Early Neolithic agriculture in Southwest Asia and Europe: re-examining the archaeobotanical evidence
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Agriculture is widely recognized as a defining characteristic of the Neolithic period in Southwest Asia and Europe, but, despite many years of research, and the discovery of much new archaeobotanical evidence, there have been few attempts to investigate its origins and spread in the region as a whole. Now, in a new project at the Institute of Archaeology, the scattered evidence for the emergence and dispersal of crops is being systematically assessed and documented both spatially and chronologically.

Some 40 years ago the pioneer archaeobotanist Hans Helbaek emphasized the importance of correctly dated plant remains as a means of investigating the relationship between “man and nature”, and he later developed a technique for separating charred plant materials from the sediments in which they had been preserved.

Although many archaeobotanical investigations have been carried out since then at Neolithic sites in Southwest Asia and Europe, we still lack a database that is sufficiently large, systematic and well founded to enable us to gain a better understanding of the emergence and spread of agriculture in the region.

In July 2001 a new three-year project was started at the Institute with the aims of collecting, assessing and systematically recording in a chronological framework all the available data on the plant remains (mainly charred seeds) that have been recovered from early Neolithic and Epipalaeolithic or Mesolithic sites in the region. In this article, we describe the background to the project and outline some of our preliminary findings.

The origins of domestic crops in the Southwest Asian Fertile Crescent

As the European icesheets began to retreat at the end of the most recent ice age soon after 18,000 years ago, the climate slowly became wetter and warmer. This gradual amelioration was punctuated by much colder and drier periods, lasting for at most a thousand years or so, and the distribution and composition of the natural vegetation cover altered significantly in response to the changes in temperature and humidity. Although the effects on the landscape of these changes were most noticeable in northern latitudes, they were also apparent to a lesser degree worldwide. The impact of the cold spells, in particular, had profound consequences for how people adapted to, and interacted with, their environments.

Semi-sedentary Natufian groups of hunter–gatherers inhabited much of the Levant when the climate was at its warmest and wettest during the so-called climatic optimum some 12,500 years before present (c. 12,500 bp). They benefited from increased local availability of the plant foods they had come to rely on, such as the grains of wild cereal grasses, as is indicated by mortars and pestles for grinding them and other possible processing tools found at Natufian sites. About 1500 years later, the Natufians experienced a sudden change of climate to much colder and drier conditions (a period referred to as the Younger Dryas, c. 11,000 to c. 10,000 bp), which caused their supplies of wild plant foods to diminish. It is probable that, as a direct result of this change, they attempted some form of management of the wild plants that had become staples in their diet. Thus, it is thought, the first attempts to cultivate wild cereals took place. By sowing the wild grains in tilled fields, the Natufians ensured that they had annual harvests sufficient for their needs and they gained some control over the supplies of plant foods regardless of climatic instability.

Domestic species of cereals evolved as a result of the cultivation of the wild forms. This led to the selection of plants with tough rachises that prevented the separate spikelets, which enclose the grains, from shedding naturally once ripe.

We encounter the earliest evidence of the domestic crops on which Neolithic agriculture was founded in the Fertile Crescent during the period referred to as the Pre-Pottery Neolithic A or PPNA (c. 10,200 to c. 9500 bp), soon after the first experiments at cultivation had apparently taken place a few hundred years earlier.

There were eight founder crops, three of which were cereals (barley, einkorn and emmer wheat), four were pulses (lentil, pea, chickpea and bitter vetch), and one was a fibre plant (flax). It is thought that the cereals were domesticated first and that the other species evolved at about the same time or possibly somewhat later.

Our knowledge of the evolution and spread of the founder crops depends on the examination and accurate identification of charred grains found in samples recovered from securely dated occupation levels at early Neolithic sites. The reported presence, or absence, at different localities and times of domestic species (when correctly identified as such) has provided the evidence for our understanding of the distribution of the earliest crops and of their subsequent dispersal throughout Southwest Asia. But this procedure is not without its pitfalls, as the example of Jericho shows.

Jericho revisited

Very few PPNA sites in Southwest Asia have yielded evidence of domestic cereals; to varying degrees, the finds from them are controversial. The domestic wheat and barley found in the PPNA levels at Jericho are no exception to this.

The large mound at Jericho – a tell about 20m high, 320m long and 140m wide – represents several thousand years of occupation. Kathleen Kenyon excavated at Jericho in the early 1950s when she was a member of staff of the Institute, and in the largest of her trenches she dug down to the earliest occupation layers of the settlement and exposed the full extent of a massive stone-built tower and walls that were first constructed during the PPNA (Fig. 1).

Together with fragments of burnt plaster and evidence beyond showing the deposits that accumulated around the tower during the Pre-Pottery Neolithic A period.

Figure 1 Part of the circular tower at Jericho (front left), with a deep excavated section beyond showing the deposits that accumulated around the tower during the Pre-Pottery Neolithic A period.
that bore the impressions of grains, samples of charred plant remains were taken for analysis from the deposits adjacent to the walls. Domestic einkorn and emmer wheat and domestic barley (the three founder-crop cereals) were identified in these finds and the radiocarbon dates of these finds and the radiocarbon dates of these cereals found at Jericho as among the earliest known, although (no less significantly) they may represent evidence from their areas of origin elsewhere in the region. This reassessment of the archaeobotanical evidence from Jericho suggests that maps showing the areas of origin and subsequent spread of the founder crops during the PPNA and PPNB may need to be redrawn. Figure 2 shows the results of our first attempts at reconstructing the changing proportions of wild and domestic cereals found at PPNA and PPNB sites around the Fertile Crescent. Wild cereals predominate in a majority of the PPNA (phase 1) sites, whereas at the few Early PPNB (phase 2) sites, the pattern is reversed, with most of them having more domestic cereals. This trend continues during the Middle and Late PPNB (phases 3 and 4), with increasing evidence for higher proportions of domestic crops at the more numerous sites now spread throughout the Fertile Crescent and extending west into south-central Anatolia.

**Modelling the spread of early farming in Europe**

Farming communities became established across Europe some time after their initial appearance in the Fertile Crescent, and the dates of their settlements become progressively later as the distances from the Southwest Asian heartland increase. The founder crops (and domestic animals) that evolved in Southwest Asia formed the basis of the so-called Neolithic farming package that disseminated throughout continental Europe and across the sea to Britain and Ireland. Whether it was the Neolithic farmers themselves who spread, or their crops and the knowledge and technology to grow them, or some combination of both, is hotly and at times acrimoniously debated. The timing and tempo of this Neolithic diaspora has been the subject of much research over the past 30 years.

A major source of evidence that has been used in the past to investigate the process of dispersal across Europe has been the chronology of the first appearance of farming communities. Grahame Clark was the first to attempt this, in 1965. He established that the initial...
spread of farming took place along the Danube, thus confirming the earlier work by Gordon Childe that was undertaken without the benefit of radiocarbon dating. Then, in 1971, Ammerman & Cavalli-Sforza proposed a statistical model for the expansion of farming. They found that, although a general rate of progression of about 1 km per year (from an assumed origin) can give us the clearest evidence not of when crops first appeared in any given region but also about the ecological and rainfall patterns across Europe. The overall objective is to model the spatial, temporal and ecological contexts of the first appearance and dispersal of plant domesticates, which will contribute greatly to our understanding of the complex processes by which crops, early farming practices and Neolithic peoples spread into Europe from their ecologically very different Southwest Asian homeland.

**Notes**


3. The project, entitled "The origin and spread of Neolithic plant economies in the Near East and Europe", is supported by a grant from the UK Arts and Humanities Research Board. Stephen Shennan is the principal investigator, and James Conolly and James Steele (of Southampton University) are co-investigators. The project is one of the research initiatives at UCL taken by the Centre for the Evolutionary Analysis of Cultural Behaviour, directed by Stephen Shennan.

4. The term "Epipalaeolithic" refers to the final part of the Palaeolithic period in Southwest Asia that immediately preceded the Neolithic. In Europe the term "Mesolithic" is used for the equivalent pre-Neolithic period.

5. The Fertile Crescent refers to the upland arc that stretches from the southern Levant north and east around the Mesopotamian lowland and southeast along the foothills of the Zagros mountains in western Iran.

6. The people known as Natufians occupied sites throughout the Levant, from the middle Euphrates valley in the north to the highlands of the Negev in the south, and east across the Jordanian plateau.

7. The rachis is the "spine" of the cereal ear. In wild cereals the rachis is brittle and the separate spikelets containing the seeds shed naturally once the plants are ripe. In the process of domestication selection for the spread of agriculture and pastoralism in Eurasia, D. R. Harris (ed.), 142–58 (London: UCL Press, 1996), and D. Zohary, "Monophyletic versus polyphyletic origin of the crops on which agriculture was founded in the Near East and Europe", Genetic Resources and Crop Evolution 46, 133–42, 1999.


12. O. Bar-Yosef & A. Goren suggest that the radiocarbon dates from Jericho indicate that the PPNA lasted there from c. 10,300 to 9300–9200 bp; see p. 257 in An early Neolithic village in the Jordan valley, part 1: the archaeology of Netiv Hagdud, O. Bar-Yosef & A. Goren (eds) [Bulletin 43, American School of Prehistoric Research, Peabody Museum of Archaeology and Ethnology, Harvard University, 1997].


20. See Gkiasta et al., cited in n. 19 above.