EARLY AGRICULTURALIST POPULATION DIASPORAS? FARMING, LANGUAGES, AND GENES

Peter Bellwood
School of Archaeology and Anthropology, Australian National University, Canberra ACT 0200, Australia; e-mail: peter.bellwood@anu.edu.au

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Abstract
The consequences of early agricultural development in several regions of the Old and New Worlds included population growth, the spread of new material cultures and of food-producing economies, the expansions of language families, and in many cases the geographical expansions of the early farming populations themselves into territories previously occupied by hunters and gatherers. This chapter discusses some of the different outcomes that can be expected according to the differing perspectives of archaeology, linguistics, and biological anthropology. I argue that agriculturalist expansion lies at the root of many of the world’s major language families, although this need not imply that farmers always replaced hunter-gatherers in the biological sense. History, environmental variations, and prior cultural configurations dictated many of the outcomes, some of which played a fundamental role in the large-scale genesis of human cultural and biological patterning from Neolithic/Formative times into the world of today.

INTRODUCTION
This chapter discusses the multidisciplinary implications of a series of major changes from hunting-gathering to farming that occurred in various parts of the world, at varying times, often independently of each other. They are of particular interest because of their potential linkages with language family and population dispersals. They form major keystones in the explanation of the patterns of human variation, both cultural and biological, that characterized the pre-Columbian world and that still dominate in many parts of the world today. As far as the general likelihood of early agriculturalist (Neolithic/Formative) population dispersal is concerned, the time has come to take stock, to look dispassionately at the options, and to take a worldwide multidisciplinary view. Some guidelines and a feeling for issues that might respond to theoretical debate should help the momentum along.
Human prehistory gives us a record of two very important, yet at first sight unrelated, examples of expansion. These are (a) the expansions of agricultural systems from hearth areas such as Southwest Asia, China, and Mesoamerica, and (b) the expansions of the world’s major language families. Some of the latter are of course associated with predominantly hunter-gatherer populations, but the majority occur in agricultural latitudes and their component languages are spoken by people who were already agriculturalists at the dawn of history. Many of these widespread agriculturalist language families, such as Austronesian, Indo-European, Niger-Congo, Uto-Aztecan, and Afroasiatic, had reached their precolonial geographical limits (give or take a few hundred kilometres) long before the local existence of any written records—their spreads belong among prehistoric farmers/pastoralists and small-scale social formations, rather than among the great conquest empires and charismatic world religions of history. Could the early dispersals of agriculture and the early spreads of certain major language families be linked effects of the same underlying set of causes? Do these causes relate to the demographic growth and rapid expansion profiles of early farmers?

In recent years, a number of prehistorians have suggested that there are major linkages between the relevant cultural, linguistic, and biological data sets pertaining to early farming dispersal in different parts of the world (e.g., Bellwood 1984, 1984–1985, 1991, 1996a,b, 1997b, 2000a; Cavalli-Sforza & Cavalli-Sforza 1995; Diamond 1997a,b, Higham 1996; Renfrew 1987, 1991, 1992, 1994, 1996). The essential reasoning here, as clearly set out by Renfrew (e.g., 1996), is that the rise of farming, wherever and whenever it occurred, formed a veritable “unconformity” that ran spatially across the chronological course of history, an unconformity that always had the potential to form a line of weakness along which factors that caused spreading could have operated with vigor.

In addition, such spreads, viewed from the experience of recent historical diasporas, would always have had the potential for substantial degrees of isomorphism between cultural, linguistic, and biological variation (i.e., if they involved well-delineated ethnic groups). Furthermore, correlations between these variables may have continued long after dispersal had ceased. But let it be stressed, given current touchiness about this issue in the anthropological literature, that no one seriously claims absolute isomorphism between the data sets (archaeology, language, biology) in any particular early farming situation. Language shift, gene flow, and cultural borrowing can obviously operate in almost all human contexts, except perhaps in situations of extreme isolation. So the possibility of any 1:1:1 correlation between a gene pool, a culture, and a language, each changing only by internal variation of inherited source materials, can be dismissed right from the start.

Because of such real-world complications, the questions asked in this essay cannot be given simple answers. But it is possible to suggest that, in a world peopled entirely by hunters and gatherers, any groups who by some means developed and
came to depend upon systematic methods of food production (of plants, of animals, and—best of all—of both) would have acquired a “demographic edge” over their neighbors, particularly if those neighbors did not also, by choice or circumstance, adopt the food-producing economy themselves. Increasing birth rates would have promoted a geographical budding-off of the agricultural populations as their numbers increased, as long as social or geographic circumscription did not intervene.

Bearing this in mind, there would appear to be two opposite outcomes in regions surrounding early foci of agricultural development, with a range of possibilities in-between. At one extreme, the hunter-gatherer neighbors of the agriculturalists could have adopted the agricultural economy themselves, thus inhibiting any tendencies by the existing farmers to spread into new territory. At the other extreme, they could have remained as hunter-gatherers facing eventual assimilation into the larger and expanding farming societies. If the former option prevailed, agriculture would have spread ultimately through many diverse linguistic and archaeological populations, previously hunter-gatherers, with similar levels of diversity probably continuing thereafter. If the latter option prevailed, agriculture would have spread mainly through the expansion of the farming populations themselves, together with their languages. Under such circumstances of farmer expansion from a homeland region, we would expect the imposition of relative homogeneity of language and material culture on the ensuing cultural and linguistic patterns, and possibly a corresponding spread of certain population-specific markers in genetics.

It is clear, however, that under pre-state social conditions, such absolute extremes are both most unlikely outcomes. Farmers will often seek new land; hunters will often, if allowed, familiarize themselves with farming techniques. Where exactly, within the continuum of reality, different historical trajectories will fall can be estimated from several sources of data:

1. Evidence for agricultural “homelands,” and the time and space coordinates of agricultural system spread into regions beyond those homelands, combined with a consideration of the productive “power” of the various agricultural economies and their resulting long-term potentials for demographic expansion.

2. Evidence of pre-agricultural to agricultural continuity, or hiatus, in the archaeological record (in general terms, Mesolithic to Neolithic in the Old World, Archaic to Formative in the New).

3. Patterns of diversity/homogeneity through space in early agricultural material culture. In this regard, some early Neolithic/Formative cultural assemblages are remarkably widespread compared to preceding and succeeding patterns, and this is a counter-intuitive situation if one considers increasing sedentism and settlement endogamy to be factors differentiating early farmers from their more mobile hunter-gatherer predecessors (i.e., early farmers had good reason to be parochial).

4. Evidence for language family homelands, proto-language cultural vocabularies (especially agricultural cognate sets), rates of spread as derived from
family tree structures (to be discussed below), and inter-family borrowing histories.

5. Palaeoanthropological studies of ancient skeletal remains from the Mesolithic-Neolithic transition, together with genetic evidence for population histories in terms of multiple nuclear gene clines, mtDNA and Y chromosome haplogroup histories and their estimated coalescence times.

The historical and behavioral possibilities involved in any hunter-to-farmer transition, encompassing factors such as economic challenge and response, language continuity and language shift, population dispersal and gene flow, are so truly immense on a worldwide scale as to defy brief generalization. This paper aims only to examine some of the major archaeological, linguistic, and genetic data sets and to apply some linking theory derived from ethnographic and historical observation. Did ancient hunter-gatherers commonly adopt agriculture, as claimed, for instance, by Price & Gebauer (1992, Price 1995)? Did ancient (pre-state and pre-literate) populations shift their languages frequently? Were early farming populations relatively endogamous or exogamous with respect to neighboring hunter-gatherers? Did farmers and hunter-gatherers switch their economies back and forth so frequently that any attempt to differentiate the two lifestyles becomes pointless? These are all questions that require theoretical consideration if interpretations of episodes of prehistoric agricultural expansion are to carry conviction.

THE PERSPECTIVE FROM ARCHAEOLOGY:
TEMPO, SPREAD, AND FRICTION

Try as they may, archaeologists alone can never prove that a population expansion occurred in prehistory because material culture is always capable of diffusing beyond the hands of its creators. But it is possible to test models created in the light of data from other disciplines and to debate how population dispersal might have been structured in specific situations and what kind of archaeological evidence could demonstrate its occurrence (Adams et al 1978; Anthony 1990, 1997; Burmeister 2000; Chapman & Hamerow 1997; Rouse 1986). Early agriculturalist expansion across continental space could have consisted, at one extreme, of continuous population growth along an expansion front, of the type defined by Ammerman & Cavalli-Sforza (1984) for Neolithic Europe as a wave of advance fueled by “demic diffusion.” At another extreme, one might have a progression of saltatory jumps from one suitable environment to another, as suggested for Neolithic Greece by van Andel & Runnels (1995). These models assume that early agricultural populations entered landscapes either devoid of humans or with relatively sparse hunter-gatherer populations. Were they to enter landscapes already settled by other farmers or by dense and complex hunter-gatherer societies, then less expansive and more reticulate outcomes must be expected (Bellwood 1996b).
One problem for archaeologists is that any population dispersal, by virtue of imposing a chain of founder effects and spanning a range of environments, as well as offering a range of outcomes from increased wealth to increased deprivation, can impose changes on the societies concerned such that homelands need not always be patently obvious in the archaeological record. For instance, population dispersal can alter social structures by encouraging founder-based ideologies as new bases for social ranking (Anthony 1990, Bellwood 1996c for Austronesia; K.P. Smith 1995 for Iceland). On the other hand, Blust (1999) shows how Austronesian populations lost many cultural items as a result of adaptations during their dispersal history from Island Southeast Asia into Polynesia. Population dispersal can also lead to an important category of situations in which the descendants of partially agricultural societies enter adverse landscapes and are thereby obliged to specialize “back” into a hunting and gathering economy. Good examples of the latter include the Punan/Penan sago collectors of Borneo, the southern Maoris of New Zealand, also probably the Numic- (Uto-Aztecan) speaking peoples of the Great Basin (Bellwood 1997a, 2000a, in press; Hill 1999, Sather 1995). Many early Polynesian agriculturalist populations also specialized toward a hunting-gathering economy among the naïve bird faunas of Oceania (Anderson 1989, Steadman 1999), at least until avian extinction/extirpation occurred and obliged them to refocus on agriculture.

Such trajectories imply that many early Neolithic/Formative cultures did not initially carry their full homeland agricultural economy into new lands, particularly when those new lands were relatively marginal in agricultural suitability. Dispersal is surely a generator of stronger selective and foundership factors, and of more rapid change, than is merely staying at home, a conclusion reached also by linguists with respect to a greater rapidity of linguistic change among small migrant populations (Blust 1991, Fortescue 1997, Ross 1991). The lesson here for archaeology is that migrants do not merely clone themselves and their cultures indefinitely. So rejecting a dispersal-based explanation just because a homeland is not immediately obvious is not always justified.

But merely considering the possible structure of an early farmer dispersal (or lack thereof) will not prove or disprove that one occurred. For this we need to examine specifics and to consider aspects of cultural transmission through time. The loci of primary agricultural origin across the world are fairly well established within the archaeological community; few would quibble over the significance of the Fertile Crescent, central China (middle Yangzi and Yellow basins), highland Mesoamerica and the Peruvian Andes, or perhaps even the Eastern Woodlands of the USA (Harris 1996, Price & Gebauer 1995, B. Smith 1995). Less agreement would be forthcoming over the roles of West Africa and the Sahel/savanna, Amazonia, and the New Guinea Highlands. The issue here is not over the homelands of specific crops, since many crops originated in regions not known to have harbored independent transitions to agriculture (e.g., India, Southeast Asia). The issue concerns independence of the trajectory from foraging to farming; archaeological and botanical demonstration of this can be claimed only for Southwest Asia, with the
other regions (including even China) still in the realm of extreme likelihood rather than certainty.

A number of questions now need to be asked, from a comparative perspective. First, how productive (food output per head of population) were the agricultural systems that evolved in the various regions? This is an important matter to consider for any demographic growth modeling. There can be no doubt that the remarkably multifaceted agropastoral economy that had evolved in Southwest Asia by the end of the Pre-Pottery Neolithic phase (c.7500 B.C.E.) wins in terms of sheer number of major domesticated cereals and animals. China, with its rice, bovids, pigs, and poultry comes a close second. Central Africa, with its millets and the adoption of caprines and bovids from the north, would probably come third. New Guinea and the Americas, with no significant meat animals at all (pigs are post-3000 BP in New Guinea) and a relatively greater emphasis on tubers as opposed to cereals, all come further down the scale. The fact that the complex civilizations and farming cultures of the Americas depended to a high degree on only one major cereal (maize) and essentially on hunted meat (localized stocks of camelids, dogs, guinea pigs, and turkeys notwithstanding) could have had a dramatic impact on many aspects of culture and history (e.g., Harris 1978, pp. 99–110). In terms of the overall extents of language family and agricultural system expansion from these homeland regions, I suspect a similar ranking applies. The evidence for early farming dispersal out of Southwest Asia and China is far more compelling across all disciplines than it is out of the New Guinea Highlands and the Andes.

A second question arises immediately, and this concerns tempos of spread. How long did it take for the agricultural complexes that developed in the various homeland regions to reach their prehistoric limits? I am a firm believer in the concept of a “Neolithic Revolution,” insofar as it relates to the inception and economic domination of cereal cultivation in Mesoamerica, Southwest Asia, and China (Sherratt 1997). In specific circumstances, the concept remains very apt. But tempos of origin and subsequent trajectories of spread must be kept analytically separate. We have the following well-established spread times from source region to ultimate prehistoric geographical limit demonstrated by archaeology and careful use of chronological techniques, well-established regardless of who (expanding farmers or converting hunters) actually spread the farming way of life:

- Fertile Crescent to Britain, 3000 years (7000 to 4000 B.C.E.) over 3600 km (Price 2000);
- Yangzi Basin to Island Southeast Asia, 4000 years (6500 to 2500 B.C.E.) over 5000 km (Bellwood 1997a);
- Central Mesoamerica to the Southwest, 2000 years (3500 to 1500 B.C.E.) over 2500 km (Muro 1998, Benz & Long 2000);
- Pakistan into Peninsular India, 4000 years (7000 to 3000 B.C.E.) over 2000 km (Chakrabarti 1999).

On these scales, average rates of spread ranged between 0.5 and 1.25 km per year, which can surely be considered fairly slow. It is irrelevant here whether the
agriculture was being spread by converting hunter-gatherers or range-expanding farmers—both groups would have become subject to population increase in good environments. Recent colonizing populations in low-density situations of good health and rich resources were frequently capable of doubling numbers every generation, and there is no reason why early farmers, whatever their origins, should have been different on the large scale. Something seems to have been applying a brake to the operation of free and untrammeled fecundity.

That something was presumably, on the continents at least, a combination of environmental variation and native hunter-gatherer resistance. The farming way of life clearly had to progress through some very complex environmental and social barrier zones. Environmentally, these included alterations of rainfall seasonality, as for instance in the changes from winter to summer (monsoon) rainfall in India and Sub-Saharan Africa, and the latitudinal factors of day-length and temperature variation, significant in the East African, East Asian, and American situations. Crosby (1986, p. 18) and Diamond (1997a, p. 176) have suggested that longitudinal (north-south) geographical axes led to slower spread than latitudinal ones, but while this may be generally true it does not work in all instances (compare South Asia with eastern and southern Africa). The conclusion at this point must be that, over the long term and the long distance, agriculture did not always spread quickly, whatever the axis.

However, the situation looks rather different if we focus on more specific situations (Figure 1). Intermediate-scale instances of rapid spread of both initial agriculture and the archaeological assemblages attached to it are in fact relatively common, and it is here that axes can matter because all such rapid spreads occurred in zones of rather high suitability for the agricultural systems concerned:

- Bismarck Archipelago to western Polynesia, 500 years (1300 to 800 B.C.E.) over a fairly daunting 4500 km, but mostly over water and along the same tropical latitude (Lapita archaeological complex—Kirch 1997);
- Hungarian Plain to Alsace, 400 years (5700 to 5300 B.C.E.) over 1000 km, again along the same general latitude and through the same zone of temperate climate (LBK [Danubian] archaeological complex—Keeley 1992, Bogucki 1996, Gronenborn 1999);
- Levant to northwestern Pakistan, 500 years or less (7500 to 7000 B.C.E.) over 2500 km, again along one latitude and in one winter rainfall climate zone (late Pre-Pottery Neolithic archaeological complex—Bar-Yosef 1998);
- East African Lakes to South Africa, 1000 years (1000 B.C.E. to C.E. 1) over 3500 km through one zone of predominantly monsoonal rainfall, albeit a north-south one in this instance (Chifumbaze complex—Phillipson 1985, 1993, Ehret 1998).

Average rates of spread in these cases were much faster than in the first more generalized group, ranging from 2.5 to 5 km per year in the continental cases, with the fastest (9 km per year) predictably in Oceania. In general, most spreads were predominantly latitudinal, except for that in Africa. Clearly, early agricultural
Figure 1  The distribution of prehistoric agriculture, with some widespread prehistoric archaeological complexes that appear to be associated with early agriculturalist expansion.
economies and their associated material cultures could spread extremely rapidly in those environments in which they had developed and/or to which they were well adapted. But environmental boundaries and transitions slowed down the process by creating friction against the easy and unopposed spread of early farming communities, and one may surmise that such “friction zones” served as likely arenas of major reticulation and reformulation within the linguistic and genetic realms, as well as in material (archaeological) culture. These friction zones, of course, occurred around the edges of the “spread zones” (after Nichols 1992) just listed, in regions such as northern and western Europe, lowland New Guinea, the Indus-to-Ganges transition from winter to summer rainfall climate, and the nonalluvial hilly terrains of southern China. We meet them also in the Americas—for example, the Amazonian interfluves and the eastern Great Plains. We can expect zones of friction to occur not just in environmentally unsuitable situations such as semi-deserts, dry grasslands, or coniferous forests, but also where hunter-gatherers lived in high densities, along productive coastlines for instance.

The above reasoning suggests that zones of rapid agricultural spread should reveal some degree of phylogenetic interruption to the continuous inheritance of material culture across the transition to agriculture. This should be the case regardless of whether existing hunters adopted farming rapidly and then spread geographically, or whether existing farmers migrated in. Rosenberg, for instance, actually lists hunter-gatherer–to–farmer transition periods in many parts of the world as the majority of his cases of rapid and discontinuous bouts of punctuated cultural evolution, when periods of “stress-generated systemic failure” (Rosenberg 1994, p. 322) stimulated the creation of new cultural formations. Continuity over the whole of a spread zone from Mesolithic/Archaic forebears would be a little unlikely from this perspective because spreading and continuity obviously contradict each other in their implications. On the other hand, friction zones should witness slower trajectories from hunter to farmer, with many apparent situations of regional continuity in culture and biology. It is here we might expect to see the clearest evidence of regional hunter-gatherer adoption of agriculture via the phases termed availability, substitution, and consolidation by Zvelebil & Rowley-Conwy (1986, Zvelebil 1998).

On the ground, of course, it is sometimes very difficult to ascertain if the change from Mesolithic to Neolithic or Archaic to Formative in a particular region does or does not reveal a phylogenetic break. Opinions on such matters differ greatly and often become quite heated, as in the debate over the Neolithic transition in Europe, where worlds often collide rather roughly. The extent of earliest Neolithic cultures in any situation clearly matters—if they are extremely widespread, as are the LBK and Lapita, then population movement will always deserve careful consideration. In my own research area, Island Southeast Asia, I have little doubt that the widespread and polythetic Neolithic cultural complex with its rice, pig, and dog bones, red-slipped or paddle-impressed pottery, polished stone adzes, shell and stone ornaments, barkcloth beaters, and occasional microblade industries and spindle whorls, marks a fundamental phylogenetic break, in both a
material-culture and an economic sense, with the preceding late-Preceramic assemblages (Bellwood 1997a). The same applies to the contemporary Lapita complex in Melanesia (Spriggs 1996). In many other parts of the archaeological world such breaks have been claimed and counterclaimed with such an intensity that any attempt here to summarize would be fruitless. In terms of continuity, however, one important pitfall must be contemplated.

This is the pitfall of ambiguous phylogeny—the situation in which there appears to be regional continuity within an archaeological record, but in which the real homeland is actually another region, perhaps one quite distant, with a similar antecedent material culture. Ambiguous phylogeny becomes a problem in situations where the material culture of the immediately prefarming phase is complacent over very large regions in terms of stylistic variation, as it is for instance in much of Southeast Asia and the western Pacific (Spriggs 1996). In much of this region, small flake industries often continue apparently without a break from Preceramic into Neolithic assemblages, but since such flake tools are virtually universal prior to the common use of iron, this need mean little. Such a circumstance can only be taken to imply continuity if it is supported by other data sets.

A final consideration, while dealing with archaeological data, is that of ultimate causation of agricultural spread. Farmer population growth and hunter-gatherer adoption doubtless fueled the process to varying degrees, but one important factor may also be that of the declining homeland environments of early farmers. Some regions of early agriculture, in particular the Levant (Rollefson & Kohler-Rollefson 1993) and northern Greece (van Andel et al 1990), are known to have suffered environmental damage during the Neolithic, and one wonders whether this could have been a relevant factor in inducing spreads of agricultural populations. The other regions of early agriculture are less well understood in terms of environmental history, but southern coastal China (particularly Fujian), the Sahel, northern Mesoamerica and drier regions of the Andes could have been affected very early on by intensive cultivation, just as were Sumer, the Indus Valley, the Southwestern United States, and Easter Island in later cultural phases. Is it purely coincidental that the spread of Neolithic agriculture into the Nile Valley and into Europe (beyond Cyprus and Greece) occurred not with the first farming in the Levant (c. 8000 B.C.E.), but with fully agropastoral and pottery-using populations at about 6500 B.C.E. or later?

THE PERSPECTIVES FROM HISTORY AND ANTHROPOLOGY: ADOPTING AGRICULTURE

The historical record obviously tells us a great deal about the dispersal of farmers into new lands. It is not my intention here to argue whether the recent colonial occupations of the Americas and Australasia offer relevant comparisons for deep Neolithic prehistory, but there are two observations I think are of great importance. The first, most clearly stated by Crosby (1986), is that colonial-era migrants rapidly dominated where pre-existing populations were small, but migrants
became increasingly less successful as prior populations became more complex and numerous and as the territorial goals became more tropical and disease-protected. Thus, Spanish ancestry dominates the genes and cultures of modern Argentina to a far greater extent than those of rural Mexico. British ancestry still dominates the genes and cultures (not to mention the surnames and place-names) of Australia to a far greater extent than those of India or Malaysia. The conclusion here must be that colonizing populations of farmers will always face relatively resistant native cultures, and in the resulting mix many factors will matter: local patterns of disease, relative demographic profiles, overlaps in territorial requirements, relative complexities of social organization, etc. In the case of Neolithic farmers entering hunter-gatherer territories, the situation might seem simple, until one begins to think about the complexity of linguistic, genetic, and social relationships between Aborigines and Europeans in many parts of modern Australia.

The second observation from the diasporas of recent history is one that goes against the feeling held by many anthropologists that race, language, and culture never correlate and always vary independently of each other ["It is customary to insist on the mutual independence of racial, cultural and linguistic factors" (Sapir 1918:10)]. For much of human prehistory, and in certain specific and well-known ethnographic situations such as lowland Melanesia, many regions of Africa, Madagascar, and the Caribbean, a substantial lack of isomorphism certainly holds good. But in many colonial-era cases of rapid long-distance migration, it manifestly did not. Naturally, intermarriage with prior inhabitants of a region will always occur, but the fact remains that, in inception, any successful colonizing expansion will have a core population within which biological variation, language, and material culture will sit together isomorphically to a very comfortable degree. Any such isomorphism, of course, may not last for long, but its long-term significance can still be very great indeed.

The anthropological (ethnographic) record also provides food for thought on three further issues. Admittedly, ethnography does not reveal any situations parallel to the initial spreads of farmers or language families (Fix 1999:150). It covers far too short a time span and deals for the most part with societies in retreat from colonial confrontations. But observations (expressed in the ethnographic present) from a fairly broad cross-section of the literature indicate that:

- Hunter-gatherer and agricultural economies rarely blend on a balanced basis over the long term (Murdock 1967, Hunn & Williams 1982). Many traditional hunter-gatherers certainly husband and protect resources. Most farmers hunt and gather if their environments allow such luxuries (Kent 1989), and clearly all farmers in the Americas continued throughout prehistory to be unusually dependent upon hunting. But 50:50 balances are rare, and those that occur generally carry a marginal air from the perspectives of agricultural expansion and demographic growth.

- Hunter-gatherers rarely adopt agriculture successfully. When they come into contact with farmers and are able to avoid assimilation, they often develop mutualistic trade- and labor-based networks of interaction (Peterson 1978).
One can of course suggest that modern hunter-gatherers, by definition and because of encapsulation (Woodburn 1982), only exist because they have not adopted agriculture; hence they are irrelevant for any consideration of the behavior of ancient hunter-gatherers, especially those in environments with high agricultural potentials. This observation, however, collides rather hard with one major objection.

The objection is that many recent hunter-gatherers in rich potential farmlands were in contact with farmers, were not encapsulated, yet never showed the slightest interest in adopting agriculture. These include the peoples of California and the Northwest Coast, and of course much of northern Australia. One can bring in many opinions here as to why agriculture was never adopted—desires for mobility and nonaccumulation of debts and property, lack of economic need (hunter-gatherer “affluence”) and so forth—but facts remain facts. Neither northern Australia nor California were hostile environments for agriculture. These populations were probably behaving quite logically—why take on the scheduling demands of agriculture unless it was necessary? Such examples, of course, make us wonder just how frequently hunter-gatherers would have adopted agriculture in the deeper past, especially in the zones of rapid farming spread.

Because I have a more detailed survey of all these topics in preparation, I conclude this section simply by stating that, in the ethnographic record, hunters and gatherers have rarely adopted agriculture, and if they were to do so, particularly in rich environments suitable for farmer spread, then quick reactions would have been required. Mesolithic hunters in Baltic Europe doubtless had far longer to weigh up their options than did their contemporaries in the Danubian loesslands (Keeley 1992, Zvelebil 1998). Hunters in the friction zones marginal for agropastoralism might have occupied ethnographically unusual oscillating economic trajectories between farming and food production (see Kent 1992), but I certainly doubt that such situations could ever have been common. Any assumption that all hunters in prehistory would or could simply have adopted agriculture as soon as the word was whispered in their ears is probably misguided.

THE PERSPECTIVE FROM LINGUISTICS: NATIVE SPEAKERS VERSUS LANGUAGE SHIFT

Linguists debate issues such as language family homeland options and proto-language dispersal histories, but they rarely focus on the social conditions in which the dispersals might have occurred. In this regard they are the opposite of archaeologists, who place great stress on the ancient societies but often have unrealistic views about how languages are transmitted through space and time. As Nettle (1996, 1999) points out, very little literature exists on the formation of language groups in anthropology. For instance, many archaeologists favor convergence, creolization, lingua francas, and multilingualism as environments for
the spreads of linguistic entities such as Proto-Indo-European (Zvelebil 1995), Proto-Bantu (Hall 1990), and Proto-Austronesian (Meacham 1984–1985). Such concepts, often linked with substantial episodes of language shift, allow archaeologists to escape the stigma attached to migration-based explanations. Indeed, language shift explanations for large-scale spread have also been proposed by a number of linguists (e.g., Nichols 1997, 1998 for Indo-European).

However, in the light of comparative historical and ethnographic observations, it seems that creolization, lingua francas, and multilingualism alone cannot be sufficient explanations for such enormous vernacular spreads as those required to understand the genetic foundations of, for instance, the early Indo-European, Bantu, and Austronesian languages (e.g., Mallory 1987, pp. 258–59, Vansina 1990, Ross 1997b). These families are not reputed, on an overall basis, to reveal massive traces of substratum residue or universal histories of creolization. The latter, apart from being in large part a postcolonial phenomenon attached to forced translocation, cannot account for the spread of language families that can be classified genetically (Mühlhäusler 1986, Thomason & Kaufman 1988). This need not imply that individual proto-languages can never have been pidgins or creoles, although my understanding of human history suggests to me that translocative situations conducive to pidgin formation would be most unusual in a Neolithic/Formative context. Pidginization, of course, must be distinguished from the more normal forms of contact-induced change discussed by many linguists (e.g., Thomason & Kaufman 1988, Dutton 1995, Ross 1996, 1997a).

Likewise, lingua francas and the languages of small ruling élites have not ever, in history, led to the spreads of single languages on anything like the required scale without substantial components of native speaker migration and settlement, as we know from the spreads of Latin, Hellenistic Greek, Spanish, Arabic (Pentz 1992), and English. The languages associated with noncolonizing conquest empires, such as Mongolian, Persian, and Nahuatl, did not replace all the vernacular languages in the regions conquered, and surely the reasons for the greater success of Quechua in this regard relate to the Inca policy of population translocation and the subsequent adoption of Quechua as a lingua franca by Spanish missionaries (Heath & Laprade 1982). The spreads of politically neutral national languages such as Bahasa Indonesia (Errington 1998) and Tok Pisin (Kulick 1992) represent circumstances specific to modern literate nations with central governments and positive language policies, hardly the assumed characteristics of Neolithic/Formative nonliterate and pre-state societies.

Multilingualism, finally, has traditionally been a vehicle for language maintenance, not replacement, as is clear in linguistically complex ethnographic situations in western Melanesia (Kulick 1992) and the Vaupes region of Amazonia. In the latter case, an almost unprecedented rate of linguistic exogamy does not cause large-scale language mixing or replacement (Sorenson 1982, Aikhenvald 1996). Multilingualism can lubricate the workings of contact-induced change and language shift, but it does not in itself promote the latter and can often militate
Language loyalty is also an extremely important factor because it can serve as an antidote to free-wheeling language shift (for interesting case studies, see Schooling 1990, Smalley 1994). Is it realistic to assume that language shift alone could have swept through vast areas of pre-state “Neolithic” social landscape, in the complete absence of any state-level mechanisms involving literacy, political unity, and the repression of ethnic identity?

For a more realistic reconstruction of language family dispersal history, it is necessary to recognize that language families are genetic entities, transmitted essentially and continuously through successive generations of native speakers. Overall, they are divergence rather than convergence phenomena; unrelated languages cannot converge into a genetically constituted family with a common proto-language. Presumably, they have originated in processes of language spread from homeland regions, ramifying through time via nodes (proto-languages) delineated by groupings of shared innovations (Blust 1995a,b, Peiros 1998).

However, languages rarely split irrevocably to form innovation-defined subgroups unless some long-distance movement or intermediate language extinction occurs. Following initial expansion, chains and meshes will form, along which innovations develop in overlapping sets (see Pawley & Ross 1995 on innovation-defined versus innovation-linked subgroups). Such chains can in time generate discrete subgroups, but if the initial spread is rapid and geographically extensive, then any such subgroups will show a rather frustrating rake-like phylogeny, which can be uninformative with respect to homeland and direction of dispersal (Ross 1997a, Pawley 1999). Language families with clearly bifurcating histories and obvious homelands are rare in reality, a circumstance which might suggest that most had fairly punctuated (rake-like) rather than gradualist (tree-like) origins and early dispersal histories, as perceived by Dixon (1997).

To explain such punctuation effects, it is necessary to resort to social explanations and of course to examine the archaeological record. Can the concepts of spread and friction zones be applied to language history, and if so, do the zones so defined correspond to any degree with those recognized from the archaeological record? It is essential to remember here that the comparative linguistic record for most parts of the world draws on living languages; thus historical leveling and replacements can alter the picture substantially (e.g., the expansions of Turkish in Anatolia, Sinitic languages in southern China, Arabic, English, Spanish, etc.), just as transformation processes can alter the archaeological record. But even with these provisos, it is apparent that many regions with very strong indications of contact-induced linguistic change or substratum interference tend to correlate with regions identified as friction zones in the archaeological discussion above. Such regions include northern India and peripheral regions of Europe within Indo-European (Masica 1978, Sverdrup & Guardans 1999, Wiik 2000), western Melanesia within Austronesian (Ross 1988, Pawley & Ross 1993, 1995, Dutton 1995), and southern China within Sino-Tibetan (Ballard 1981).

Conversely, in many archaeological spread zones, the dispersals of major language families have left few clear traces of any prior linguistic patterning—we
often seem to have a series of clean sweeps with no survival of linguistic isolates or major traces of substrata. Such is certainly the case with Austronesian in most of Island Southeast Asia, with the Bantu languages in Africa, and with Sinitic in central China. Of course, linguists have also toyed with the concepts of spread and friction (otherwise residual) zones, in particular Johanna Nichols (1992, 1997), with whom the concepts appear to have originated. Like Nichols, I regard spread zones as canvases for rapid and relatively overwhelming language movement and replacement (as we would expect from early farming dispersal, among other reasons), whereas the residual zones of Nichols 1992 can have two distinct types of origin. They can be end-of-the-line regions of inflow and substratum residue, as in the concept of the friction zone presented above. This is the sense in which Nichols generally uses the term “residual zone.” On the other hand, many regions of great diversity at the level of whole language families—areas such as the Middle East, Mesoamerica, East Asia in general, and central Africa—cannot really be considered residual zones but rather are “upwelling” or “starburst” zones of net population increase and outflow. These regions are all agricultural homelands, and all have linguistic profiles that reflect language family genesis and outflow rather than residual accretion (Bellwood 1991, 1994, 1996a, 1997b).

So, in terms of language dispersal, we have three concepts: (a) the homeland starburst zone of language outflow and nonreplacement; (b) the spread zone of rapid language flow and widespread replacement; and (c) the friction zone of reticulation. Through these zones, the ancestral genetic components of the major language families must have been transported for the most part in the mouths of native speakers, and processes involving language shift would have operated most frequently in the friction zones. But even in spread zones, societies would have been permeable with respect to the incorporation of outsiders, perhaps in large numbers in situations of low population density, with lack of conflict over land and bilateral as opposed to tightly unilineal land ownership. From this perspective, early language dispersals such as those of early Indo-European or early Austronesian must have involved the movement of sizeable populations of native speakers, however the criterion of “nativeness” might be spelt out in reality. As Ross (1997b, p. 183) points out for Austronesian:

... it is indeed difficult to conceive of the movement of Austronesian languages only or even largely in terms of language shift: what could have motivated group after group to abandon its language in favor of an Austronesian one? We must infer that movements of people have played a large role in the dispersal of the Austronesian languages.

This background debate brings us around again to the central hypothesis—that the foundation dispersals of the major agriculturalist language families (i.e., the spread of their basal-node proto-languages) have a high chance of being directly associated with the spread of initial farming populations through regions previously occupied by hunter-gatherers. If this hypothesis has a fair chance of surviving closer
examination (it goes without saying that absolute proof will never be an option), then we would expect a number of correlations to occur:

- Language families with potential for this kind of origin should have strong proto-language cognate sets, with stable meanings, relating to crops, agricultural activities, and perhaps domestic animals, according to regional circumstances.
- They should have indications of an early spread over a large area, probably to be indicated by a rake-like basal phylogeny (i.e., two or more first-order subgroups that cannot be ordered hierarchically and that could have emerged from a prior innovation-linked continuum).
- They should have time-depths that correspond roughly with those for early agricultural dispersal from the archaeological record (issues of language-family time depths cannot be examined in detail here, but see Renfrew et al 2000 for a constellation of current views).
- They should have other material items reconstructible within their proto-language etyma that can be correlated with nonuniversal items in the archaeological record (for many examples of this kind of reconstruction in the Austronesian family, see Pawley & Ross 1994, Ross et al 1998, Kirch & Green 2001—horizon-like and sudden appearances are perhaps the most useful). The archaeological record should reveal homeland and dispersal histories for agriculture, and most importantly, it should place the homelands and directions of spread in a geographical framework similar to the (potentially linked) linguistic homelands and spreads.

A number of points require special comment here. First, it is extremely difficult to offer homelands for language families that began with far-flung proto-language dispersals (Fix 1999, p. 163, makes the same point for biological anthropology—that rapid population expansion tends to mask information on phylogeny). But in previous papers, Renfrew and I (see listed references) have suggested that agricultural homelands do correlate to a major degree with potential language family homelands and that the dispersal of these language families can be seen as radiative or flower-like, spreading out of a source region (see also Sherratt & Sherratt 1988). There is no doubt scope for disagreement here, particularly over homelands of very widespread families such as Indo-European or Uto-Aztecan, but I detect increasing agreement among linguists and archaeologists that, for instance, Proto-Indo-European originated in the vicinity of Anatolia (Dolgopolsky 1993, Gamkrelidze & Ivanov 1995, Mallory 1997, Renfrew 1999) as opposed to the Ukraine, and that Proto-Uto-Aztecan originated in Mesoamerica (Bellwood 2000a, Hill 1999) as opposed to Oregon or California. Both Anatolia and Mesoamerica are of course well-established foci of early agricultural development. The Ukraine and Oregon are not.

Finally, we must ask if it is purely coincidental that most language families would appear to belong to the past 8,000 years, not to the past 15,000, at least
according to a very broad range of calculations from glottochronology to rule-of-thumb comparisons of modern languages with their ancient literary forebears. The only language family commonly given a time-depth of more than 8,000 years is Afroasiatic. The vast majority of others are reputed to be between 2,000 and 8,000 years old (Bellwood 2000a). Why? Is it because comparative linguistics has a rock-bottom limit of 8,000 years? Or is it because these language families do represent real flowerings imposed over a prior continuum of Palaeolithic/Mesolithic languages, which were not ordered into sharply bounded families and which, instead, reflected a vast mesh of intersecting relationships similar to the Pama-Nyungan hunter-gatherer languages of Australia? [I make this point without wishing to be drawn into the debate over Pama-Nyungan identity and origins (Dixon 1997, McConvell 1996, Evans & Jones 1997)]. If such flowerings did occur out of agricultural homeland regions, then this could provide the historical background for those shadowy macrofamilies, such as Nostratic and Austric, which currently generate so much heat among linguists (e.g., Renfrew & Nettle 1999).

THE PERSPECTIVE FROM BIOLOGICAL ANTHROPOLOGY: BONES, GENES, AND CHRONOLOGY

Early farming expansion implies dispersals of real populations. The only way to recover prehistoric people directly is through their bones—languages, archaeology, and the genetics of living populations can never offer more than proxy data for the on-the-spot prehistoric culture-wielding animal itself. Did the first farmers all radiate as distinct ethnic and racial groups from agricultural homelands? Did no one move at all, with only languages and agriculture passing from group to group? Or was there always a mixture, with farmer demic spread being most marked in the spread zones, but hunter-gatherer incorporation being most marked in the friction zones where farming was not always the ultimate panacea?

Palaeoanthropology should, in theory, be a major arbiter. However, it presents some major problems. Large skeletal assemblages are widely reported from Neolithic sites but are rare from Mesolithic ones, and when they are available from either side of the transition, they are usually not from the same site or immediate region. One interesting exception here is the large Hoabinhian and Neolithic sample from the shelter of Gua Cha in Malaysia (Bulbeck 2000), where, as one might expect, the evidence for population continuity is quite strong (the interior Malay Peninsular rainforests are undoubtedly a major friction zone with respect to agriculture). In Europe, Mesolithic samples are rare and small, and opinions on population continuity or lack thereof vary. For instance, Fox (1996) and Jackes et al (1997) offer opposing opinions for Portugal, a presumed friction zone, whereas Vencl (1988) favors Neolithic replacement in the spread zone of central Europe. For China, Brown (1998) points to major morphological change across the Mesolithic/Neolithic boundary. A large literature on palaeoanthropological aspects of the Jomon to Yayoi transition in Japan, recently reviewed by Hudson
(1999), indicates major morphological change associated with Yayoi immigration from Korea. To my knowledge, however, there have been very few large-sample studies of morphological variation in human bones dating to either side of the transition from single localities. Indeed, there is a major need for a synthesis of the palaeoanthropological record for the hunter-to-farmer transition on a worldwide basis.

Three other aspects of palaeoanthropology are also of direct relevance in the transition to farming: trends in health, fertility, and diet. With regard to health, there is no strong evidence to suggest that early farming was the universal slide into ill-health sometimes visualized as an epiphenomenon of the “affluent forager” syndrome, at least not until the emergence of crowd diseases and burgeoning population densities. However, the proviso here must be that large samples from relevant time periods are rare. That farmer health declined in general through later prehistory is not in debate (Larsen 1995) and is not here considered a relevant issue.

Major problems with determining the fertility profiles of cemetery populations (Wood et al 1992, Meindl & Russell 1998, p. 390) render comment on issues of early farmer demography and birth rates by a nonspecialist rather superfluous. But Tayles (1999) provides evidence for high birthrates among first farmers in Neolithic central Thailand. Even without direct skeletal evidence for fertility increases, the cemetery size and site-area increases in the Neolithic/Formative in regions such as the Levant, China, and Mesoamerica tend to make it fairly obvious that there were many more first farmers in agricultural homeland regions than there were last hunters (Hassan 1981). In terms of diet, a number of recent stable isotope studies on bone have also pointed to major changes toward increasing quantities of agricultural foods across the transition (e.g., Richards & Hedges 1999, Bonsall 1997).

But perhaps the main point to be derived from the palaeoanthropological literature is that both population continuity and replacement can be identified across the hunter-to-farmer transition in different parts of the world; there is no right or wrong universal, and every situation needs to be examined on its own merits.

In terms of genetic history derived from living populations, we seem to be currently in a phase of impasse. The recombining nuclear DNA data for Europe, as analyzed from a multisystem standpoint, present a clinal situation suggestive of significant demic diffusion across the continent from southeast to northwest at some time in prehistory (Ammerman & Cavalli-Sforza 1984, Cavalli-Sforza et al 1994, Barbujani et al 1994, 1998, Cavalli-Sforza & Minch 1997, Chikhi et al 1998, Barbujani & Bertorelle 2001). These techniques in themselves offer no time depth or precise ties with early farmers and are basically phenetic rather than directly phylogenetic in implication, but they are nevertheless highly suggestive. As Cavalli-Sforza & Cavalli-Sforza (1995:149) point out, the first principal component of one particular European gene frequency analysis explains 28% of the total variation and must reflect population movement—so many genes
could not produce such a cline as a result of natural selection alone, unless we follow the suggestion of Fix (1996, 1999) that the moving agropastoral system itself was supplying the selective basis for the gene frequencies via zoonotic diseases. Even from this viewpoint, however, Fix is unable to argue strongly for hunter-gatherer adoption of agriculture as opposed to farmer spread, and indeed Fix concludes that genetics alone cannot solve the problem. Furthermore, Krantz (1988, p. 93) offers the interesting observation that a constant incorporation of native hunter-gatherer genes into a spreading agricultural population of ultimate Southwest Asian origin would give the eventual Northwest European first farmers a genome between 70% and 94% of European derivation. So, even if demic diffusion did occur across Europe during the Neolithic, we can hardly expect the Neolithic British to have been exact clones of the denizens of Catalhoyuk in Anatolia.

The strongest claims against the reconstructions favoring demic spread in the European Neolithic come from studies of the nonrecombining portions of the genome—mitochondrial DNA and the Y chromosome. In Europe, current calculations of coalescence times for mtDNA haplotypes suggest origination in European Late Palaeolithic rather than Neolithic Southwest Asian chronological contexts (Sykes 1999, Richards et al 2000). But some very crucial issues here would seem to involve the precise mutation rates utilized for such calculations. Indeed, my impression of the nonrecombining DNA literature is that coalescence dates are getting ever younger and overlapping with the terminal Pleistocene and the beginning of the Holocene (e.g., Torroni et al 1998, Sykes 1999, Excoffier & Schneider 1999, especially Kayser et al 2001). I anticipate further movement toward an even younger direction in the near future. There is tremendous scope here for insight into early farming dispersal, particularly if the impressive starbursts of mtDNA lineages presented by Di Rienzo & Wilson (1991; see also Rogers & Jorde 1995) can be dated to the relevant timescale. Kayser et al (2000, 2001) suggest major phases of population expansion commencing 6000 BP for Austronesians and 2200 BP for Polynesians from Y chromosome data, and it has to be admitted that these dates do fit extremely well with the archaeological and linguistic data on Austronesian dispersal.

In the Pacific region, recent work on the nonrecombining genetic systems has focused attention on Austronesian origins in Island Southeast Asia and Taiwan, versus Papuan origins among more ancient populations in western Oceania (Richards et al 1998, Lum et al 1998, Merriwether et al 1999, Hagelberg et al 1999, Bing Su et al 2000, Kayser et al 2000, 2001). This research supports a general scenario of Austronesian horticulturalist expansion around the Papuan horticultural and arboricultural homeland region of New Guinea, combined later with a substantial Papuan takeover of Austronesian language and genotype in the western Pacific (Bellwood 1998, Kayser et al 2000, 2001). The latter brings up a perhaps obvious point, that a “native” genotype in an environment with a high incidence of diseases such as malaria will have some selective advantage over an immigrant genotype.
But although this perspective can explain why Melanesia is Melanesian, it cannot explain the much stronger Asian genetic heritage in neighboring and equally tropical western and central Indonesia, a heritage clearly visible in all genetic systems. Here we must fall back on cultural explanations, one of these being that migrating Austronesians replaced hunter-gatherers in Indonesia but were in turn absorbed by denser populations of existing arboriculturalists in lowland Melanesia (Bellwood 1997a, 1998).

Because the genetic field of population history is in a constant state of flux, as befits its new and revolutionary explosion into the arena of prehistory, I avoid further comment and merely raise the question of how modern gene distributions in living populations can really reflect on prehistoric “events” that occurred many millennia ago. As Bertranpetit (2000, p. 6927) points out, in discussing an apparent misfit between Y chromosome and palaeoanthropological chronologies for modern human expansion, inferences from molecules to populations are not straightforward. As Weiss (1998, p. 285) also points out, different population histories can generate the same genetic outcome.

If Polynesian or European mtDNA lineages indeed turn out to have Palaeolithic coalescence times (as claimed by Richards et al 1998, 2000), we still need to ask just where these lineages originally commenced their existences in geographical terms (Barbujani & Bertorelle 2001). There could be problems of masked phylogeny here similar to those in archaeology, especially if the traces of genetic events that might have seemed major at the time have become hidden by the vagaries of millennia of subsequent history.

CONCLUSIONS: HOMELANDS, SPREADING INTO FRICTION, AND BEYOND

In this paper I have obviously taken the position that Neolithic farmer dispersal was an important factor in establishing the current world pattern of languages and geographical races. I have also pointed to regions where such dispersal was minimized by hunter-gatherer adoption of agriculture and language (certainly Melanesia, maybe western and northern Europe, maybe northern India, but in all honesty I find it hard to point with great conviction to many other large-scale regions). Archaeologists have great difficulty in coming to agreement on this issue, as can be seen from the absolutely voluminous literature that has emanated in recent years on the Mesolithic to Neolithic transition in Europe, favoring both Neolithic “packages” and Mesolithic adoption. By contrast, American archaeology has been singularly quiet on this issue, mainly because a majority of North American archaeologists accept without question a hunter-gather adoption of agriculture in all situations and relatively few (with notable exceptions) take an interest in linguistic prehistory.

Many linguists, however, do support agriculture and language farmer-dispersal correlations for language family origins, to the extent that even the Trans-New
Guinea Phylum languages of western Melanesia are now being debated as another possible example of early farmer dispersal (Papuan Pasts 2000; and see Hagelberg et al 1999 for some mtDNA data that could support this). Some linguists remain negative about farmer dispersal (Campbell 1999, p. 221), as do some biologists (Oppenheimer 1997; see Bellwood 2000b for a discussion of this book). But other geneticists (Cavalli-Sforza & Cavalli-Sforza 1995, Barbujani et al 1998) seem to have no doubts about its efficacy as an explainer of the past.

In the future, increased knowledge and understanding will only come from careful multidisciplinary considerations of many strands of evidence (Renfrew 1992, 2000). This observation applies to archaeologists, linguists, palaeoanthropologists and geneticists alike; disciplinary superiority gets us nowhere. Right now, I sense a fairly even balance across the anthropological community for and against the concept of early farming dispersals, a circumstance which suggests to me that (a) there can be no absolute answer, and (b) reality combines both perspectives of agriculturalist dispersal and hunter-gatherer adoption. *But in any specific situation, reality will not be absolutely balanced,* and the sciences of prehistory need to treat every situation as of equal significance. Starburst zones, spread zones, friction zones, and also the “beyond” zones where migrating former-farmers were obliged to specialize into hunting and gathering, can be expected to give entirely different results with respect to phylogenetic versus reticulative transmission of genes, languages, and material cultures (Table 1). What works for central Europe might not work for coastal New Guinea or the Great Basin.

<table>
<thead>
<tr>
<th></th>
<th>Homeland/Starburst zones</th>
<th>Spread zones</th>
<th>Friction zones</th>
<th>Beyond (no agriculture)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tempo of spread</td>
<td>Upwelling at varied rates</td>
<td>Fast</td>
<td>Slow</td>
<td>Variable</td>
</tr>
<tr>
<td>Extent of spread</td>
<td>Upwelling with radial spread</td>
<td>Great</td>
<td>Varies, generally limited</td>
<td>Variable</td>
</tr>
<tr>
<td>Suitability for agriculture</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Nil</td>
</tr>
<tr>
<td>Prior hunter-gatherer population densities</td>
<td>High (but hunters become farmers)</td>
<td>Low</td>
<td>Often high, especially along coastlines and rivers</td>
<td>Variable</td>
</tr>
<tr>
<td>Mesolithic-Neolithic continuity</td>
<td>Yes</td>
<td>Unlikely, except at entry point</td>
<td>Yes, to varying degrees</td>
<td>No</td>
</tr>
</tbody>
</table>
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LITERATURE CITED


Bellwood P. 1997b. Prehistoric cultural explanations for widespread language families. See McConvell & Evans, pp. 123–34


EARLY AGRICULTURAL DIASPORAS?


Hassan F. 1981. Demographic Archaeology. New York: Academic


EARLY AGRICULTURAL DIASPORAS?


Inequality, ed. TD Price, GF Feinman, pp. 129–51. New Y ok: Plenum
Torróni A., Bandelt H-G, D’Urbano L., Lahermo P., Moral P., et al. 1998. MtDNA analysis reveals a major late Paleolithic population ex-