

The agricultural transition and the origins of Neolithic society in Europe

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ABSTRACT - *The origin of Neolithic societies and the agricultural transition have been a subject of concentrated attention and a subject of debate and controversy among archaeologist, geneticists and linguists. In my contribution I review and evaluate different archaeological interpretations of the transition to farming. I will also discuss the archaeogenetic evidence and its integration with archaeological data.*

IZVLEČEK - *Izvor neolitskih skupnosti in prehod h kmetovanju vzbujata veliko pozornost in sprožata razprave ter nasprotovanja med arheologi, genetiki in lingvisti. V članku podajam pregled in oceno različnih arheoloških razlag prehoda h kmetovanju. Pretresem tudi arheogenetske dokaze in njihovo vključevanje v arheološke podatke.*

KEY WORDS - *transition to farming; archaeogenetic*

INTRODUCTION

In my contribution, I address the dispersal of farming and the origin of Neolithic societies in Europe, with particular attention paid to the meaning and role of the genetic evidence in this process. My point of departure is that neither the introduction of farming through contact, nor by migration can alone explain the establishment of Neolithic societies. More sophisticated processes, which include both movement and contact must have been responsible for the regional variation characteristic of the Neolithic.

The basic premise of my argument is that the dispersal of farming and the process of neolithisation were embedded in the existing, pre-Neolithic social and historical conditions of each region, in the history of contacts with communities which had already adopted farming (beginning in the Levant or Anatolia), and in the inter-generational transmission of knowledge. In this sense, the social context of the agricultural transition in Europe had its structure and agency. The structure was set by the network of so-

cial relationships and contacts, and by tradition: the socially and culturally defined normative rules for the transmission of knowledge and practical skill from one generation to another. People, through contact and colonisation, provided the agency such transmissions, for the incorporation of innovations such as cultigens and domesticates, and for changing the structural framework of the social context.

AGRO-PASTORAL DISPERSALS

There can be little doubt that agro-pastoral (Neolithic) farming originated in the Levant and Anatolia some 10 000 years ago. But how was it introduced to Europe?

This question is most commonly debated in terms of deceptively simple dichotomy: introduction through contact or population movement. However, the situation is not so simple. Considered more thought-

fully, the following mechanisms of diffusion can be suggested:

- ① *Folk migration* – is a directional and major population movement to a previously identified region (causing sudden gene replacement).
- ② *Demic diffusion* – is a sequential colonisation of a region by small groups or households. It occurs over many generations and involves slowly expanding farming populations, colonising new areas by the ‘budding off’ of daughter hamlets from the old agricultural settlements in a non-directional pattern (causing gradual gene replacement)
- ③ *Elite dominance* – involves the penetration of an area by social elite and subsequent imposition of control over the native population (causing gene mixing, genetic continuity with genetic ad-stratum, and the retention of genetic markers of intrusive population).
- ④ *Infiltration* – involves a gradual penetration by small, usually specialist groups of a region, who fill a specific economic or social niche (i.e. itinerant smiths, tinkers, leather workers, livestock herders). This may be genetically undetectable if there is no inter-group gene flow, if gene flow occurs, then small-scale genetic signature as in (3) can be expected.
- ⑤ *Leapfrog colonisation*: denotes selective colonisation of an area by small groups, who target optimal areas for exploitation, thus forming an enclave settlement among native inhabitants (causing gene replacement which is regionally variable, genetic ‘islands’ which may be diffused in time through gene mixing with local population).
- ⑥ *Frontier mobility* – denotes small-scale movement of population within contact zones between foragers and farmers, occurring along the established social networks, such as trading partnerships, kinship lines, marriage alliances and so on (causing gene mixing marked by graded or discontinuous patterning in gene frequencies between genetically distinct populations, but if population were genetically similar, this would be undetectable).
- ⑦ *Contact* – through trade, exchange, within the framework of regional, or extra-regional trading networks which served as channels of communication through which innovations, including domesticated plants and animals, spread (there is no gene replacement due to migration, genetic continuity prevails).

AGRICULTURAL TRANSITION: INTERPRETATIONS OF THE ARCHAEOLOGICAL EVIDENCE

From the archaeological position, which is based on the treatment and interpretation of the archaeological evidence, we can identify three major points of view:

The migrationist position

Ever since Childe (1925; 1957), it has become an established view to regard the adoption of farming in Europe as a case of replacement of indigenous hunter-gatherers by farmers immigrating from the Near East and, over the generations, colonising hitherto unfarmed areas of Europe. These new people laid the foundations of the Neolithic settlement in Europe. This process was driven by a rapid population growth experienced by the Neolithic farming populations (Piggott 1965; Case 1969; Lichardus and Lichardus-Itten 1985; Vencl 1986; Aurenche and Cauvin 1989; Cauvin 1994; van Andel and Runnells 1995; Cavalli-Sforza and Cavalli-Sforza 1995; etc). These events are thought to have shaped the genetic map of Europe (Ammerman and Cavalli-Sforza 1984; Cavalli-Sforza, Menozzi and Piazza 1994 with references; Cavalli-Sforza and Cavalli-Sforza 1995; Cavalli-Sforza 1997), and to have been responsible for the introduction of Indo-European languages to the continent (Renfrew 1987; but see Renfrew 1996; 2000 for recent modifications).

This school of thought holds dispersal processes 1–5 exclusively or primarily responsible for the introduction of farming into Europe, although the relative contribution of each is a matter of debate. Earlier scholars (i.e. Childe 1957; Piggott 1965) tended to favour migration, but more recent workers favour demic diffusion (i.e. Ammerman and Cavalli-Sforza 1984; Renfrew 1987). Elite dominance is discounted by some (i.e. Renfrew 1987), while others accept infiltration as a part of the neolithisation process (Neustupný 1982). Leapfrog colonisation has recently been introduced as a more realistic alternative to other forms of movement (Arnaud 1982; Zilhão 1993; Renfrew 1996; 2000). The migrationist view is most readily accepted among the public, among non-archaeological scholars, and commands a favoured position among archaeologists on the continent.

The indigenist position

This school of thought believes that the adoption of farming into Europe and the origins of the Neolithic

came about exclusively through frontier contact and cultural diffusion (processes 6 and 7). Migration from the Near East had little or no role to play. Genetically, then, populations of Near Eastern origin had little or no contribution to make. This view is based on strict interpretation of archaeological evidence, where the burden of proof is placed on the presence of clear archaeological markers of migration.

'Indigenists' fall into two groups, depending on their perceived importance of innovations which were spreading with cultural diffusion. Dennell (1983; 1992) and Barker (1985) regard the spread of agropastoral farming and Neolithic technology as the defining features of the Neolithic. Tilley (1994) and Thomas (1988; 1996) perceive the eventual shift from hunting-gathering to farming communities as internal social and ideological restructuring of Mesolithic communities that also – almost incidentally involved farming. Whittle (1996) and Pluciennik (1998) adopt an intermediate position. The indigenist position has almost no support outside Britain and Scandinavia.

The integrationist position

This group regards processes of leapfrog colonisation, frontier mobility and contact responsible for the agricultural transition (Zvelebil 1986a; 1986b; 1989; 1995; 1996; Chapman 1994; Thorpe 1996; Price 1987; 1991; 1996; Zilhão 1993; 1997; Auban 1997; Renfrew 1996), although the relative contribution of each differs from author to author. A good number of archaeologists in Britain as well as in North America and continental Europe adhere to this view, although it is less popular outside the profession (*but see Willis and Bennett 1994; Richards et al. 1996*). Although the differences of interpretation between the three groups are of a degree rather than categorical, the implications for the population history and genetic patterning at the agricultural transition are quite major.

Discussion of the archaeological evidence

The indigenist scenario places emphases on archaeological evidence, which shows lack of support for any kind of population movement. The problem here is the resolution of archaeological data: we cannot expect clear and unequivocal signatures for human behaviour, including migration. Past human behaviour is merely one among many factors, which structure the archaeological record (see below). Bearing this in mind, archaeological cultures seem best

regarded as cultural traditions of multivariate origin, including most recent variables of taphonomy and modern hermeneutics. The specific relationship between archaeological cultures and human migration has also been much discussed recently, without resolution (Renfrew 1986; Mallory 1989; Anthony 1990; Chapman and Dolukhanov 1992; Bellwood 1996; Renfrew and Boyle 2000). The problem lies in specifying the relationship between population movement, normative (ethnically-identified, see below) concept of culture and archaeological signatures of these phenomena. Despite the fuzziness between past human identities, behaviour and its archaeological signatures, there are four developments, which, if coeval, are likely to indicate population movement:

- the introduction of new cultural traits into a region in more than one cultural 'subsystem' (or aspects of culture)
- their discrete and coeval distribution,
- the lack of earlier traditions for such traits within the region;
- and the existence of an adjacent donor culture where such trait occur.

Gordon Childe has already drawn attention to such signifiers of population movement in the material culture (1957). In here, they are accepted as indicators of population movements (processes 1–5) without the corresponding ethnic connotations of a 'folk' or 'people'. The more precise form of population movement than has to be identified on the basis of other historical observations.

Bearing in mind this argument, and taking into the account archaeological evidence for continuity and discontinuity at the time of the agricultural transition, the indigenist explanation throughout Europe seems untenable. Too many new traits are introduced coevally in parts of the east and west Mediterranean, south-east Europe and Central Europe (Fig. 1).

Equally, the migrationist hypothesis does not find unequivocal support in either the archaeological, ecological, or demographic evidence. For the demic diffusion of farming populations, the rationale most often cited for the immigration of Neolithic farmers from the Near East to Europe is the rapid population growth brought about by the emergence and development of farming (*i.e. Renfrew 1987; 1996*), regarded by some as 'demographic explosion' (Cavalli-Sforza and Cavalli-Sforza 1995.133–134). The shift to agriculture brought about increasingly sedentary existence, improved diet, and rise in the economic value of child labour. This in turn reduced the need

for population controls and made having more children both possible and desirable. In consequence, farming populations grew rapidly, colonised adjacent regions, and replaced hunter-gatherer communities, whose population growth was negligible or nil.

Archaeologically, there is no evidence for sustained and wide-ranging immigration that would support either the demic diffusion hypothesis or a major continent-wide migration (Dolukhanov 1979; Dennell 1983; 1992; Barker 1985; Zvelebil 1986a; 1986b; 1989; 1995; Thomas 1996; Midgley 1992; Larsson 1990): there is simply too much cultural continuity in most regions of Europe to warrant such an interpretation.

Demographically, there is no evidence for population pressure which would encourage first farmers to migrate, nor is there evidence for rapid population growth (*i.e.* van Andel and Runnels 1995). Archaeological evidence does not record any evidence for rapid saturation of areas colonised by Neolithic farmers, or for demographic expansion, with the single possible exception of the Linear Pottery Culture in central Europe. Even in the presumed core area for such expansion, south-east Europe, the saturation process was slow and incomplete. This is shown, for example, through the work of van Andel and Runnels in Thessaly. Even though they argue in favour

of the demic diffusion for the spread of farming (1995:494–498), their own calculations fail to substantiate the population growth rates necessary for such model to operate. They conclude that the Early and Middle Neolithic periods “seemed to have been a time of steady but not very rapid population growth” so that “even the Larisa basin, region of major growth, required some 1500 years, from about 9000 to 7500 BP to reach saturation” (1995:497). This is a far cry from “demographic explosion” of Cavalli-Sforza, but in complete agreement with the recent palynological work carried out by Willis and Bennett (1994) showing that even in south-east Europe (including Greece) the impact of agriculture is not evidence until ca 6000 BP, suggesting that the introduction of farming ‘was not of sufficient intensity to be detected upon a landscape scale’ (1994: 327).

Archaeological evidence for the Mesolithic in much of Europe (except central and south-east Europe) records stable, relatively affluent, often semi-sedentary communities which would have maintained relatively high population densities see Rowley-Conwy 1983; 1999; Price 1987; Price and Brown 1986; Zvelebil 1986; 1996; Tilley 1996; Finlayson and Edwards 1997; Voytek and Tringham 1989; Price 2000; *etc.*). Archaeological evidence for the early Neolithic in much of Europe records partly mobile communities which relied on a mixture of farming,

hunting, gathering and animal husbandry (*except for south-east and central Europe*: Barker 1985; Bogucki 1988; Tilley 1994; 1996; Thomas 1991; Whittle 1996; Thorpe 1996; Barclay 1997; *etc.*). Consequently, the differences in economy and sedentism between hunters and farmers, which are held responsible for differences in population growth of the two types of communities, were much reduced during the time in question, removing the rationale for ‘demographic explosion’ and ‘the growth-migration cycle’ (Cavalli-Sforza 1997: 386).

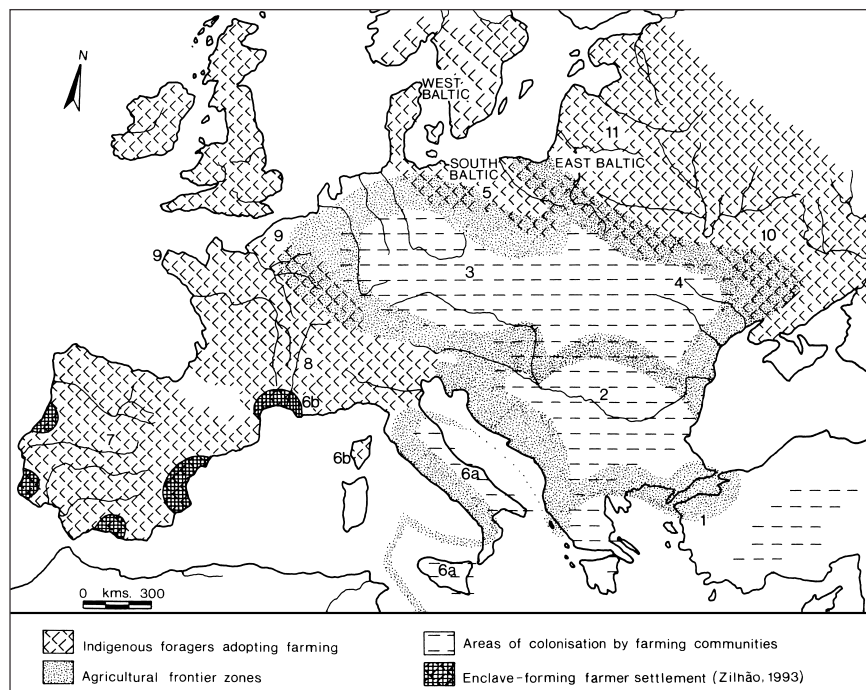


Fig. 1. ‘Colonist’ and ‘indigenous’ regions of Europe at the agricultural transition according to one (integrationist) interpretation of the archaeological evidence. Base map after Renfrew (1986) with additional information from Zvelebil and Zvelebil (1988) and Zilhão (1993).

Ecologically, there is no evidence for sustained

woodland clearances after the initial phase and for environmental degradation that would indicate extensive agriculture on one hand, and provide a rationale for relocation on the other before the *late* Neolithic (*Willis and Bennett 199; Willis et al. 1998; Smith 1981; Whittington and Edwards 1997; Berglund 1990*). At the same time, the ecology of Europe was favourable to supporting greater-than-average densities of hunter-gatherer populations, especially in coastal and lacustrine regions and along major rivers (*Clarke 1976; Price 1987; Zvelebil 1986a; 1996*).

Ethnographically, the choice by the migrationist school of examples as analogues for the historical situation at the Mesolithic-Neolithic transition is inappropriate (*i.e. Piggott 1965; Ammerman and Cavalli-Sforza 1984; Cavalli-Sforza and Cavalli-Sforza 1995*). In fact, pertinent ethno-historical evidence shows that there is a wide overlap in population densities between hunter-gatherers and subsistence farmers, further eroding the demographic basis of the farming colonisation hypothesis. The ethnographic sample shows that hunter-gatherer population densities range from 0.02 to about 100 per square kilometre (*Hassan 1975*) with coastal, more sedentary foragers having the greater population densities. For example, hunter-gatherer population densities in river basins of south-east Australia are thought to have been 20–40 times higher than in non-riverine regions (*Birdsell 1953; Pardoe 1990*). Given their economic and mobility patterns, Mesolithic communities were likely to approximate the higher population densities found among the Californian and north-west coast Native Americans. By comparison, the population densities of subsistence farmers engaged in swidden agriculture ranged from 3 per km. sq. in Laos and Zimbabwe, to 30 in the Philippines and to 300 in New Guinea, while the rural population of Lorraine and of Belgium in mid-15th century was 10–25 and 30–70 people per km. sq. respectively, and the population of England in 1086 was calculated as 78 per km. sq. (*Hassan 1978*). *Hammel (1996.228)* notes that the current evidence suggests no major change in mortality rates between the Palaeolithic and the eighteenth century AD, and that rapid population growth took off only 300 years ago ‘when doubling times generally dropped below a millennium’ (*Hammel 1996.221*). Finally, recent genetic studies in Africa also show the lack of any great differences in population dynamics between hunter-gatherers and subsistence farmers (*Bandelt and Foster 1997*). Even though one cannot make much of these figures, they suggest in aggregate a

more even demographic playing field between foragers and farmers in prehistoric Europe. These considerations remove a central plank from arguments in favour of the migrationist hypothesis. Although population growth rates for farmers were likely to be greater than for hunter-gatherers, the difference must have been considerably smaller than originally postulated. The population densities of prehistoric foragers and farmers in Europe may have partly overlapped as they do in the ethnographic sample.

In summary, then, the assumption of marked population differences between prehistoric hunter-gatherers and Neolithic farmers is based on a misunderstanding of hunter-gatherers as always mobile and organisationally simple, yet in Mesolithic Europe they tended toward socio-economic complexity and sedentism. Neolithic farmers are always sedentary and super-productive, yet in Neolithic Europe they were often transhumant or mobile, with mixed hunting-farming economy.

With this in mind, I would argue that the agricultural transition in Europe was, in the main, accomplished by the local hunter-gatherer communities, with varying degrees of gene flow between the hunter-gatherer communities and the settlements of Neolithic farmers. Enduring contact and exchange between the foraging and farming communities led to the development of agricultural frontier zones, manifested in the archaeological record by enduring cultural boundaries, for example between the Balkan Neolithic cultures and the Mesolithic/LBK of Central Europe, or the LBK and derived communities in Central Europe and the Mesolithic/TRB cultures of north temperate Europe (Figs. 1, 2 and 4). From an integrationist perspective, two patterns can be discerned:

Within south-east and central Europe, colonisation by farmers occurred through ‘leapfrog colonisation’, which I find a more convincing process of population movement than the demic diffusion model. Even though the idea of leapfrog colonisation was originally applied by *Arnaud (1982)* and *Zilhão (1993)* to explain seaborne colonisation of the west Mediterranean from the east, a similar process could be used to explain the rapid spread of farming communities through the fertile lowland basins and river valleys in the Balkans and Central Europe.

Within such a scenario, the farming groups would target patches of fertile soil – for example loess in Central Europe – for ‘enclave-forming’ settlement. At

the same time, local adoption of farming occurred through contact in the frontier zones around the initial farming settlement. Such a combination of colonisation and contact can perhaps explain the origins of the Neolithic in the Balkans and in Central Europe. Here, the genesis of the LBK culture can be explained as the adoption and the adaptation of the First Balkan Neolithic farming by the local hunter-gatherers at the periphery of the Körös culture (Fig. 2). With the adaptation of farming practices to local conditions, hunter-gatherers turned farmers were

in a position to expand quite rapidly within their own ecological region or culture area, in a 'star-burst' pattern of local adoption of farming, integration with local hunter-gatherer communities and regional demographic expansion. This did not require any major population explosion, only a shift in settlement pattern and moderate population growth associated with the initial opening of a new economic niche. Genetically, then, the people who were colonising these habitats mainly originated from the area of present-day Hungary, rather than from south-east Europe.

Similar processes of contact and colonisation may have been responsible for the origins of the Neolithic in south-east Europe and parts of the Mediterranean: Greece, Istria and Dalmatia, Danube Gorges, southern Italy and the Iberian peninsula, for example (Radovanović 1996; Budja 1991; Chapman and Müller 1990; Auban 1997; Zilhao 1993; 1997). Although in some regions of the west Mediterranean, as in modern Languedoc or Tuscany, local cultural continuity and staggered introduction of farming practices and technology would argue in favour of a local adoption through contact and frontier mobility, rather than any form of colonisation (Guillaune 1976; Lewthwaite 1986; Vaquer 1990; Barnett 1995; see Fig. 3).

In other parts of Europe, I see the transition to farming occurring through contact and frontier mobility. In either case, such exchanges were socially con-

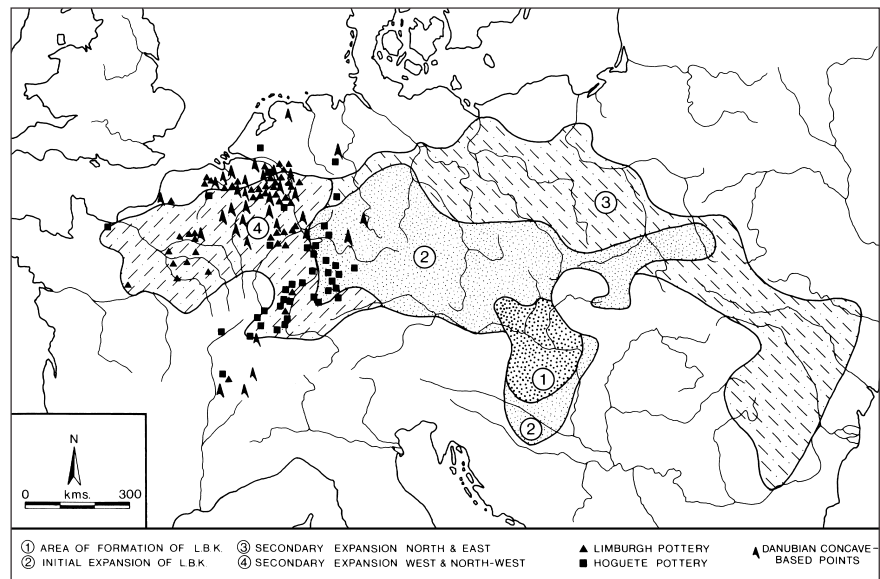


Fig. 2. The origin and dispersal of the Linear Pottery Ware culture. Base map after Lünning, Kloos and Albert (1989) and Bogucki (1995), with additional information from Guillaune and Manen (1995), Verhart and Vansleebe (1997), Gronenborn (1998).

textualised: they happened within an established framework of social networks, such as kinship ties, marriage alliances, trading/exchange partnerships and other social ties of reciprocity and obligation between the hunter-gatherers and the first farming settlements in a region. Within this scenario, the direction and the pace of the adoption of farming reflected a much the existing Mesolithic social context and routes of communication, as it did the conditions of the Neolithic communities and the regional ecological circumstances. The outcomes of such contacts between the foragers and farmers, documented ethnographically, are listed in the Table 1. Although such information can only serve as a rough guide to prehistoric situations, it is this form of contact, of socially embedded mobility unfolding between the two kinds of communities – foragers and farmers – which in my view was mostly responsible for the formation of the Neolithic in most regions of Europe.

FORAGER-FARMER CONTACTS AND THE SOCIAL CONTEXT OF THE AGRICULTURAL TRANSITION

From my review so far, it is clear that contacts between foraging and farming communities, and the social context of such contacts are fundamental to our understanding of the cultural, genetic and linguistic history of communities undergoing the transition to farming. How can we recognise the operation of social networks, with all its genetic and linguistic implications, in the archaeological record?

At the Mesolithic-Neolithic transition, the social context for such networks would have been provided by the agricultural frontier zones. Such frontier zones can be either static or mobile, and open to contact or closed (Alexander 1978; Dennell 1983; 1992). The role of contact between foragers and farmers across this frontier could have been both supportive (Gregg 1988; Bogucki 1988), and disruptive for the foragers (Moore 1985; Keeley 1992). I suggest that in the early phase of forager-farmer contact, cooperation would prevail. At this stage, the effect of the frontier would have been largely supportive: the exchange of raw materials, foodstuffs, tools and prestige items across the frontier would reduce unpredictable variation in food supply and the risk of failure for both the hunting and farming communities (Fig. 6).

Contacts between foragers and farmers may have also occurred in terms of client-patron relationships, in which foragers acted as providers of specialist services or as rented herders of livestock for farming communities (Feuwerker 1996). Typically, foragers derive economic benefit from livestock or its products, while farmers are able to extend the grazing area and increase the size of their herds through renting out to client foragers. Such a system has been in operation as a part of forager-farmer relationships in Africa. The movement of livestock may also have been of major importance in regional exchange systems. Such exchange in cattle would pass, as Sherratt (1982:23) suggested, 'as transactions between acephalous groups linked by alliances and as symbols of competitive prestige'.

There is a growing body of evidence for such exchange between foragers and farmers, which evidence comes from all parts of Europe (Figs. 2, 4 and 5). Let us take the frontier zone between foragers and farmers across the north European Plain as an example (Fig. 4). The date is fifth and fourth millennium bc. The imports from farming societies include the technology of pottery making and the pots themselves, such as the Baalberg and Michelsberg

pottery at Rosenhof (Schwabedissen 1981). They also include shoe-last adzes and other stone axe imports, while t-shaped antler axes, bone combs, and rings appear to be Ertebølle imitations of neolithic artefacts (Solberg 1989; Price and Gebauer 1992). Bones of cattle which are found in small quantities on late Mesolithic sites in Denmark, Scania and northern Poland are also probably the results of trade, traded perhaps as prestige items as well as food. These products may have been exchanged for furs, seal fat, and forest products such as honey. The evidence for the specialized exploitation of fur animals, and their use for fur rather than meat, at such sites as Tybrind Vig and Ringkloster (Andersen 1975; 1987; 2000; Rowley-Conwy 1999) offers at least some support to this suggestion.

A similar exchange system existed within the frontier zone in the Central and east Baltic, where we have clear evidence for trade in amber (Vankina 1970) and other prestige items (axes, pots), and possibly also agricultural imports (Dolukhanov 1979; 1993) and trade in seal fat (Fig. 5), (Zvelebil 1981;

Outcomes of contacts between foragers and farmers	
<p>Replacement</p> <p>Annihilation. Hunter-gatherer communities are annihilated by farming communities in a violent conflict or through disease</p> <p>Assimilation. Hunter-gatherer communities disintegrate and their members join farming communities, introducing some aspects of (material) culture into farming communities</p> <p>Adoption. Hunter-gatherer communities adopt farming way of life in the main, and accept farming ideology and a farming sense of identity, whilst retaining some aspects of traditional hunter-gatherer existence</p> <p>Acquisition. Hunter-gatherer communities adopt farming practices selectively, whilst retaining significant elements of traditional hunter-gatherer existence, thereby producing new, or mixed (hybrid) cultural traditions</p> <p>Integration</p> <p>Infiltration. Gradual penetration by small, usually specialist groups of a region, who fill a specific economic or social niche (i.e. hunters, fishermen, honey collectors, leather workers, livestock herders)</p>	<p>Integration (continued)</p> <p>Absorption of farmers by foragers. Hunter-gatherer communities absorb farming households by force or peacefully within their communities and way of life, whilst at the same time adopting some aspects of farming existence</p> <p>Survival</p> <p>Isolation. Hunter-gatherer communities remove themselves from contact with farming communities, usually by moving away and imposing "no man's land" between foragers and farmers; this results in a "closed static frontier"</p> <p>Encapsulation. Foragers are forced by farmers to move into suboptimal areas where they survive in relative isolation and impoverishment</p> <p>Commercialisation. Hunter-gatherers reorganise their economy in response to demands by farming communities and commercial interests further afield (e.g. fur trade)</p> <p>Reversion</p> <p>Reversion. Farmers return to hunting, fishing and gathering as the principal means of subsistence</p>

Tab. 1. Outcomes of contact between foragers and farmers.

Rowley-Conwy and Zvelebil 1989). Local pottery shows the influence of ornamental motifs from early Neolithic sites in the Dnieper basin (Zvelebil and Dolukhanov 1991) and from the western Baltic (Dolukhanov 1979; Timofeev 1987; 1990), giving rise to hybrid ceramic traditions in northeast Poland and Lithuania (Timofeev 1987). Such a network of contact and exchange reached out over a wide area of the Baltic and eastern Europe, creating a pathway for new ideas and cultural innovations, which, in the later stages, may have been manifested archaeologically in the Corded Ware/Boat Axe horizon (Zvelebil 1993; Zvelebil and Lillie 2000).

With the increasing stability of the agricultural frontier, disruptive effects gained the upper hand (Fig. 6). This would have been marked by the following developments:

- 1 Internal disruption of the social fabric among hunter-gatherers arising from increased circulation of prestige items and increased social competition.
- 2 Opportunistic use of hunter-gatherer lands by farmers, which, as Moore has shown, can cause serious interference in hunter-gatherer foraging strategies and information exchange (Moore 1985) and initiate an ecological change disruptive for foraging strategies.
- 3 Direct procurement of raw materials and wild foods by farmers establishing their own 'hunting lands' in hunter-gatherer territories as part of a secondary agricultural expansion.
- 4 Ecological change and over-exploitation consequent upon the development of commercially-oriented hunting and gathering
- 5 Hypergyny: loss of women through marriage, voluntary departure or appropriation from hunting-gathering to farming communities, thereby generating an excess of women among farmers (hypergyny), and a shortage among hunter-gatherers (hypogyny). This is an ideologically conditioned

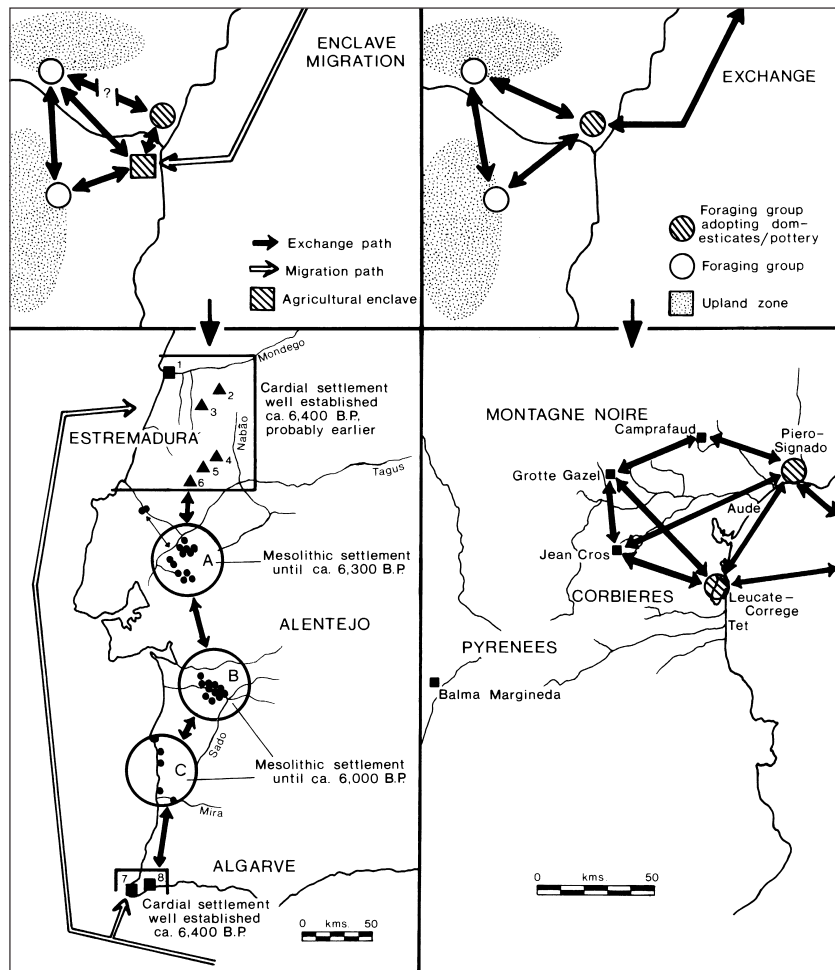


Fig. 3. Origins of the Neolithic communities in Iberian peninsula: Different views for different regions. Redrawn after Barnett (1995), Zilhão (1997), Auban (1997).

practice, occurring in situations where among women farming is perceived as being of greater advantage than a hunting-gathering existence.

- 6 Transmission of disease between the two communities

There are several indicators of conflict and competition within the agricultural frontier zone in northern Europe. These include marks of increased social competition, territoriality, and violence among the late Mesolithic hunter-gatherers around the perimeter of the agricultural frontier on the north European plain (Whittle 1996; Keeley 1992) and southern Scandinavia (Persson and Persson 1984; Bennike 1985; Meiklejohn and Zvelebil 1991; Price and Gebauer 1992), the presence of fortified farming villages on the farming side of the frontier and, in some areas such as in Limburgh and Brabant, the existence of a 'no man's land' (Keeley 1992). Similar areas of apparently unoccupied land around 20–40 km in width can be detected between the agricultural Bronze Age

and forager inland Neolithic sites during the first millennium bc in Finland, again suggesting antagonistic relations prior to the transformation of the hunter-gatherer communities there (Zvelebil 1981). Similarly, the presence of Mesolithic armatures for arrows in Neolithic assemblages in Poland, Germany and the Low Countries could be explained as a manifestation of conflict between foragers and farmers, while Neolithic artefacts could be seen as loot rather than imports (Tomaszewski 1988; Keeley 1992; Gromenborn 1990)

Some regional examples

It is my belief that contacts and exchanges such as those outlined here were principally responsible for the emergence of Neolithic communities in Europe through cultural transformations of the kind illustrated in Table 1. We are now beginning to reconstruct regional histories of the emergence of the Neolithic communities in various parts of Europe. This includes social and ideological, not just economic contexts. For example, Radovanović (1996) argues convincingly that ideological integration and a shift from individual to collective identity in the Iron Gates region extended the existence of hunter-gatherer communities there and enabled their eventual assimilation into the surrounding world of farmers. Similar arguments were used to explain the constitution of Neolithic societies in north-west Europe (Armit and Finlayson 1992; Tilley 1994; Thomas 1996).

Similarly, if we turn to the Baltic Sea basin as an example, it is clear that hunter-gatherers, as individuals and as communities, played an active part in the introduction of agropastoral farming and the appearance of the first Neolithic communities on the north European plain. In so doing, they have contributed to the generation of the Neolithic in two ways: by the transformation of their own communities and by their influence on the established

farming settlements (Zvelebil 1986b; 1993; 1998; Bogucki 1988; Midgley 1993; Whittle 1996; Janik 1998; Price 2000; see also Thomas 1996 and contrast with Thomas 1988). The remarkable cultural diversity which characterises the first Neolithic of the TRB (Trichterbecherkultur or Funnel Beaker) tradition there and of the subsequent cultural groups is a reflection of the divergent ways in which Neolithic communities developed through contact and native transformation.

Western Baltic region

The historical situation of the west Baltic region is marked by the extended delay and then a rapid adoption of farming – long availability, short substitution. As hunter-gatherers of relative social and economic complexity (Rowley-Conwy 1983; 1999; Price 1987; 2000; Larsson 1990; Tilley 1994) the inhabitants of the coastal zone were better equipped demographically and technologically to interact with the farming communities on a more equal basis than the foragers of the interior. Here, the erosive effects of the competition may never have gained the upper hand. The early and extended phase of contact between forager and farmer communities in the fourth millennium bc may have established enduring kinship ties, and resulted in associated transferral of ex-

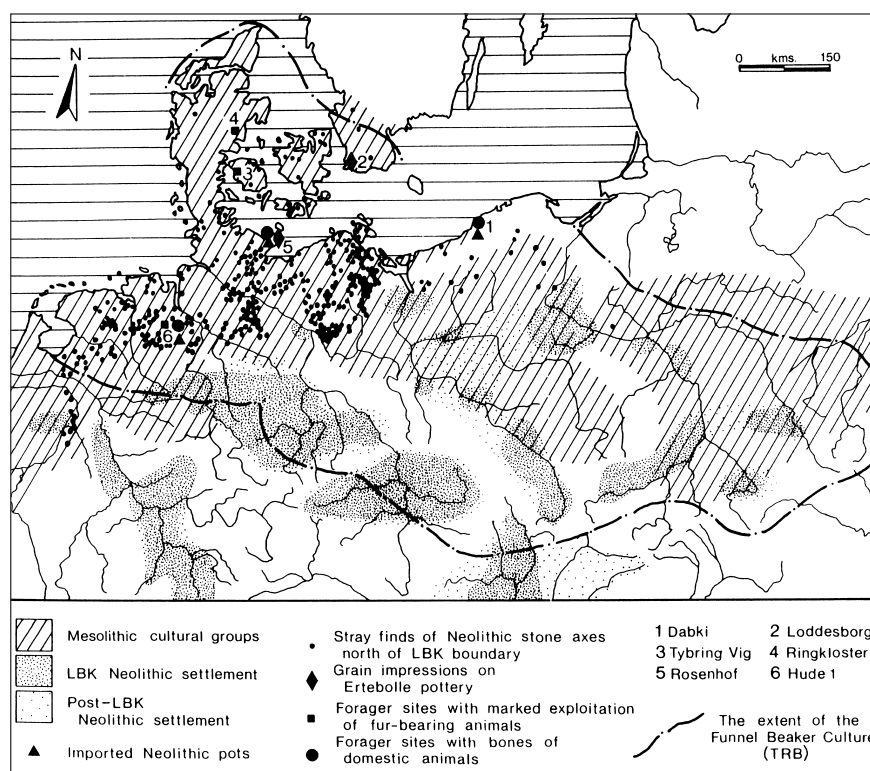


Fig. 4. Origins of the Neolithic communities on the north European plain. Several sources (see Zvelebil 1996).

change from the inter-tribal to tribal context, i.e. from negative to generalised/balanced reciprocity. Such relations were also likely to result in intermarriage rather than loss of women to farming communities, and consequently in the blending of cultural traits and the genesis of a new archaeological culture. In terms of cultural developments, listed in Figure 2, these considerations suggest processes of acquisition, absorption, and then adoption of the farming way of life in this region (Tab. 1, Fig. 5).

Southern Baltic Region

The genesis of the TRB culture east of the Odra (Oder) river on the north European (Polish) plain shows similar patterns of change and continuity. One of the most striking features of the conditions prevailing on the Polish plain is the long co-existence of farming and hunting-gathering communities, co-existence that lasted for more than 2500 years between 4400 and 1700 bc. In some areas, such as Ku-

yavia or Pomerania, hunter-gatherers and farmers – both of the TRB and the Danubian tradition – lived side by side only a few kilometres apart (Zvelebil, Dennell and Domaska 1998). Despite the coarse spatial and temporal resolution of the evidence available today, such patterning suggests a very gradual incorporation of foraging communities with those of farmers after an extended history of contact, occurring within some established and effective framework. Such a framework may have been created by hunter-gatherers responding to the needs of the farming settlements and to their own social needs by commercialising their operations. Within such a framework, hunter-gatherers would play the role of suppliers of specialised goods and services, such as products of hunting, fishing, and sealing, and act perhaps as herders in client-patron relationships. The inter-marriage between the two communities would result in the breakdown of the early farming (LBK and Lengyel) social and ideological structure, witnessed, for example, in the final stage of the Brzesc

Kujawski settlement in Kuyavia (Bogucki 1995; 1998), and a subsequent development of a new foraging-farming community, identified archaeologically as TRB (Midgley 1993). This process would have been accomplished inter-generationally, as one generation replicated and combined the cultural traditions of earlier foraging and farming generations, in an act of cultural creolisation. These considerations suggest the processes of commercialisation followed by integration of farmers as the basis of the cultural transformation responsible for the emergence of the TRB Neolithic (Zvelebil 1998; Zvelebil and Lillie 2000) (Tab. 1, Fig. 4).

East Baltic Region

In the Eastern Baltic, the picture was different again. Instead of generations of separate co-existence and creolisation, we can identify the slow and staggered adoption of cultural traits and innovations, traditionally associated with

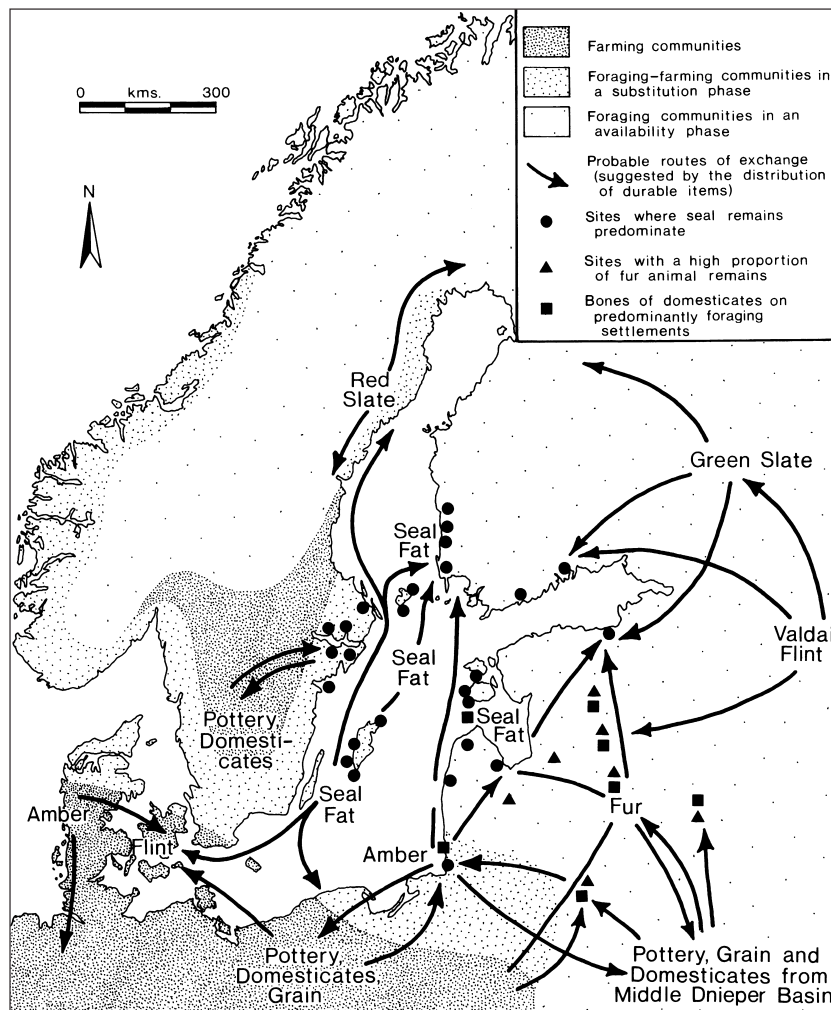


Fig. 5. Agricultural Frontier Zone and forager-farmer contacts in central and eastern Baltic 2500-1500 bc (after Zvelebil 1996).

the Neolithic, by communities of indigenous hunter-gatherers. The use of ceramics was adopted first, between 4500 and 4000 bc (see *Timofeev 1987; 1998; 1999; Dolukhanov 1979; 1986; 1996; Zvelebil and Dolukhanov 1991*). Elements of agro-pastoral farming were adopted at a very slow rate over the following three thousand years: the decisive shift to an agro-pastoral economy occurred between 1300 and 600 bc. In between, there was a society based principally on hunting and gathering for subsistence, yet making some occasional use of domesticates and possibly cultigens from about 2500 bc (*Rimantiene 1992; Vuorela and Lempiäinen 1988*). The presence of domesticates in such low numbers can be explained as a result of wide-ranging trading networks, operating within the context of the Corded Ware/Boat Axe culture (*Dolukhanov 1979; Zvelebil 1993*); while their limited use, which continued until the end of the second millennium bc, fits with the notion of their ritual and symbolic, rather than economic significance (*Hayden 1990*). The picture emerging here, then, is one of acquisition of Neolithic technology by hunter-gatherers and commercialisation of hunter-gatherer communities during some 3000 years before the final adoption of farming (Tab. 1, Fig. 5)

**AGRICULTURAL TRANSITION:
INTERPRETATIONS OF GENETIC EVIDENCE**

A wide range of genetic studies, relating to the agricultural transition in Europe and the origins of the Neolithic, has been carried out to date (*i.e. Ammerman and Cavalli-Sforza 1984; Cavalli-Sforza 1991; 1997; Cavalli-Sforza and Piazza 1993; Cavalli-Sforza et al. 1994; Cavalli-Sforza and Cavalli-Sforza 1995; Richards et al. 1996; 1998; 2000; Calafell and Betranpetit 1993; Barbujani and Sokal 1990; Sokal et al. 1989; 1991; 1992; 1998; Torroni et al. 1998; Renfrew and Boyle 2000; etc.*). These studies include human DNA, as well as the DNA of domestic plants and animals (*i.e. Bailey et al. 1996; Bradley 1997; Renfrew and Boyle 2000*). They involve mostly modern but also ancient samples. Most of this work is at the cutting edge of research and of enormous importance to our understanding of the cultural, genetic and linguistic history of populations in Europe and elsewhere.

At the same time, genetically-driven explanations are usually used to argue the case for the introduction of the Neolithic into Europe through migration or demic diffusion – both forms of population move-

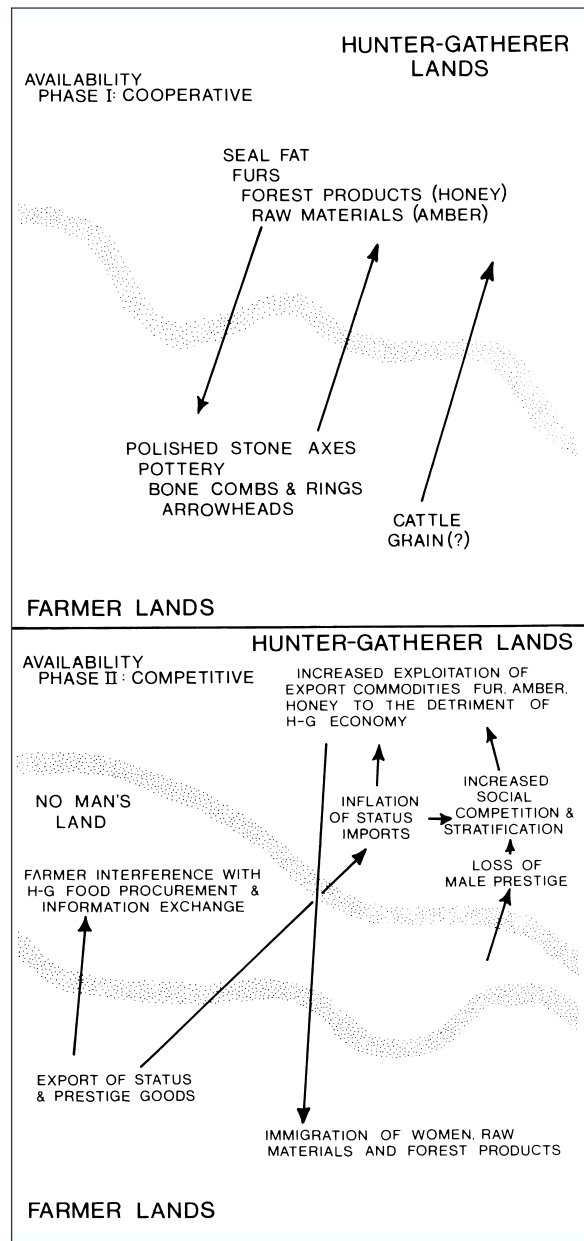


Fig. 6. Exchanges between foragers and farmers within an agricultural frontier zone: a general pattern (after Zvelebil 1996).

ment. Consequently, such explanations are often at variance with the archaeological interpretation of the evidence. In particular, the question of social context and of socially embedded, small scale genetic exchanges at the agricultural transition represent a problematic issue. In the critical appraisal below I address questions of methodology to my colleagues in palaeogenetics and argue that the conditional pattern and structure identified in the genetic patterning of European populations through principal component analyses and other methods can, to my mind, be explained in ways other than migration or demic diffusion.

March of the genes: the case of Europe

Based on published genetic evidence and the papers given at the 1999 HUGO conference at Cambridge (Renfrew and Boyle 2000), five major migratory events contributed to shaping the demographic history of modern populations in Europe:

❶ Initial colonisation by *anatomically* modern humans from North Africa/Near East by all or any of three routes: from North Africa, from Anatolia into the Balkans, and by a Circum-Pontic route north of the Black Sea. Date, based on mutation rates (dating by 'molecular clock'), falls between 50 000–30 000 BP. This migration horizon is indicated by mitochondrial and Y-chromosomal evidence (Otte 2000; Richards et al. 1996; 1998; 2000).

❷ Later intrusion into Europe during the Upper Palaeolithic, perhaps associated with the Gravettian culture, dated between 25 000 and 20 000 BP from Eastern Europe/Near East. This is based principally on mitochondrial evidence (Richards et al. 1998; Torronni et al. 1998; Evison 1999 and in press).

❸ Late Glacial population expansion and colonisation of areas freed by deglaciation in northern Europe. Thought to originate from south-west France/northern Spain, Late Palaeolithic hunter-gatherers of the Magdalenian tradition moved north between 15 000 and 10 000 BP, colonising areas hitherto covered by ice, water or polar desert. This is based on mitochondrial, Y-chromosomal and classical marker evidence (Torronni et al. 1998, 1149). The modern composition of European gene pool reflects this movement more strongly than any other demographic event (according to Richards et al. (1996; 1998), around 85% of European mitochondrial sequences thought to originate in the Upper Palaeolithic), and provides the best correlation with archaeological data (Richards et al. 1996; 1998; 2000; Torronni et al. 1998; Evison 1999 and in press).

❹ Early post-glacial 'demic diffusion' into Europe by the first farmers from the Near East, ushering the Neolithic into Europe. Identified initially through 'classical markers', this notion is now supported to the extent of 'pioneer' or 'leapfrog' colonisation by mitochondrial DNA and Y-chromosomal DNA: dated to 8500–5500 BP (Richards et al. 1996; 2000; see below).

❺ Late prehistoric intrusion from eastern Europe, thought to represent nomadic and pastoral Indo-Eu-

ropean speakers, moving into central Europe and adjacent regions in the north, west and south-east. This horizon is dated to 6000–4500 BP and supported mainly by the principal component analysis of classical markers (Ammerman and Cavalli-Sforza 1984; Cavalli-Sforza et al. 1994; Cavalli-Sforza and Cavalli-Sforza 1995; Renfrew and Boyle 2000).

❻ Later movements of the classical and early medieval 'migration' period, which are more geographically restricted in character, and much better documented historically. They are held to explain only a small amount of modern genetic variation in Europe, yet the genetic evidence for gene flow in the first millennium AD is more compelling than any other (see papers in this volume, Cavalli-Sforza et al. 1994; Cavalli-Sforza and Cavalli-Sforza 1995; Laan and Paabo 1997; Torronni et al. 1998; Richards et al. 1998, 253, 258).

It is clear there is disagreement among geneticists themselves on the relative contribution of each of these demographic events to the genetic history of European populations (compare and contrast, for example, papers in Renfrew and Boyle 2000; Cavalli-Sforza et al. 1994 and Richards et al. 1996; 1998; 2000; Evison 1999; about the Neolithic dispersals, Richards et al. 1996; 1998; Torronni et al. 1998 and Cavalli-Sforza and Minch 1997; Izzagirre and de la Rua 1999 about the late glacial migrations, or see Calafell and Bertranpetit 1993; Lalueza Fox 1996; Jackes et al. 1997 about the genetic history of Iberian peninsula). There are also different degrees of correspondence with archaeological and historical data, the late glacial and the early historic (first millennium AD) perhaps commanding the best support. Against this background, I would like to focus now on the genetic support for the demic diffusion at the beginning of the Neolithic period (the fourth major demographic event).

Population movements at the agricultural transition: a closer look

The genetic evidence for the post-glacial 'demic diffusion' of Neolithic farmers is based on three sets of data:

❶ Principal component analysis of the 'classical markers'. The first principal component explains, according to Cavalli-Sforza (Ammermann and Cavalli-Sforza 1984; Cavalli-Sforza and Cavalli-Sforza 1997), about 26%–28% of the modern genetic varia-

tion of Europe, mapped as a gradual distribution in values between the Near East and north-west Europe the directionality of spread indicated could be from either margin).

② Mitochondrial DNA analysis, which seems to be more reliable than the component analysis of ‘classical markers’ because fewer assumptions are involved, shows a similar trend, but this accounts only for 10%–20% of mitochondrial sequences (*Richards et al. 1996; 1998; 2000*). Based on the founder analysis of mitochondrial DNA, Richards et al conclude that ‘the Neolithic contribution to the extant mtDNA pool is probably on the order of 10%–20% overall. Our regional analyses support this, with values of ~20% for southeastern, central, northwestern and northeastern Europe....Incoming lineages, at least on the maternal side, were nevertheless in the minority, in comparison with indigenous Mesolithic lineages whose bearers adopted the new way of life. This does not exclude the possibility that acculturation occurred principally in southeastern Europe and that there was considerable replacement in central Europe. The Mesolithic component is even higher along the Mediterranean coastline....The Neolithic component here is ~10%. It is similar in Scandinavia, where, again the development of the Neolithic way of life was very late and the impact of newcomers likely was slight’ (*Richards et al. 2000.1271*).

③ Y-chromosomal DNA analysis confirm the mitochondrial evidence: the frequency of Y-chromosome haplotypes originating in the Near East average about 15%, with around 25% in the Balkans, and less than 10% in western Europe (*Semino et al. 1996*). From my understanding of these patterns, two other explanations are more plausible than the demic diffusion model. These would be more in keeping with the more reliable mitochondrial and Y-chromosomal evidence outlined above:

- a ‘Star-burst’ pattern of regional demic expansion, which I outlined above (in-filling or locally available niches utilised by a genetically mixed population comprising local hunter-gatherers and some immigrant farmers). Arguably, this might produce the graded variation pattern observed in modern genome more faithfully than the demic diffusion would.
- b ‘Incremental palimpsest’ whereby the pattern we see today is a palimpsest of small-scale population movements progressing from south-east Europe to the north-west over millennia. This would not be surprising given that Europe is a north-western peninsular extension of Asia.

Discussion of the genetic evidence

As a non-geneticist, I am all too aware of my own incomplete understanding of methodological issues involved as well as of the implications for the interpretation of broader patterns of human behaviour. But in my opinion, there are uncertainties regarding the understanding and the historical interpretation of genetic evidence. These can be grouped into two types of potential errors:

Category 1 error is a group of potential errors internal to archaeogenetic analysis of human genome as a methodological procedure. Reconstructing genetic history from modern population genetics (i.e. tracing ancestry of modern populations back into the remote past, reconstructing their lines of descent) appear to have the following potential sources of error (Tab. 3):

① *The size of the sample*: this is often too small for the size of the sampled population unit, itself often defined in a questionable way (see below), (*Evison in press; Moore 1994; etc*).

② *Dating of genetic changes* within samples by mutation rates, or molecular clock. As some have noted, ‘molecular clock models are full of questionable assumptions’ (*Clark 1997; Lewin 1988a; 1988b*). The mutation rates, held to account for gene or gene-derived polymorphisms is assumed to be constant, but apparently are not always so. The constant rate of accumulation of genetic changes is based on the assumptions of demographically stable populations and on adaptively neutral role of genetic traits. These assumptions are rarely if ever met in reality for reasons outlined below. The result is that the dating of genetic changes, and, by implication, demographic events, such as gene flow (migration) has very broad confidence limits and may be in error altogether.

③ *Genetic drift*: It is assumed that genetic drift in small isolated populations will result in marked genetic heterogeneity relative to other populations and in the expression of signature mutations through founder effect. Hunter-gatherer populations in general are often quoted as examples of such populations, for example by Cavalli-Sorza et al (*1994.15*) in the case of the European Mesolithic. Yet as many have recognised, exogamy is a common feature of such populations to keep them as viable interbreeding networks (i.e. *Wobst 1974; Cavalli-Sforza and Cavalli-Sforza 1995.19–20*). Moore (*1994.93A*) has

shown that intermarriage between separate ethnic groups of North American hunter-gatherers was likely to equalise any distinct genetic signatures and homogenise genetic patterning across large areas such as the Plains of North America 'within a few hundred years. In reality, many, if not all, small-scale populations share in large interbreeding networks for reasons of survival. This appears to violate the assumption of stable population units (*see also MacEachern 2000*). Would this not homogenise the genetic landscape of small, low-density populations and obscure genetic signatures of population units defined by language or ethnicity (*i.e. Amorin 1999; Moore 1994*)?

④ *Natural selection* and environmental factors are not given a full role in the explanation of genetic variability. Although genes are assumed to be adaptively neutral, or at least non-directional (in that stochastic variation neutralizes any patterning), it is clear that the presence or absence of specific haplotypes may be related to disease resistance, or otherwise, confers selective advantages or disadvantages on an individual in specific ecological and/or cultural circumstances. The HLA complex (*Cavalli-Sforza et al. 1994; Evison in press*), or genetic mutations controlling for thalassemia (*Cavalli-Sforza et al. 1994*) or for lactase tolerance (*Harrison 1975; McCracken 1971; Simoons 1979; Hollox 2000*) can all be used as examples. Given the well-known selective role of some genetic variants, one is tempted to ask why is the role of selection apparently minimised in archaeogenetics?

⑤ *Age-sex structure of the reproducing population*. Mutation rates can be expected to increase as the child-bearing population gets older. This would indicate that mutation rates should have speeded up in the last few generations (c300 years, *see Hammel 1996*), rendering the 'molecular clock' faster. This is at variance with the assumption of the constant rate of mutation changes which forms the basis for the dating of demographic events by molecular clock (*see Richards et al. 2000 for further discussion*).

⑥ There is a wide range of *statistical problems* such as spatial auto-correlation, associated with the principal component analysis and other forms of correlation between genes and geography, weakening the statistical treatment of genetic evidence and reducing the probability of the conclusions being correct (*Clark 1997; Bandelt et al. 1995; Amorin 1999; Richards et al. 2000; Renfrew and Boyle 2000*). Failure to address weaknesses inherent in some of the assumptions operationally necessary for the perfor-

mance of statistical tests is leading to the loss of confidence, 'Cavalli-Sforza uses principal component analysis (PCA) to ransack correlation coefficient matrices for pattern in genetic polymorphisms and isolates a number of principal components, expressed geographically, which are interpreted as time-successive, quasi-historical, migration events....This form of argument from induction is called post-hoc accommodation....a weak form of inference' (*Clark 1997:407, for similar critique, see also Moore 1994; MacEachern 2000*). Are the critics wrong or should the geneticists adhere to a more sober form of statistically-supported interpretation?

⑦ *The overall representativeness of the sample*: all the assumptions discussed above bear on the representativeness of the investigated sample. In addition, there is the problem of relationships between different units of analysis within the population as an interbreeding unit. This is true somatically of different genetic units within an individual, as well as extra-somatically, when it comes to specifying the relationship between the individual and the population. As Moore put it: 'It is misleading for synthesists to treat the nodes of genetic cladograms as if they were tribes or demes, not to mention regional or continental populations. Even if we had a complete mitochondrial cladogram for all human beings, it would say nothing about where the individual carriers of the genotypes lived or what the genetic variability in local populations might have been. Individual pedigrees and histories of populations are two entirely different matters. Nevertheless, certain sythesists continue to treat ancestral sequences as if they were characteristic of populations all carrying the same genotype as the reconstructed individual' (*Moore 1994:934*).

⑧ *Inter-demic genome similarities, the dating of demographic events by molecular clock and the palimpsest effect*: All the 'type 1 errors' noted above combine to reduce the reliability of reconstructing population histories from genetic evidence. This is particularly true if the representativeness of the sample is statistically compromised and if the dating of demographic events depends on mutation rates within a single class of genetic data. Genetic variation described by the principal component analysis and other diversity measures reflects not only demographic events such as migrations, but also the genetic distance between incomers and the native population, as well as the genetic distances between incomers at any one time and subsequent population movements (*Cavalli-Sforza and Cavalli-Sforza 1995*;

Zvelebil 1995; 1998; Richards et al. 1996; 2000). Most human genetic diversity is intra-populational, with only a very small proportion of genome accounting for differences between populations (*Amorin 1999.18*). The consequence of this realisation appears to be at least twofold. On the one hand, principal components such those used to argue for the Neolithic colonisation of Europe from the Near East may in fact reflect a diachronic incremental palimpsest of small-scale intrusions into Europe, the patterning of which is set by the geography of Europe as a peninsular extension of Asia. On the other hand, a migration of Neolithic farmers into Europe may not be detected genetically if the donor and target gene-pools were sufficiently similar.

Category 2 errors are relational, arising from presumed relationships between the genetic population (gene pool) and its related components, such as language, material culture, and ethnicity. We are back to the notion of human societies whose organisation is predicated on the ideology of ethnic nationalism, and on the normative definition of ethnicity, based on descent (and therefore genetic uniformity). But these relational components are not corresponding units, in either the analytical sense, or in conceptual sense (*Moore 1994; Pluciennik 1996; MacEachern 2000*). As MacEachern notes: 'Probably the most obvious of these problems is one that bedevils all interdisciplinary investigations of the human past: to what extent are the very different analytical units in these various disciplines comparable? Under what circumstances may we expect that ethnicity, language, material culture and gene pool will co-vary in the past, and when can we expect that they will differ in extent and characteristics?' (*2000.359*).

Analytically, it is a matter of size and definition. Different population sizes pose different sampling and methodological problems. Related to this is the definition of demes, as groups whose members share greater genetic similarity because of greater frequency of interbreeding relative to non-members. How to define these units operationally? As many studies have shown, ethnic identity or shared language is a poor indicator of demes genetically defined (*e.g. Bateman et al. 1990; Moore 1994; and MacEachern 2000*). If this is the case, where do we go from here? Is there a case for random sampling of the gene pool, irrespective of cultural attributes?

Conceptually, it is a matter of meaning and temporality. It is often assumed that human society is organised in culturally meaningful corresponding units

(‘analogous taxonomies’, *MacEachern 2000*), giving us a normative definition of a genetic population as linguistically and culturally uniform ethnic unit so: population = language unit = cultural unit = ethnic unit (tribe)). Yet the analytical units used are not comparable. It cannot be assumed that language, ethnicity, material culture and gene pool will co-vary in the past, and we do not know how such co-variation might work. At best, we can assume a broader relationship approximately as follows: deme = speech community = social network = shared material culture, but not exclusively so.

In the 20th century, European archaeology was mostly dominated by the culture historical paradigm and the normative concept of culture. Formulated at the beginning of the century (*Kossinna 1911; 1926*) it gained broad acceptance through the work of pre-eminent scholars such as Gordon Childe (*1929; 1956*). The organising principle of the normative concept of culture was the belief that archaeological artefacts by their shape and decoration symbolise ethnic identity, and that the distribution of key artefacts or their salient features identify ancient settlement areas of tribes or ethnic groups in prehistory. Following this principle, cultural homogeneity becomes a signature of an ethnic group, differences in material culture can be explained in terms of ethnic variation, and the replacement of one set of cultural features by another identifies migration and population replacement. In this way, the normative concept of culture became the principal framework for explaining culture change

David Clarke, in his seminal essays (*1968, 1972*) rejected Childe’s approach. He noted that ethnographic case studies of cultural variation showed considerable heterogeneity (*Clarke 1968*). Even within ‘homogenous cultures’ there was polythetic variation between assemblages from different locations, with overall affinity level ranging from 65%–95%. Assemblages sharing 65%–30% of traits tended to belong to separate social groups with a considerable degree of contact and communication. Assemblages sharing 30% or less of attributes tended to reflect only common functional purpose or a response to similar ecological conditions, lending some empirical support to the notion of techno-complexes (*Clarke 1968.387–388, 398*). Such ethnographic observations, methodological considerations and archaeological case studies (*Clarke 1970; 1972*) convinced Clarke that archaeological cultures should be re-defined as polythetic sets of attributes representing cultural traditions of human groups with different

sets of meaning (i.e. trade and contact areas, techno-complexes, cultural identity areas). As Shennan notes, both Childe and Clarke 'adopted classificatory expedients to remove the untidiness in the cross-cutting distributions, rather than taking the more radical step of recognising that this untidiness is, in fact, the essence of the situation, arising from the fact that there are no such entities as 'cultures', simply the contingent interrelations of different distributions, produced by different factors' (*Shennan 1989:13*).

Other workers broadly within the processual school of thought, have drawn attention to patterns of deposition and to post-depositional processes which selectively accord archaeological materials their patterning and distribution (i.e. *Binford 1962; 1965; 1968; 1972; 1983; Schiffer 1972; 1976; etc.*). The essence of the processual critique of the normative concept of culture was that variation in material culture arises from a wide range of different factors, operating at the original time of deposition as well as post-depositionally; that such factors are both human and non-human, and that variation caused by humans may be intentional or incidental. Together, all of this generates varying combinations of cultural patterning in space with very different meanings.

Post-modernist deconstruction of the concept of archaeological culture has been led by Hodder (*1982; 1992; etc.*), Barrett (*1994*), and Shanks and Tilley (*1987*). In summary, culture is represented as a social tradition in a constant state of change, and material culture is perceived as an active agent, employed by 'knowledgeable human actors' in reproducing culture as a social tradition. It is stressed that situationally embedded symbolism and ideological variables have a decisive influence on the spatial patterning of material culture attributes such as shape and decoration of objects. Because the meaning of things is situational and dependent on social context, an object can be loaded with several meanings, whose significance will change with the context of use and with time. Artefacts are not merely used as tools or symbols, but are actively manipulated in the negotiation of identities, negotiation for status and power, negotiation for resources, and negotiation of the meaning of things and events (as, for example, in the representation of the past). It follows then that artefacts do not reveal the past in the way it was, but are 'meaningfully constituted' by a double process of interpretation, 'double hermeneutic'. The first occurred through the agency of human actors in antiquity in the specific context of the ideologies of the past, the second is imposed by the ideological

codes and knowledge of the contemporary investigators. Archaeologists are clearly not in a position to understand the full range of meanings embedded in an object's attributes under these conditions.

This is not the place to explain in detail the enormous amount of work carried in archaeology about the nature of archaeological cultures in the last 40 years. But as a result of these developments, we are far less naive today, and the problem of understanding archaeological cultures is far more complicated than under the culture historical paradigm. We now know that archaeological cultures do not, as a rule, correlate with ethnic groups, although there are exceptions. At minimum, we know that the constitution and meaning of archaeological culture can reflect a wide number of variables, such as patterns of discard and deposition reflecting ecological conditions, existing levels of technology, function, cultural tradition and patterns of inter-generational transmission of knowledge, patterns of trade and exchange, social status of artefacts, routine activities in the landscape, a range of overlapping symbolic activities, post-depositional processes of selective destruction and relocation, and the selective interpretation and reinterpretation of cultural remains, mediated by strategic, ideological and political agendas of humans as social actors. Cultural variation symbolising ethnicity is merely one among many variables which play a role the composition of an archaeological culture.

Additionally, problems emerge at both ends of the direct equation between archaeological cultures and ethnic groups. The correlative nature of this relationship has now been evaluated and mostly discredited by anthropologists, archaeologist, and linguists (for example, see *Clarke 1968; Binford 1962; 1965; 1983; Hodder 1978; Shennan 1989; Graves-Brown et al. 1996 and Jones 1997 for archaeology, Ehret 1988; Bateman et al. 1990; and Thomason and Kaufman 1988 for linguistics, and Fried 1967; 1968; Barth 1969; 1994; Moore 1994; MacEachern 2000; or Terrell and Stewart 1996 for ethnography*).

The concept of ethnicity in particular generates its own problems (*Barth 1969; Moore 1994; Plucienik 1996; MacEachern 2000*). These are both temporal and spatial. Historically, we cannot assume that notions of ethnicity, as we understand them today, can be projected into the past. Ethnic groups are subjective, constructed and situational, deeply embedded in economic and political relations. As Barth (*1969; 1994*) demonstrated, ethnicity is a

changing phenomenon, which tends to attain greatest expression in situations of conflict, competition and cultural change. As such, ethnic groups can be characterised as interest groups competing for economic and political resources and territory. This aduces a degree of opportunism to ethnicity in the characterisation of it as a situational resource. It follows that identity, including ethnic identity, must be at least partly understood as a strategic resource, with its definition, membership, symbolic power and material expression changing situationally and with the historical conditions. This fluidity of boundaries of social identity is particularly true among hunter-gatherer societies and other groups with low population densities (*Hodder 1978; MacEachern 2000; Pluciennik 1996; Wobst 1974*).

So, in summary it is incorrect to assume that language, genes and cultural identity (as a broader definition of ethnic identity) are co-evally overlapping in space. First, we are not dealing with corresponding units of definition or analysis (*Moore 1994; MacEachern 2000*). Second, genetic populations, linguistic areas and archaeological cultures, however defined, overlap in space at any one time only rarely, if ever (*i.e. see Clarke 1968 and references above*). In other words, it is difficult to identify which, if any of such elements specify a population's ethnic sense of belonging in its historically situated context. Neither archaeological nor genetic evidence alone shed any light on the linguistic identity or ethnicity of the colonising populations. however interesting, all these suggestions, must retain the status of speculative hypotheses of relative veracity until a carefully considered combination of archaeological, genetic and linguistic data are brought to bear upon them in a methodologically sophisticated assessment.

CONCLUSIONS

To summarise my argument, the agricultural transition in Europe, and the origin of the Neolithic communities can only be understood in its social and historical context, which involved both the resident hunter-gatherer Mesolithic populations, as well as immigrating communities of early farmers. The degree of mobility and the mechanism of dispersal were regionally variable across Europe, as was the genetic contribution of each the foragers and farmers to the subsequent Neolithic populations of Europe. To date, genetic evidence can be interpreted to accommodate several mechanism of dispersal, while archaeological evidence shows hunter-gatherer con-

tinuity and contact across the agricultural transition in western, northern and eastern Europe.

From my argument here we should expect that the gene pool of the Mesolithic and the Neolithic populations was largely the same in western, northern and eastern Europe, while in the European continental interior we can expect a mixed gene pool comprising both the indigenous and immigrant elements. In central and south-eastern Europe, this would involve a limited gene flow between the initial farming settlements and the indigenous hunter-gatherers, and in some regions such as Danubian basin, the farmers themselves could be expected to originate mostly in the same region as the foragers, if one accepts that it was the local foragers who adopted farming and then undertook regionally specific dispersals through Central Europe, archaeologically recognisable as the Linear Pottery Ware Culture.

It is often the prevailing view that our genetic inheritance played a key, if not the determining role in our cultural behaviour, that 'Our genes make us what we are' (*John Hands, reporting on recent archaeological research, The Independent, 20.10.96*).

Far from it. Our behaviour, even our physical characteristics are determined in a large measure by our history and our society. The resources placed at our disposal by culture enable us to change and transform the conditions set by our genes and make us into something other than our genes would. That is the essential point if we want to understand the way we were in the prehistoric past, as well as who we are today.

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