6353 (4.6%) 6309 BC 6265 (90.8%) 6054 BC	'monochrome'	*Borić and Miracle 2004. Tab. 4.*
Bln-869	**Grivac** pit dwelling I	7250±100	6219-6031	6368-5924	*68.2% probability* 6219 (68.2%) 6031 BC *95.4% probability* 6368 (93.8%) 5979 BC	'monochrome'	*Bogdanović 2004. 497.*
 OxA-8608 OxA-8609 OxA-8760	**Poljna (Blagotin)** dwelling 7, pit dwelling 7, burial dwelling 7	 7480±55 7270±50 7230±50	 6421-6262 6212-6074 6206-6028	 6437-6239 6231-6032 6205-5889	*68.2% probability* 6090 (68.2%) 5809 BC *95.4% probability* 6246 (95.4%) 5713 BC	'monochrome' 'white' and 'red' painted	*Whittle et al. 2002. 113. Fig. 9.*
 GrN–15974 GrN–15976 GrN–15975 OxA–8557 OxA–8556 OxA–8555 GrN–24609	**Donja Branjevina** trench V/86-87, pit dwellig, hearth trench V/86-87, outside pit dwelling trench V/86-87, outside pit dwelling trench II/87, under house remains trench II/87, under house remains trench II/87, hearth trench XXX/96, pit 7	 7155±50 7140±90 6955±50 7080±55 6775±60 6845±55 6810±80	 6062-5992 6089-5901 5891-5767 6014-5902 5717-5636 5775-5666 5762-5630	 6204-5911 6221-5841 5978-5732 6055-5845 5778-5563 5843-5636 5883-5564	*68.2% probability* 6062 (22.1%) 5974 BC 5951 (7.0%) 5917 BC 5798 (39.1%) 5635 BC *95.4% probability* 6100 (94.9%) 5616 BC	'monochrome' 'white' and 'red' painted	*Whittle et al. 2002. 114. Fig. 9.; Tasić 203.184; Karmanski 2005. 71.*
GrN–15973	**Magareći Mlin** house no.3, hearth	7130±60	6060-5926	6203-5880	*68.2% probability* 6060 (58.5%) 5981 BC *95.4% probability* 6105 (93.8%) 5880 BC	'white painted'	*Tasić 203.184h*
 Bln–823 Bln–866 Bln–866a Bln–931	**Divostin** feature 15(earth-cabin 5) house 14, beneath floor house 14, beneath floor house 14, beneath floor	 7080±180 7060±100 7200±100 7050±100	 6096-5743 6031-5838 6211-5992 6021-5814	 6355-5637 6202-5726 6343-5849 6098-5721	*68.2% probability* 6090 (68.2%) 5809 BC *95.4% probability* 6246 (95.4%) 5713 BC	'white painted'	*Tissen 2009. Table 4; Tasić 203.183.*
GrA–24137	**Gura Baciului** pit dwelling B1BG	7140±45	6054-5988	6084-5911	*68.2% probability* 6054 (68.2%) 5988 BC *95.4% probability* 6084 (84.2%) 5971 BC 5954 (11.2%) 5911 BC	'white painted'	*Biagi et al. 2005. 46-47; Luca and Sicu 2008.44.*
GrN-28114	**Seusa** dwelling L1, stone floor foundation	7070±60	6009-5897	6061-5811	*68.2% probability* 6009 (68.2%) 5897 BC *95.4% probability* 6061 (94.2%) 5836 BC	'white painted'	*Biagi et al. 2005. 49; Luca and Sicu 2008.44.*
  GrN-28520 Poz-24697 GrN29954	**Petriş-Miercurea Sibiului** pit dwelling B10 pit dwelling B17 pit G26	 7050±70 7030±50 7010±40	 6006-5849 5986-5879 5978-5846	 6052-5775 6011-5795 5990-5794	*68.2% probability* 5984 (63.4%) 5876 BC *95.4% probability* 6020 (95.4%) 5778 BC	'white painted'	*Luca et al. 2008. 328, Fig. 19.*
OxA–9336	**Pitvaros** pit 3/B	7060±45	5994-5901	6019-5845	*68.2% probability* 5994 (68.2%) 5901 BC *95.4% probability* 6019 (95.4%) 5845 BC	'white painted'	*Whittle et al. 2002: 115. Fig. 9.*

Tab. 1. All available ^{14}C-ages for the initial Neolithic in the northern and north-eastern Balkans, the southern Pannonian Plain, and Carpathians. All calculations are carried out with OxCal v4.1.3 (**Bronk Ramsey 2009*****).***

lity. This age range set is followed by later ranges at Seusa (6009–5897 [6061–5811]) and Petriş-Miercurea Sibiului (5984–5848 [6020–5778]) in Transylvania, and Pitvaros in the Tisza River catchment (5994–5901 [6019–5845]) calBC at 68,2% [95,4%] probability (Tab. 1 and Tab. 2).

Fig. 3. Early Neolithic pottery from Anzabegovo (Anza) and Donja Branjevina.

The appearance of white painted pottery in the northern Balkans and the southern Pannonian Plain chronologically corresponds with its appearance at Anzabegovo (Anza) in Macedonia in the southern Balkans. The ^{14}C series embedded the Anzabegovo assemblage within 6097–5561 (6453–5322) calBC at 68,2% (95,4%) probability. We have already mentioned that the white-painted motifs differ significantly between these regions. While white floral motifs and stepped triangles comprise the main ornamental motifs in the south, patterns of white dots and grids predominate in the north (see *Schubert 1999; 2005; Budja 2001*) (Fig. 3).

It is worth remembering that there is no evidence of painted ware on the Eastern Adriatic before 5539–5480 calBC. However, the dates of the earliest pottery production in northern Ionia (Sidari) sum at 6641–6119 (6801–5897) calBC at 68,2% (95,4%) probability. In the Eastern Adriatic catchment, the dates range between 6228–5811 (6391–5716) in Vela Spila, 6076–5741 (6208–5728) in Gudnja Cave, 6004–5232 (6203–4844) at Tinj, 5988–5808 (6046–5726) in Gospodska pećina, 5987–5847 (6017–5772) in Grapčeva spila and at Vižula 5877–4960 (6050–4851) calBC at 68,2% (95,4%) probability (calculated with OxCal v4.1.3; for data set see *Forenbaher and Miracle 2006.Tab. 13.2 and 13.3*). The ornamental system is based exclusively on incised, impressed and cardium-impressed ornaments. The old question of why painted pottery and female figurines were not distributed throughout the eastern Adriatic catchment in the Early Neolithic remains to be answered.

The ^{14}C gradient of pottery dispersal suggests that the sites in the southern Balkans are not significantly older than those in the northern and eastern Balkans (Tabs. 1 and 2). A gradual demic diffusion model from south to north and a millennium time span vector thus find no confirmation in the set of AMS ^{14}C dates and associated contexts that mark pottery dispersal within Southeastern Europe (Fig. 4). We may postulate a widespread, contemporary adoption and adaptation of pottery manufacturing techniques by local populations which not necessarily coincide with the adoption of farming. In this context, we have to examine the various ornamental patterns and techniques and colour application as much as the above-mentioned heterogeneity of Early Neolithic wheat and plant compositions within the region.

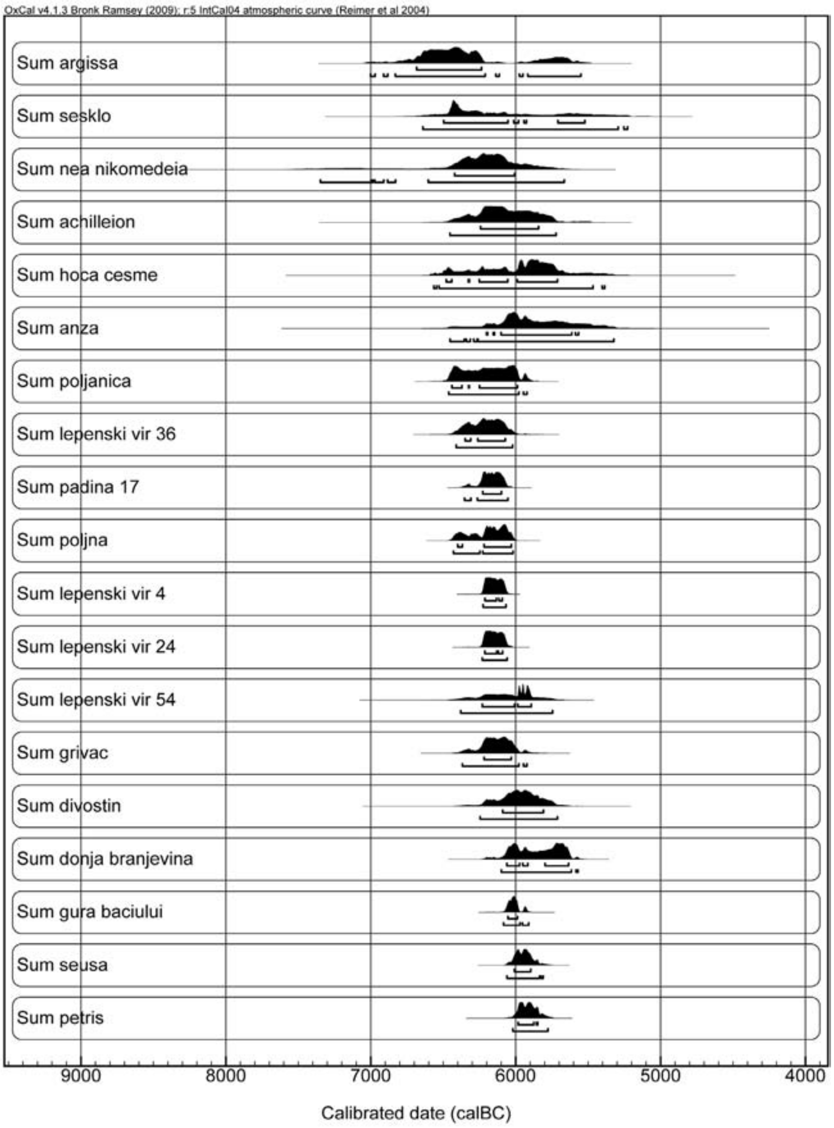
Concluding remarks

A critical reflection on the demic diffusion model and hypothesised population replacement during the initial European Neolithic in population genetics and archaeology shows that two basic assumptions – the continuously moving boundary between savagery and civilization and population replacement at the onset of the Neolithic – remain speculative. The hypothesis of gradual pottery distribution and the suggested time span vector believed to mark migration and acculturation – the absorption of hunter-gather groups by farmers in an interaction which took place through culture contact and emulation between two groups – are unrealistic.

Geneticists suggest that the peopling of Europe is a complex process and that the view of the spread of the Neolithic in Europe being the result of a unique and homogeneous process is too simplistic. Y-chromosomal paternal lineages reveal the signatures of several demographic population expansions within Europe, and between Europe and western Asia in both directions. This continuous gene flow and demographic expansion have been calculated for the Mesolithic, Neolithic and Chalcolithic periods, and seem to be more visible in the frequency of Y-chromosome markers in modern populations in the Balkans and Mediterranean than in other regions.

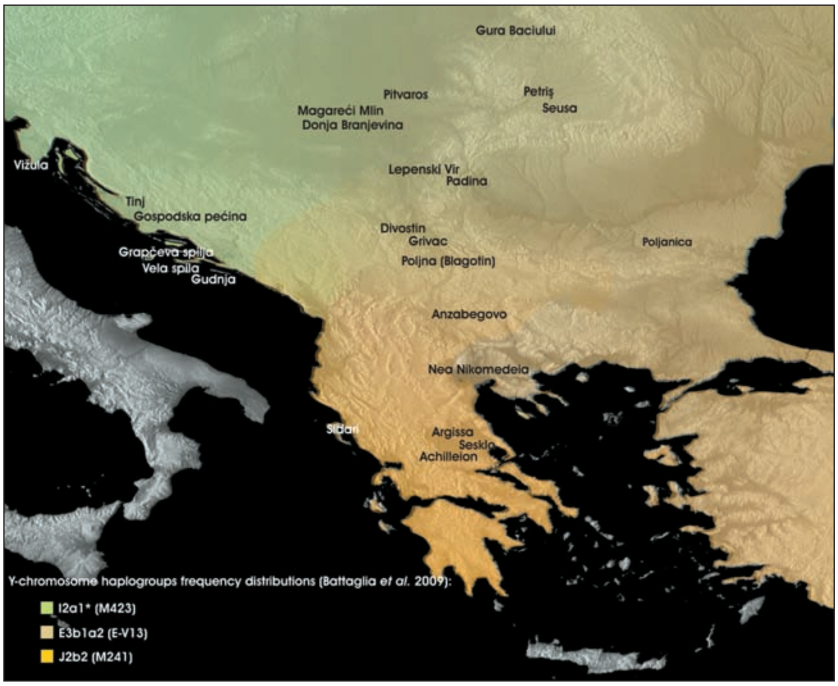
Recent phylogenetic analyses of ancient maternally inherited mitochondrial DNA have yielded contradictory results. Thus the phylogeographic analysis of the Iberian Peninsula suggests a long period of genetic continuity between the Neolithic population and modern populations in Spain, but not with the Middle East group (*Sampietro et al. 2007*). The comparison of the ancient mitochondrial DNA sequences from late hunter-gatherer skeletons with those from Neolithic farmers and with modern populations in Central and North Europe show that modern European sample are 'significantly different from the early farmer and from the hunter-gatherer' (*Bramanti et al. 2009.2*). The characteristic mtDNA type N1a with a frequency distribution of 25% among Neolithic LBK farmers in Central Europe shows in contrast low frequency of 0.2% in modern mtDNA samples in the same area (*Haak et al. 2005*). The N1a type was not observed in hunter-gatherer samples from western and northern Europe and this led Bramanti *et al.* (*2009.3*) to reject a direct continuity between hunter-gatherers and early farmers, and between hunter gatherers and modern Europeans, but assume 'continuity between early farmers and modern Europeans'. The assumption is supported by coalescent simulations which were performed to test if the genetic differences between the population samples could be explained by the null-hypothesis of genetic drift over time in a continuous population. They suggest a 'substantial influx of people' from the Pannonian Plain in Central and North Europe who did not mix significantly with the resident female hunter-gatherers. Shennan and Edinborough proposed, however, an alternative scenario in which the lost of N1a type relates to 'a population crash of enormous magnitude' after 5000 BC. They recognized the latter in a marked decrease in occupation intensity at the end of the LBK by applying the analysis of summed probability distributions of radiocarbon dates of settlement contexts in the region (*Shennan and Edinborough 2007; Shennan 2007*).

Initial pottery distribution in southeast Europe shows the wide-spread and contemporary appearance of pottery making techniques. The various structures, ornamental patterns and differences in colour application reflect Balkan cultural complexity and local knowledge and not the hypothesized axial transfer of the Near Eastern artefact and nutrition package along the gradual Neolithic frontier displacements across the Balkans. This pottery predates artefact assemblage consist-



***Tab. 2. Sum probability distributions plot of initial Neolithic pottery distribution based on available ^{14}C- data from Argissa, Sesklo, Nea Nikomedeia, Achilleion, Anzabegovov (Anza) and Hoca Çeşme (*Reingruber and Thissen 2005*); Poljanica (*Weninger et al. 2006.Tab. 11*), Lepenski Vir, Padina, Poljna, Divostin, Donja Branjevina, Magareći Mlin and Pitvaros (*Borić and Dimitrijević 2009.Tab. 1; Tissen 2009.Tab. 4; Whittle et al. 2002. 115, Fig. 9*); Grivac (*Bogdanović 2004.497*); Gura Baciului, Seusa and Petriş (*Biagi et al. 2005.46–47; Luca and Sicu 2008.44; Luca et al. 2008.328, Fig. 19*). All calculations are carried out with OxCal v4.1.3 (*Bronk Ramsey 2009; Reimer et al. 2004*).**

Fig. 4. Frequency distributions of the Mesolithic and Neolithic Y-chromosome haplogroups I (M423), E (V13) and J (M241) (after **Battaglia et al. 2009.Fig. 4*****), and the sites with pottery assemblages and*** ^{14}***C ranges and sum probability distributions listed on Table 1 and Table 2.***



ing of female figurines, stamp seals, anthropomorphic and zoomorphic vessels, and polypod vessels and tripods, with distribution in both regions, the Balkans and Anatolia, and was traditionally assumed to be associated with either demic diffusion or the leap-frog colonization of Europe. It is worth remembering that neither this assemblage nor painted pottery was distributed in the Dinaric region or the eastern Adriatic coast.

We suggest that interpretations of the transformation process and transition to farming cannot be marginalized neither to contacts in frontier zones nor to the gradual axial dispersal of Early Neolithic material culture and Y-chromosome markers and associated paternal lineages from western Asia to Southeastern Europe. The paternal heritage of Southeastern Europe reveals continuous Mesolithic, Neolithic and post-Neolithic gene flows within southeastern Europe, and between Europe and the Near East in both directions. The ^{14}C gradient of pottery dispersal suggests that the sites in the southern Balkans are not significantly older than those in the northern and eastern Balkans. The earliest pottery assemblages differ morphologically and ornamentally between the Anatolia and the Balkans and between southern and northern Balkan regions. The first 'demic event' that was hypothesised to reshape significantly European population structure and generate a uniform process of neolithisation of Southestern Europe has no confirmation in frequency of Y-chromosome subhaplogroups J2b and E3b1 distribution and in initial Neolithic pottery dispersal.

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