

First wave of cultivators spread to Cyprus at least 10,600 y ago

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Early Neolithic sedentary villagers started cultivating wild cereals in the Near East 11,500 y ago [Pre-Pottery Neolithic A (PPNA)]. Recent discoveries indicated that Cyprus was frequented by Late PPNA people, but the earliest evidence until now for both the use of cereals and Neolithic villages on the island dates to 10,400 y ago. Here we present the recent archaeological excavation at Klimonas, which demonstrates that established villagers were living on Cyprus between 11,100 and 10,600 y ago. Villagers had stone artifacts and buildings (including a remarkable 10-m diameter communal building) that were similar to those found on Late PPNA sites on the mainland. Cereals were introduced from the Levant, and meat was obtained by hunting the only ungulate living on the island, a small indigenous Cypriot wild boar. Cats and small domestic dogs were brought from the mainland. This colonization suggests well-developed maritime capabilities by the PPNA period, but also that migration from the mainland may have occurred shortly after the beginning of agriculture.

domestication | *Sus scrofa* | food production | prehistoric seafaring | Neolithic mobility

The transition from hunting-gathering to food production is a major step in the history of humanity and the biosphere (1, 2). Humans began to cultivate morphologically wild cereals and pulses over a wide area in the Near East by ~11.5 cal kyBP (thousands of calibrated radiocarbon years before present), a period known as the Pre-Pottery Neolithic A (PPNA) (3–7). Early cultivators lived in small villages and continued to hunt and gather in the wild (8–10). By 10.5–9 cal kyBP, during the Pre-Pottery Neolithic B (PPNB), villages increased in size, and the subsistence strategy developed into an established mixed agropastoral economy based on domesticated crops and animals (sheep, goat, pig, and cattle) (11–13). Previous research indicates that the first farmers settled Cyprus during the Early PPNB, beginning ~10.4 cal kyBP (14, 15), bringing with them domestic cereals, pulses, goat, cattle, sheep, and pig to the island (*SI Appendix, SI Text S1*) (14, 16, 17). Before these settlements, the only known human presence on Cyprus was limited to the small Aetokremnos rock shelter occupied by fisher-trappers dating to 12.5 cal kyBP (18). Recently, three sites dated to ~11.1–10.6 cal kyBP have been discovered (19–22). The extensive excavations at one of these sites, Klimonas (*SI Appendix, Figs. S1 and S2*), unearthed plant remains, abundant animal bones, thousands of artifacts, and the remains of several buildings, including one communal structure. These finds reveal previously unknown aspects of the social and economic organization of the inhabitants of Cyprus at this early date.

Our analyses of these finds combined with a series of 11 radiocarbon dates demonstrate that Cyprus was settled by Neolithic

villagers several centuries earlier than suspected, a phenomenon that has far-reaching implications for a fuller understanding of the Neolithic Revolution in the Near East. The inhabitants of Klimonas cultivated a primitive wheat introduced from the mainland and hunted the only large mammal living on the island—namely, an extinct species of wild boar. The occupation at Klimonas coincides with a period on the mainland when agriculture was still becoming established; it shows that at this time human groups in the eastern Mediterranean could be highly mobile and participated in complex exchange systems. These groups also had the capacity to adapt to new environments with a low density of food animals. The findings from Cyprus reveal unsuspected sea-faring capabilities and provide unique information regarding the beginnings of plant and animal domestication, including that of dogs and cats.

Results

Collective Building. That the inhabitants of Klimonas had a complex society is demonstrated by the discovery of a circular building 10 m in diameter (Fig. 1*A* and *SI Appendix, Figs. S3–S6*). Although the building's upper part had been destroyed, it was possible to show that it was dug into the ancient land surface to a depth of at least 1 m (*SI Appendix, SI Text S2*). This feat would have entailed considerable labor to remove at least 75 m³ of the geological substratum (*SI Appendix, Fig. S7*). At the outer edge of the building was a foundation ditch, dug for the surrounding wall, and containing its remains at the time of excavations; this wall varied in thickness, perhaps for decorative reasons. The base of the wall contained numerous hidden caches with flint arrowheads and blades; shell pendants; and green stone beads. A series of caches were also found in the floor, along with numerous hearths, pits, and post holes (Fig. 1*B*). These finds, together with the possibility that there was a surrounding interior bench, confirm that this structure ST 10 was a collective building rather than a domestic dwelling. The building is similar in size and plan to Late PPNA sunken buildings in the northern Levant, which were sometimes decorated and contained caches of precious objects suggesting ceremonial use. These buildings have been interpreted as multifunctional communal buildings for collective storage, meetings, and ritual use (8, 23). Early

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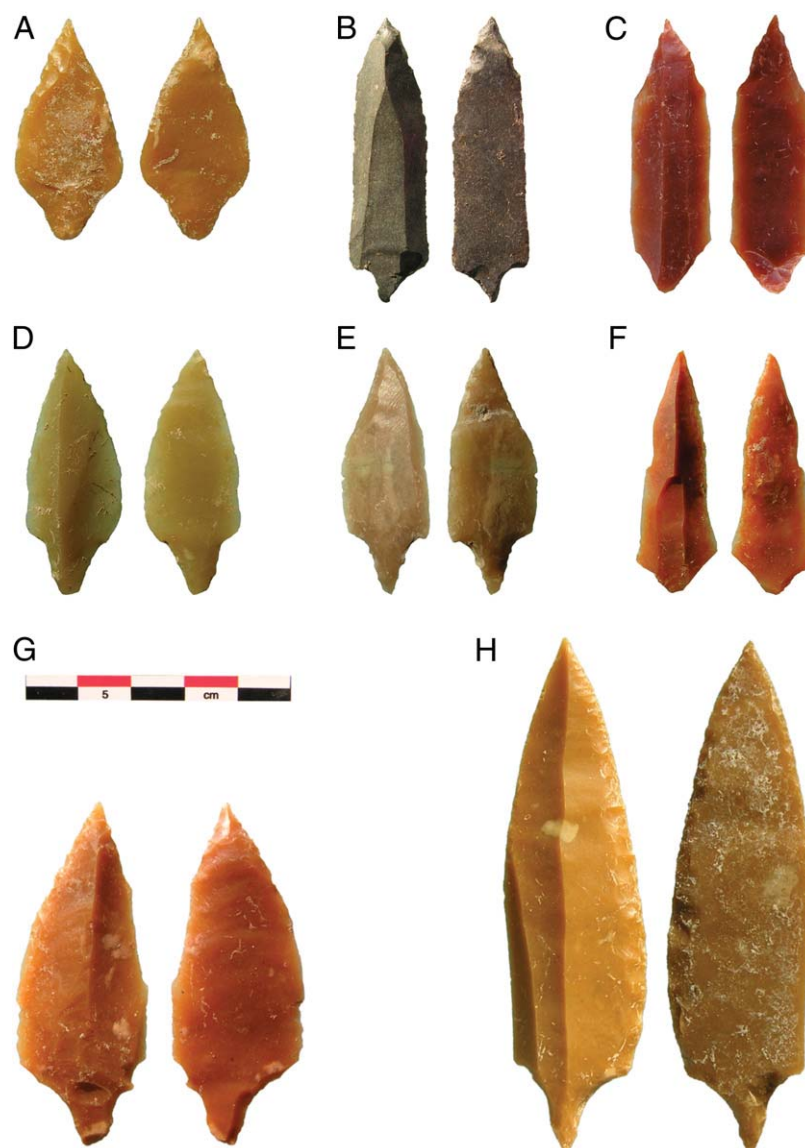


Fig. 2. Different types of arrowheads found in building 1 of Klimonas. (A, B, and D) SU (stratigraphic unit) 10.3; (C) SU 10.11; (E and F) SU 10.6; (G) SU 10.8; and (H) foundation trench. (Photo by F.B.)

contained impressions left by cereal chaff (*SI Appendix, Fig. S13*). The practice of using cereal chaff as tempering material is common at PPN sites on the mainland as well as on Cyprus (4, 16). Barley (*Hordeum spontaneum/distichon*) and emmer wheat (*Triticum dicocum/dicocoides*) were identified from the impressions. The impressions do not permit distinction between wild and domestic varieties at this stage (25). Wild emmer is not considered native to Cyprus because (i) it does not grow there today, and (ii) edaphic conditions are not suitable; it must have been introduced from the mainland (5, 16). Einkorn wheat has been found on later Cypriot sites, suggesting more than one wave of introductions (26). Given that the chaff was available in sufficient quantities to be used as building material, it is probable that cereals were cultivated locally rather than imported. Additional evidence for the harvesting and processing of cereals comes from glossed flint sickle blades and from oval querns, respectively. At contemporary continental sites, these tools are known to have been used for cereal harvesting (7). The combined evidence indicates cereal consumption and probably cultivation only five centuries later than the earliest evidence of

cultivation of predomesticated wild cereals and pulses on the mainland (11.5 cal kyBP) (3, 4, 6).

Animal Bones. The numerous and well-preserved animal remains in the fill of building 1 are predominantly food refuse (*SI Appendix, SI Texts S4–S6*). Marine food resources and bird bones are rare (*SI Appendix, Table S1 and Figs. S14–S17*). Meat consumption was dominated by a small wild boar. Morphological analyses demonstrate that this boar is similar to the small Cypriot wild boar first present at the site of Aetokremnos, dated to 12.5 cal kyBP, and presumably introduced to Cyprus before that date with the aim of developing wild game resources (27). Osteometric data confirm that wild boars were 10–16% smaller than PPN Near Eastern suids, either wild or early domestic, but that they did not differ in size from the small domestic pigs present later, during the 10th to 9th millennia BP in Cyprus (Fig. 3 and *SI Appendix, SI Text S4, Table S3, and Figs. S18 and S19*) (28). However, the wide range of slaughtering ages, including a high proportion of very old individuals together with the abundance of arrowheads (>100 in the filling of building 1) suggests hunting or herd control, rather than

National d'Histoire Naturelle using an acid-alkali-acid pretreatment, and measured at the Artemis accelerator mass spectrometry (AMS) laboratory of Saclay. One charcoal sample from the 2009 campaign had previously been sent to the AMS laboratory in Tucson, AZ, for ^{14}C dating (16) and was added to the list. Raw dates are corrected for isotopic fractionation and calibrated at 1 and 2σ (standard error) using Intcal09 (40) (*SI Appendix, Fig. S9*).

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