

# The Early Neolithic of Iraqi Kurdistan: Current research at Bestansur, Shahrizor Plain

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**Abstract.** Human communities made the transition from hunter-foraging to more sedentary agriculture and herding at multiple locations across Southwest Asia through the Early Neolithic period (ca. 10,000-7000 cal. BC). Societies explored strategies involving increasing management and development of plants, animals, materials, technologies, and ideologies specific to each region whilst sharing some common attributes. Current research in the Eastern Fertile Crescent is contributing new insights into the Early Neolithic transition and the critical role that this region played. The Central Zagros Archaeological Project (CZAP) is investigating this transition in Iraqi Kurdistan, including at the earliest Neolithic settlement so far excavated in the region. In this article, we focus on results from ongoing excavations at the Early Neolithic site of Bestansur on the Shahrizor Plain, Sulaimaniyah province, in order to address key themes in the Neolithic transition.

Les communautés humaines ont fait la transition de chasseurs-foragers à une agriculture plus sédentaire et le maintien des stocks à plusieurs endroits à travers l'Asie du Sud-Ouest au cours de la période néolithique précoce (vers 10 000 à 7 000 Av. J.-C.). Les sociétés ont exploré des stratégies impliquant une gestion et développement intensifs des plantes, des animaux, des matériaux, des technologies et des idéologies propres à chaque région tout en partageant certains attributs communs. Les recherches actuelles dans le Croissant fertile oriental apportent de nouvelles perspectives sur la transition néolithique précoce et le rôle crucial que cette région a joué. Le Projet archéologique central de Zagros (CZAP) étudie cette transition au Kurdistan irakien, y compris le plus ancien site néolithique jusqu'à présent fouillé dans la région. Dans cet article, nous nous concentrons sur les résultats des fouilles en cours sur le site néolithique précoce de Bestansur sur la plaine de Shahrizor, province de Sulaimaniyah, afin d'aborder les thèmes clés de la transition néolithique.

Keywords: Neolithic, Eastern Fertile Crescent, sedentism, agriculture

Mots-clés: Néolithique, Croissant fertile de l'Est, sédentisme, agriculture

## Addressing key issues in early agriculture and sedentism

Through the Early Neolithic period (10,000-7000 cal. BC), human communities across Southwest Asia developed new ways of living as more sedentary farmers and herders after millennia of leading more mobile hunter-forager lifeways. As the Younger Dryas cold period gave way to the warmer, wetter Holocene, this disruption coincided with an era of abrupt warming as dramatic as that through which we are presently living. Through this period people increasingly managed and domesticated animals

and plants, including goat, sheep, cattle, and pig, as well as cereal and legume crops. They developed networks to access materials such as obsidian, carnelian, and seashells, for tools and adornment. Based on resource management and farming, societies accumulated food surpluses which supported larger communities and new societal structures indicative of social cooperation and planning.

Since 2007 the Central Zagros Archaeological Project (CZAP) has conducted fieldwork and research at key sites in Western Iran and Eastern Iraq spanning the Late Pleistocene-Early Holocene transition (Fazeli Nashli and Matthews 2013; Matthews *et al.* 2013, 2016). In this article we articulate four major themes in the Neolithic transition before we focus on ongoing research at the Early Neolithic site of Bestansur on the Shahrizor Plain, Iraq, where excavations have been conducted since 2012, demonstrating how our interdisciplinary research is addressing these themes.

## Resource use and sustainability

In researching the issue of domestication of both plants and animals the emphasis has shifted from overarching theories such as climatic determinism or population pressure, to approaches that consider the interconnections between ecological and cultural change, focusing on regions as case-studies of transition, and drawing on contextually-robust evidence generated by modern field and scientific methodologies (Zeder and Smith 2009; Ibáñez *et al.* 2018). The factors affecting ecological and cultivation strategies were diverse: spanning climate and environment, species ecology, socio-economic context, cultural traditions, and individual choice. New research stresses the long timespans and the locale-specific nature of multi-centred domestication (Fuller *et al.* 2011; Asouti and Fuller 2013; Riehl *et al.* 2013, 2015; Zeder 2011). Our project investigates resource use and sustainability in the Central Zagros region through integrated archaeobotanical, zooarchaeological, micromorphological, phytolith, and GC-MS research, to study ecological strategies and interrelations between plants, animals and humans.

## Sedentism and society

One of the attributes of the Neolithic transition was the construction of more permanent and complex built environments as communities adopted more sedentary lifeways. Across Southwest Asia, there were trends towards larger, more densely populated settlements, from communal and shared lifeways to greater privatisation and increasingly separate household units, and from circular to rectilinear architecture *ca.* 8500-8000 cal. BC (Byrd 2000; Kuijt 2000). Built environments are both product and producer of political, economic, social, and cultural life and relations (Bloch 2010; Fisher 2009; Fisher and Creekmore 2014). Our current knowledge of the significance and variation of these developments, however, is limited by the sparsity of area exposures and applications of high-resolution interdisciplinary analyses, particularly for the Eastern Fertile Crescent. To address this issue, we apply microstratigraphic and contextual approaches, integrating micromorphology, microarchaeology and geochemical characterisation (Elliott 2016; Godleman *et al.* 2016; Matthews 2018), to investigate building life-histories, use of diverse plant resources and related activities, and the earliest stages of human-animal interrelations through interdisciplinary study of animal dung, especially as few artefacts are left on floors at many sites to indicate use, as Braidwood *et al.* (1983: 10) lamented for Jarmo (Anderson *et al.* 2014; Matthews 2005, 2010, 2016; Matthews *et al.* 2014).

## Health

The Neolithic transition across Southwest Asia is rich in evidence for elaborate human burial practices (Croucher 2012). Human remains and burial practices provide a range of evidence with which to investigate how humans were impacted by changes in Early Neolithic ecology, lifeways and social relations. How did human communities cope with the enhanced opportunities for transmission of disease, including newly developing zoonotic diseases (Pearce-Duvel 2006; Moreno

2014) provided by settled agglomerations of humans and animals in fixed locales? Zoonotic diseases such as brucellosis evolved in the context of proximity between humans and animals during the Neolithic transition (Bar-Gal and Greenblatt 2007; Chisholm *et al.* 2016; Baker *et al.* 2017) and, like tuberculosis, can leave traces on ancient human remains. Simulation modelling of goat demography in the Neolithic Zagros suggests that brucellosis could have emerged at the very beginnings of goat husbandry (Fournié *et al.* 2017). Recent research in bioarchaeology has examined Neolithic human remains and demographic patterns for traces of impacts of the agricultural transition (Bocquet-Appel 2011; Pinhasi and Stock 2011; Larsen 2014). This research has yielded insights into demography, diet and disease through the Neolithic transition, but so far study has focused largely on the Levant (Smith and Horwitz 2007; Eshed *et al.* 2010) and Turkey (Pearson *et al.* 2013; Larsen *et al.* 2015). In this project, we aim to introduce into the debates new human remains assemblages from the Eastern Fertile Crescent, developing insights into the palaeopathology and demography of an Early Neolithic community, as well as health and the built environment through microstratigraphic analyses of disease reservoirs, vectors and pathways.<sup>1</sup>

## Networks

Early Neolithic craft activities, from resource access through portage, exchange, manufacture, use, repair, reuse, and disposal, constitute one of the principal sources of evidence for enhanced resource use, skills acquisition and as media for the expression of community identity at a range of geographic scales from local to trans-regional. Analysis of “exotic” materials and practices at Early Neolithic sites, such as seashells, obsidian tools and carnelian beads, can inform on identity and “otherness” in inter-community interactions (Knappett 2005). The evidence includes widespread distribution of materials, including obsidian from Eastern Turkey (Chataigner *et al.* 1998), carnelian from Iran or Afghanistan, and seashells from the Mediterranean and the Persian Gulf (Darabi and Glascock 2013). Earlier interpretations of these distributions, of obsidian, in particular highlighted mechanisms for material movement (Renfrew and Dixon 1976; Bar-Yosef 1996). Here we examine how communities and individuals engaged with “exotic” materials such as obsidian according to local needs, practices and preferences, situating these culturally and historically.

Across the Eastern Fertile Crescent, and often beyond, there is evidence for sharing of practices in planning and construction of buildings, in use of clay animal and human figurines and possible “tokens” (Richardson 2014; Riehl *et al.* 2015; Bennison-Chapman 2016), and in modes of human burial (Kuijt 2008; Croucher 2012). Coward’s preliminary analysis of Neolithic connectivity across Southwest Asia (Coward 2013) indicates a low impact of increasing geographic distance on material culture comparability, suggesting that communities could overcome the “tyranny of distance” (Blainey 1966) in sustaining their trans-regional networks. In the new CZAP research, we apply integrated artefact analysis of lithics and ground stone tools (Matthews *et al.* 2018; Mudd 2019), while geochemical analysis is applied to characterise artefact source materials and investigate trans-regional networks of material movement (Richardson 2017).

## Research objectives

The research objectives are to conduct excavations at Early Neolithic sites in the Eastern Fertile Crescent to generate multi-scalar, contextual evidence with which to investigate the ecological and socio-cultural strategies of communities in this region during the Neolithic transition. We aim to

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<sup>1</sup> MATTHEWS R., MATTHEWS W., RASHEED RAHEEM K. and RICHARDSON A. (eds.), *The Early Neolithic of the Eastern Fertile Crescent: Excavations at Bestansur and Shimshara, Iraqi Kurdistan*. Oxford: Oxbow Books, forthcoming.

provide inter-disciplinary insights into changing human/animal/plant environment interrelations, at household, intra- and inter-community scales, to analyse the results in investigations of community networks, individual and collective identities and resilience strategies and to investigate the global significance of the Eastern Fertile Crescent as a core zone, informing on societal engagement with disruptive changes, with significance for understanding challenges of today including interconnections between environmental and social change. Beyond the scope of this article, the project is also conducting fieldwork and research at other relevant sites in the Zagros region of Eastern Iraq and Western Iran.

To investigate climate and environment, these investigations are integrated with the exploration of cave sites for speleothem analysis in order to contribute new evidence for the region, including the interaction between climate change and human economic and social change during the Early Neolithic transition. A sample from Gejkar Cave, Iraq, has revealed a long-term aridification trend in the region (Flohre *et al.* 2017), and analysis of new sediment cores from Iraq and Iran are yielding significant new insights into the profound changes that took place during the Early Holocene adding to research conducted by Altaweel and colleagues (2012).

## The Zagros region in the Neolithic transition

The Eastern Fertile Crescent has recently come into sharper focus for investigation of the Neolithic transition (Fazeli Nashli and Matthews 2013; Matthews *et al.* 2013; Helwing 2014; Riehl *et al.* 2015; Roustaei and Mashkour 2016). The importance of the region in the Neolithic transition was established in the 1940s-1950s in research in the Zagros “hilly flanks” recognised as habitats of wild plants and animals later to be domesticated. Early research included excavation of Epipalaeolithic occupation at rock shelter and cave sites including Zarzi (Garrod 1930; Wahida 1981, 1999) and Palegawra (Braidwood 1951; Braidwood and Howe 1960), dating between 15,500 and 11,500 cal. BC. In Iraqi Kurdistan, knowledge of early settlement in the Zagros foothills has been dominated by investigations at the Neolithic site of Jarmo (Braidwood *et al.* 1983). Following the conclusion of their work at Jarmo, the Braidwoods realised that future research should focus on the 2500-year period preceding Jarmo, focusing on the formative Early Neolithic period. The Braidwoods’ fieldwork in the Zagros inspired later investigations at Eastern Fertile Crescent sites, including Ganj Dareh (Smith 1976, 1990), Guran (Mortensen 2014) and Abdul Hosein (Pullar 1990), and in the south Zagros at Ali Kosh (Hole *et al.* 1969), Chogha Sefid (Hole 1977) and Chogha Bonut (Alizadeh *et al.* 2003). More recent excavations in Western Iran include East Chia Sabz (Darabi *et al.* 2011) and Chogha Golan (Riehl *et al.* 2015). In addition, since 2007 new investigations of the Early Neolithic of the Zagros uplands have been conducted under the remit of the Central Zagros Archaeological Project (CZAP)<sup>2</sup> at Sheikh-e Abad and Jani in the high Iranian Zagros and at Bestansur and Shimshara in the Iraqi Zagros foothills (fig. 1-2; Matthews *et al.* 2010, 2013, 2016).

Current research on the Zagros high steppe, foothills and mountain plains indicates that this was a core zone of the Neolithic transition. The archaeological and ancient DNA (aDNA) evidence (Luikart *et al.* 2001; Naderi *et al.* 2008; Pereira and Amorim 2010; Daly *et al.* 2018) suggests that goats were independently domesticated at several locations across Southwest Asia including the Zagros-Taurus uplands. There are indications of early barley domestication in the Zagros and further east in Iran, independently of its domestication in the Western Fertile Crescent (Morrell and Clegg 2007; Saisho and Purugganan 2007). Analysis of plant assemblages from Early Neolithic sites strengthens the argument for an independent trajectory from gathering to cultivation of cereal crops in the Zagros

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<sup>2</sup> See online: <http://www.czap.org/>.

foothills (Riehl 2012; Riehl *et al.* 2013, 2015) and high plains (Whitlam *et al.* 2013, 2018), supported by continuity in Epipalaeolithic to Neolithic Eastern Fertile Crescent stone tool assemblages (Thomalsky 2016).

Analysis of human remains from the sites of Hotu, Abdul Hosein and Ganj Dareh has identified a Zagros human population, not related to early farmers in Turkey to the north or in the Western Fertile Crescent (Gallego Llorente *et al.* 2016), indicative of lengthy independent population development in Western Iran (Lazaridis *et al.* 2016). Ongoing aDNA analysis of human remains from the Neolithic Eastern Fertile Crescent identifies the Zagros as “the cradle of eastward expansion” into Central and South Asia of “the SW-Asian domestic plant and animal economy” (Broushaki *et al.* 2016: 3).

The conclusion from new research is that the Zagros comprises a key formative zone for some of the earliest, most significant steps in the transition from mobile hunter-forager to settled farmer-herder life-ways, with unique significance as a source region for new human-plant-animal interconnections that spread eastwards across Iran, into Central Asia and northwards into Transcaucasia (Helwing 2014).

## Investigations at Bestansur

The site of Bestansur, 65 km southeast of Jarmo, dates chronologically earlier than Jarmo, confirming Braidwood and Howe’s hypothesis that earlier stages of the Neolithic transition are present in the region. Bestansur is located 33 km southeast of Sulaimaniyah city, in the northwest corner of the Shahrizor Plain, within a cluster of important prehistoric and historic sites close to a major perennial spring currently 1 km north of the site (Altaweel *et al.* 2012: fig. 1). The watercourse from this spring joins the Tanjero River which flows across the plain from northwest to southeast, joining the Sirwan or Upper Diyala at the southeast end of the plain. The immediate environs of Bestansur provide a wide range of ecological opportunities for early settlers including fertile arable soils (Sehgal 1976), fresh spring water, nearby hilly and mountainous terrain for hunting and foraging of a biodiverse range of animal and plant species, plus proximity to multiple sources of stone suitable for both ground stone and chipped stone tool manufacture.

The mound of Bestansur first came to archaeological attention in 1927 when visited by Speiser during a survey of Southern Kurdistan (Speiser 1926-1927: 10-11). Speiser examined sherds at “Bistansur”, proposing that none of the pottery was later than the Persian period, as well as putting soundings in the nearby mounds of Arbat and Yasin Tepe. Iraqi archaeologists catalogued Bestansur during the 1940s, including it in the *Iraqi Atlas of Archaeological Sites* (Directorate General of Antiquities 1970). Survey of the Shahrizor Plain since 2009 by a German/Iraqi team included surface investigation of many sites across the plain including Bestansur. The site was listed as SSP6 within the Shahrizor Survey Project, identified as one of six Pottery Neolithic sites on the Shahrizor Plain (Altaweel *et al.* 2012: 21).

### Initial investigations

Surface walking and artefact collection in 2011 on and around the mound at Bestansur suggested that intact Neolithic levels could be excavated in the fields surrounding the main mound, on the basis of finds of chert and obsidian stone tools and debitage. We excavated 10 trial trenches, each 2 x 2 m in area, on the lower slopes of the mound and in the surrounding fields to investigate the nature of different sectors of the settlement (fig. 3). As excavations proceeded it became clear that substantial Neolithic deposits and architecture survive 40-50 cm below the modern plough soil at

almost all the locations investigated. Intact Neolithic deposits are preserved across a sampled area of more than one hectare.

Neolithic deposits were also revealed in the base of the mound itself in trenches 1-2. Much of the raised mound, however, is Iron Age and later in date. It was clear that excavation of Neolithic levels within the topography of the mound needs to remove 1.5-2 m of later layers and slope wash before reaching Neolithic deposits. Investigation of the Iron Age and later levels is conducted under the direction of L. Cooper at the University of British Columbia (Canada). All excavation areas were sampled intensively for a range of environmental and materials analyses. No sherds of Neolithic pottery were recovered in the course of excavation and no Chalcolithic or Bronze Age materials were found at Bestansur.

## Excavation of an Early Neolithic settlement

Further investigations at Bestansur have focused on several key areas for intensive excavation: architectural features in trench 7 to the west of the mound; finely stratified deposits exposed in an eroded section in trenches 12-13 to the north; deposits containing large numbers of chert and obsidian bullet cores and bone working debris in trench 10 to the east; and open-air activity areas and fire installations in trench 9 to the south. Building 3 in trench 7 comprised a multi-roomed building. Several depositional episodes of ground-stone items in this building may indicate long-term or seasonal storage rather than *in situ* activity. The external area to the north and west of the building contains material evidence for repeated human activity, attested by clusters of activity areas with land snail shells, scatters of small stones, shattered fragments of animal bones, discarded chert and obsidian tools and debitage, and a double human burial. These traces are found on sequences of trampled surfaces throughout a considerable depth of occupation, up to *ca.* 75 cm deep, and may thus represent long-term activities including taking seasonal advantage of spring-time availability of land snails and other natural resources of the region in the Early Neolithic. In trench 9, traces of Neolithic activities include areas of burning, butchery remains, an abundance of molluscs, hearth structures, and traces of architecture. To the north of the mound, an eroded section was cleaned to an extent of 13 m to reveal a finely stratified sequence. Excavations into the adjacent sloping field revealed Early Neolithic buildings and activity areas. Two major phases of occupation have been identified in this north sector of the mound. The total depth of intact deposits with chipped stone lithics and without discernible pottery is at least 2 m. An AMS radiocarbon date for bone collagen extracted from an articulated pig carpal indicates butchery activity in this area at 7175-7055 cal. BC at 95% confidence (Beta-408868). A goat bone fragment from Neolithic deposits in trench 10 yielded an AMS radiocarbon date of 7720-7580 cal. BC at 95% confidence (Beta-368934).

Further excavations in trench 10 have revealed a sequence of two large, well-preserved buildings, building 5 which overlies building 8, in a neighbourhood of smaller structures (fig. 4). These buildings have provided significant new insights into Early Neolithic lifeways. Rooms and walls of a well-constructed mudbrick building, Building 8, were partially excavated in Trench 10. The bricks are 4-6 cm thick with tapering edges, and are characteristic of 'boat-shaped bricks' that were manufactured from as far west as Boncuklu in Central Anatolia and Ganj Dareh and Jani in the high Zagros, suggesting shared knowledge of architectural technologies across more than 1500 km in southwest Asia (Smith 1990; Matthews *et al.* 2013: 58, fig. 5.7; Baird *et al.* 2017). The bricks are set in layers of mortar and the walls are coated with multiple applications of plaster of varying textures and hues with traces of paint on one wall face (Godleman *et al.* 2016). Building 8 is overlain by building 5 whose plan includes an open portico, facing southeast, with an offset plastered entrance. Building 5 is constructed of reddish-brown mudbrick with white inclusions.



Space 50 in building 5 is a large room covering *ca.* 8 x 4.5 m. Below the floors of space 50, multiple deposits of disarticulated human remains, including many skulls, are placed in cuts, packing material and filling of the underlying structure, building 8 (fig. 5). The human remains assemblage from this room to date comprises >65 individuals with more to be excavated. The packing deposits may be interpreted as the closure of the underlying structure, building 8, and foundation for the overlying structure, building 5. The sequences of burial and other cuts into the packing and the later floors are sealed below multiple replasterings. A separate deposit of human remains with associated stone and shell beads in the upper room fill of space 50 may indicate an ongoing association of space 50 with human burial at the closure of building 5.

The floors of space 50 consist of multiple layers of thin brown, green and white plasters in at least two phases. Beneath the floor, a skirting of small angular pebbles was laid along the inner wall faces of space 50 to a width of *ca.* 10 cm. Thick deposits of collapse including fragments of the wall with attached plaster were excavated from above the floors of space 50. Ongoing excavation of building 5 is providing high-resolution insight into Early Neolithic activity in and around a large building which clearly had a special character. The association of multiple disarticulated as well as intact human remains, many of children and infants and featuring multiple skulls, suggests that building 5 and probably also the underlying building 8 hosted multi-staged human burial activities through significant periods.

Excavations at Bestansur have yielded 1.8 tonnes of archaeological materials largely in the form of clay, bone and stone objects, including worked bone tools, beads and adornments, clay tokens and figurines, and cowrie shells associated with human burials. Analysis of the materials used to produce these objects and the many obsidian tools from the site have highlighted material networks which connect the occupants to the local and regional landscape and also to resources much further afield, as far as eastern Anatolia, the Alborz Mountains of northern Iran and the Mediterranean coast.

## Addressing key issues at Bestansur

### Food and fuel procurement strategies

The Neolithic inhabitants of Bestansur operated a mixed strategy that enhanced stability and flexibility in resource use. The remains of plants and animals attest elements of both hunter-forager and farmer-herder lifeways through mixed approaches to domesticates and wild foods. Amongst the charred botanical material at Bestansur the most frequent remains are crop types, including pulses and the cereals glume wheat, free-threshing wheat and, less commonly, barley (table 1; Whitlam 2015). Alongside the crop evidence, there are notable frequencies of wild taxa, including nut and fruit fragments and wild grasses. Phytoliths from grasses and reeds are abundant at Bestansur, in micromorphological and phytoliths samples, including as occasional finds of intact reed/grass matting, hinting at the richness of the more perishable material culture of the Neolithic settlement.

Metric assessment of the goat remains indicates that female animals outnumber males, suggestive of a herded rather than hunted population (Zeder and Hesse 2000). The earliest domestic goats in the Eastern Fertile Crescent are demographically attested at Ganj Dareh within the high Zagros, in the preferred habitat of the wild goat, by *ca.* 7900 cal. BC (Zeder 2005). The Bestansur foothills goats are likely the direct descendants of the high Zagros populations. Morphologically wild sheep and pig were heavily exploited at Bestansur (fig. 6). There is considerable evidence for the hunting of large wild game, including cattle, red deer, roe deer and gazelle, as well as small game such as hare, beaver and tortoise, a large variety of birds and much freshwater fish and crab. Quantities of pierced stone net-sinkers indicate the use of gill nets for catching fish. We recovered evidence for faecal

material including ruminant dung and omnivore coprolites across the deposits at Bestansur (Elliott 2016), suggesting regular proximity of animals and humans within the settlement. Pigs would have been common along the reed beds of the nearby river and, after sheep, are the second most abundant animal (fig. 6). Regarding fuel use, traces of high temperature burnt herbivore dung and reeds and grasses are ubiquitous in micromorphological samples of ash-deposits across Bestansur, while wood charcoal is rare, indicating selection of more sustainable renewable and second-generation fuel sources (fig. 7).

As at Epipalaeolithic and Neolithic sites of the Zagros region, including Zarzi (Bate 1930; Payne 1981; Olszewski 2012), Jarmo (Lubell 2004) and Sheikh-e Abad (Shillito *et al.* 2013), edible land snails *Helix salomonica* are found throughout the settlement at Bestansur including in dense, discrete deposits or middens (Iversen 2015). Their occurrence in clay-lined fire pits, often in association with chert and obsidian tools, demonstrates that edible snails formed a significant component of the Neolithic diet at Bestansur. *In situ* evidence for their cooking and consumption at Bestansur comes from external areas alongside evidence for activities such as tool repair and food preparation. The consumption of edible snails appears to have been an outdoor, shared seasonal activity. The Bestansur inhabitants took full advantage of the rich environments on and adjacent to the Shahrizor Plain, pursuing a flexible mix of dietary strategies that drew on both traditional patterns of hunting wild game and foraging wild plants as well as on the newly developing practices of herding a small number of domesticable species such as goat and cultivating a range of pulse and cereal crops in fields on the surrounding plain.

## Early sedentism and community structure

Innovations in built environment design and materials were configured to accommodate and to shape fundamental changes in human lifeways and in human, animal, plant and material interrelations. Integrated analyses of a diverse range of fields of action and social arenas have demonstrated how individual and intra- and inter-community roles and relations shaped and were shaped by the built environment. At Bestansur the excavated architecture consists of >11 rectilinear structures identified thus far across an area of one hectare, all aligned approximately northwest/southeast, suggesting community-wide planning and co-operation in the settlement layout. Notably, each of the seven buildings in trench 10 has its own boundary walls, without the use of party walls, attesting the emergence of distinctive household units as observed at many Neolithic sites of Southwest Asia (Kuijt 2000). At least some of these buildings are abutting. The recovered architectural plan from trench 10 allows us to begin to envisage a Neolithic neighbourhood at Bestansur, dating to *ca.* 7700 cal. BC. Excavated internal rooms tend to be relatively clean of artifacts and debris, at both macro and micro scales, while external surfaces have greater densities and variety of debris from activities such as butchery, cooking, eating, and tool manufacture and repair (fig. 8).

The presence of buildings does not necessarily directly imply the presence of a “village”, even less so “households”, as has been highlighted in the Levant (Finlayson *et al.* 2011). The burial of a large number of individuals in building 5, including primary and secondary burials and skull caching, demonstrates the strength of the social networks, which are currently being investigated through aDNA analyses by R. Pinhasi, I. Laziridis and D. Reich. An emerging pattern from our investigations of a neighbourhood of buildings surrounding building 5 in trench 10, however, indicates the presence of at least one hearth/oven attributed to each structure, enabling each self-contained unit to function independently and to contribute to more communal feasts or activities. Investigations to the north of the mound revealed a *ca.* 2 m deep sequence of successive occupation deposits,



including small rectilinear buildings with external spaces containing domestic waste and human coprolites.

The closest architectural parallels for building 5 at Bestansur are from Tell Halula and Abu Hureyra in Syria, consisting of rectilinear architecture often with a portico and linear arrangements of rooms (Molist 2001). The high number of burials within building 5 at >65, however, exceeds those in single buildings at these sites which total 15 and 24 respectively and tend to be intact single inhumations. Pending further excavation of buildings 5 and 8, and adjacent buildings, it remains uncertain whether building 5 was used for both living and human burial. Houses with high numbers of burials have been characterised as “Houses of the Dead”. The most notable of these is the Skull Building at Çayönü, which was in use for up to 1000 years from *ca.* 8500 cal. BC, with at least 450 individuals represented by disarticulated remains (Özdoğan 1999). The “House of the Dead” at Dja’dé al-Mughara on the Syrian Euphrates perhaps represents the closest parallel for Bestansur building 5 and 8. Five successive phases of the same building, in phase DJ III dated to *ca.* 8540-8290 cal. BC, demonstrated a similar pattern of persistent practice in a single location, combining primary and secondary burials and using mats and baskets as at Bestansur (Coqueugniot 2000, 2016). The Dja’dé House of the Dead consists of four small rectilinear rooms within which the remains of more than 70 individuals were found, mainly of infants and young adults (Chamel 2014), demonstrating a similar age profile to those recovered at Bestansur (table 2).

## Health

The recovery of more than 65 individuals to date at Bestansur provides an important new assemblage for analysis of the impact of more sedentary agricultural human populations, lifeways and health. Evidence for pathologies in the Early Neolithic has been attributed in part to larger populations, population density, reduced residential mobility and living in close proximity with animals (Pearce-Duvet 2006; Fournié *et al.* 2017). Most of this evidence, however, to date comes from the Levant (Eshed *et al.* 2004, 2006, 2010) or from cross-cultural comparisons (Armelagos 2013).

At Bestansur the human osteological assemblage provides insights into health across all age groups from perinatal infants to older adults. Pathological skeletal and dental changes were observed in 24 individuals, 18 of whom demonstrated multiple pathologies. Most frequently occurring were enamel hypoplasia, cribra orbitalia, porotic hyperostosis, and periostitic bone, all of which are indications of physiological stress or malnutrition (table 3). There were also small amounts of joint degeneration and trauma. Evidence of healed cranial fractures at Shanidar has indicated a pre-existing knowledge of healing and care in the community (Solecki *et al.* 2004). This is also attested at Bestansur in an individual with a badly healed lower leg fracture which would have inhibited their mobility.

Evidence of palaeopathology at Bestansur is comparable to other assemblages in the region such as Ganj Darah and Shanidar (Merrett 2004; Solecki *et al.* 2004). What is most striking is the high number of juveniles (49 of 65 individuals), most of whom are aged from prenatal infant to 2 years. It is these individuals who demonstrate the most evidence of malnutrition. Two juvenile individuals had enamel defects over multiple teeth indicating systemic stress during development. Linear enamel hypoplasia also survives in adult teeth formed during infancy and early childhood. Little is known about infant health during this time, but as a vulnerable age group, infants are an important indicator of the health of the community (Tocheri *et al.* 2005). Abu Hureyra and Ganj Dareh also have high numbers of juveniles but these are more equal in number to adults (Moore and Molleson 2000; Merrett 2004).

Indications of physiological stress and infant mortality could be caused by a range of factors including traumatic birth, weaning problems, diet, infection, or trauma (Kurek *et al.* 2016; Scott and Halcrow 2017). The high proportion of juveniles compared with adults within the assemblage may change based on future excavations. Overall the human remains from Bestansur provide important insights into the health of a population from an under-researched area and the infant remains are a valuable resource for future research on juvenile development during the Neolithic transition.

## Networks of cultural practice

The ritualisation of mortuary practices at Bestansur is attested by the structured processing and placement of bodies within space 50. The burial deposits demonstrate different phases in the deconstruction of bodies; earlier deposits include spreads of disarticulated and partly articulated bones which appear to have been pushed aside, once defleshed, for the later interment of articulated bodies. Some deposits comprise extremely compact skeletons or bundles of disarticulated bones, wrapped in split-reed matting before deposition. There are also scatters of small bones and teeth on floor surfaces which may have been left behind after removal of larger bones. Skull burials include multiple juvenile crania which appear to have been positioned to face the threshold of building 5 (Walsh and Matthews 2018). Evidence of bone polish and breakage patterns indicates that at least some of the remains were curated before final burial. Nine cut cowrie shells with bitumen residue were found in close association with juvenile burials, particularly skulls, suggesting the adornment of either the skull or the mortuary wrappings. Some of the earliest burials have traces of red pigment, found on both articulated and disarticulated crania and long bones and wrappings.

Analysis of the material technologies employed by the community at Bestansur indicates that these were both rooted in tradition as well as adapted to new environments and practices. They made their chipped stone tools, principally blades and bladelets, from finely worked “bullet cores” using the pressure technique on locally available cherts with modest evidence for the use of sickle blades in harvesting crops, reeds and rushes. The inhabitants of Bestansur had access to moderate amounts of obsidian which accounted for 11% of the chipped stone assemblage by weight or 26% by count, comparable with early levels at Jarmo (Hole 1983). Portable x-ray fluorescence analysis of a sample of the obsidian shows the majority was arriving at Bestansur from the Nemrut Dağ source at Lake Van in Eastern Turkey, 500 km to the northwest. Significantly, the Bestansur assemblage includes 93 fragments of the heavily retouched blades known as Çayönü tools (fig. 9), found across the Taurus-Zagros zone. Use-wear studies (Anderson 1994) suggest that these tools were used as polishers for finishing the production of alabaster bracelets, including the distinctive type with a flanged profile, found at Bestansur and across the Taurus-Zagros region (Matthews *et al.* 2018).

Bestansur artisans had a well-developed capability in the manufacture of ground stone tools and implements (Mudd 2016, 2019). They made tools of local limestone and sandstone, as well as alabaster, gabbro and granite from sources 30-40 km to the east in the higher Zagros fringes where chert also occurs. They used ground stone tools for processing of plants and hides, breaking of animal bones for marrow extraction, pounding of minerals for pigments used on wall plasters, retouching of chipped stone tools, as architectural features such as threshold stones, and as status items in the form of fine mace-heads. Occasionally, they shaped stone vessels out of fine alabaster. They also made delicate pierced beads of stone, including materials sourced from hundreds of kilometres away such as carnelian, *Dentalium*, and cowries, as well as of clay, bone and shell (fig. 10; Richardson 2017). From Neolithic contexts at Bestansur, 958 beads have been catalogued, 96.5% of which were found in association with the burials beneath the floors of building 5. The majority of these beads (685 in total) are pierced freshwater *Theodoxus* shell, rather than the marine *Nassarius*

common to Levantine sites (Bar-Yosef Mayer 2005), and appear to have been used abundantly to adorn the dead. Anthropomorphic or zoomorphic clay figurines are rare but there are many deliberately shaped clay objects in the form of balls, cones and a spool (fig. 11; Richardson 2019). Clay tokens are commonly present at Neolithic settlements across Southwest Asia from the 9<sup>th</sup> millennium cal. BC (Zeder *et al.* 2006; Cole *et al.* 2013). One baked clay cone from Bestansur with a scored gash has close parallels with a common form seen only at Ganj Dareh in the high Zagros (Broman Morales and Smith 1990). A figurine of the simple seated type (Broman Morales 1983) was buried in the clay packing beneath the floors of space 50 in building 5, in a style common to sites in the region including Sheikh-e Abad, Jarmo, Sarab and Guran (Daems 2008).

Taken together, the Bestansur artefact assemblages attest a community engaged with material networks spanning local, regional and trans-regional scales. While much of their requirements were met by locally available plant, clay, stone, bitumen and other resources, they obtained a range of material from more distant sources, including obsidian from East Turkey, carnelian and variscite probably from Iran (Weisgerber 2004), and cowry shells from the Persian Gulf. Both the materials themselves and the characteristics of the artefacts into which they were fashioned, such as lozenge-shaped beads or Çayönü tools, reveal the scale and intensity of material, technological and ideological networks within which the Bestansur inhabitants were actively engaged. These networks will in future provide a significant comparison with the results from aDNA and isotopic analysis of human remains from building 5 and elsewhere at Bestansur.

## Conclusions

Research conducted within the remit of the Central Zagros Archaeological Project is significantly enhancing our understanding of the Neolithic transition in the Eastern Fertile Crescent. This region of Southwest Asia hosted major developments in human sedentarisation and construction of the built environment, the intensification of plant cultivation and the early management and domestication of animals such as goat. Human societies explored and constructed new ways of living together in highly distinctive ways, region by region and even site by site. But there is still so much to investigate and to learn.

Excavations at Bestansur, whose global importance is recognised by its inscription on the UNESCO World Heritage Tentative List,<sup>3</sup> are shedding new light on some of the early stages in the transition to settled village life in the Early Neolithic of the Eastern Fertile Crescent. Of special significance is the sophisticated nature of the mudbrick architecture, manifest in large-scale multi-roomed rectilinear buildings at least one of which has strong associations with the burial of the human dead. The community living at Neolithic Bestansur was sustained by a biodiverse diet with potentially less reliance on a Neolithic plant package and significant exploitation, including some degree of management, of animals including domesticated goat, wild sheep and pig alongside hunting of a range of large and small mammals. Consumption of fish, fowl and land snail was also a significant component of their diet. Their material culture attests highly developed networks of engagements reaching far and wide as well as being locally embedded. The corpus of human remains from Bestansur building 5 is one of the most substantial and most richly contextualised Neolithic assemblages from the entire Eastern Fertile Crescent. It is providing unique insights into the challenges faced by human communities through the Neolithic transition, with considerable evidence for malnutrition and dietary stress early in life in many of the individuals.

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<sup>3</sup> See online: <https://whc.unesco.org/en/tentativelists/6172/>.

The settlement at Bestansur, therefore, demonstrates how the community had access to networks of materials and shared technologies that extended from the high Zagros in the east and across the Fertile Crescent to the north and west in Southeast and Central Anatolia. The site and community were an important node in these networks, situated on a branch of the much later Silk Roads. The location of the settlement close to a major spring with access to local wetlands, riparian zones, a major plain and foothills provided a rich range of biodiverse resources which helped this community to buffer the risks associated with early agriculture and to sustain sedentism and engagement in local and supra-regional networks.

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