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The Neolithic settlement in the southern Lut Desert, Iran

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Abstract

This article presents results from recent archaeological survey in the southern Lut Desert area (Kerman Province, southeastern Iran). This fieldwork, conducted in the Bam region since 2016, has recorded numerous Neolithic sites, probably among the largest concentrations of Neolithic sites reported so far in southeastern Iran. This region is located in the lowlands east of the Jebel Barez Mountains, while all other Neolithic sites known in southeastern Iran are west of these mountains. It is also halfway between India and the Zagros Mountains of western Iran. As such, this fieldwork not only has brought important new data on the Neolithic period in the southern Lut Desert area and southeastern Iran, but it also has allowed us to address again broader research questions relating to the development of agriculture east of the Fertile Crescent, across the Iranian Plateau into South Asia. In this article, we describe the main characteristics of the regional Neolithic settlement we have surveyed and offer preliminary interpretations as to its chronology and spatial distribution. We first provide information on the ancient climate and topography of the Bam region, for these are key aspects to understanding settlement pattern during the Neolithic period. We also summarize results from three excavation-seasons at Tell-e Atashi, the single Neolithic site that has been excavated in the southern Lut Desert area. We conclude by discussing our results with consideration of current knowledge on the Neolithic period in southern Iran and Pakistan and questions relating to the emergence of agriculture east of the Fertile Crescent.

Keywords

Iran, Lut Desert, Neolithic, Tell-e Atashi, Archaeological Survey, Excavation

1 Introduction

Agriculture is largely believed to have been invented in the Fertile Crescent, between the Levant, southern Anatolia, and the Zagros Mountains, around 9500 cal. BCE (e.g., Weeks, 2013b; Bar-Yosef, 2014). Research in Europe has shown that agriculture then began spreading west of the Fertile Crescent during the seventh millennium cal. BCE. Many scholars agree that plant cultivation and animal breeding began spreading at about the same time eastward across the Iranian Plateau to Central Asia and South Asia. Yet, while we are relatively well-informed as to the processes and chronology of this development in Europe (e.g., Silva and Vander Linden, 2017), current knowledge on this topic in the regions east of the Fertile Crescent is much more limited and at times inconsistent, especially as far as the chronology of the early farming villages in these regions is concerned. Consequently, it is unclear whether and in which cases agriculture emerged across the Iranian Plateau and South Asia as a result of cultural or demic diffusion, or local, independent processes.

Different types of data tend to support the demic diffusion hypothesis. Results from recent human DNA analyses are consistent with this hypothesis (Narasimhan *et al.* 2019). Also, most available radiocarbon

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dates do not contradict this scenario as they show that the earliest Neolithic sites in the Fertile Crescent are older than most Neolithic sites known at present further east (and further west in Europe). Additionally, a number of plant and animal species are thought to have been introduced onto the Iranian Plateau and in South Asia from Southwest Asia. Yet, there are significant disagreements on the latter line of evidence (see Bellwood, 2005: 84-86; Harris, 2010; Kingwell-Banham *et al.*, 2015: 267-273; Patel and Meadow, 2017). On the DNA studies, despite an increasing set of analyses and major improvements in this field, it is legitimate to argue that they do not cover the immensity and complexity of the Neolithic landscape in the regions east of the Fertile Crescent. As for the radiocarbon dates, one may contend that many Neolithic sites have yet to be discovered, potentially including sites where local, independent development of agriculture occurred and Neolithic settlements as early as those in the Fertile Crescent.

A fact indeed remains that our understanding of the emergence of agriculture in these regions is currently based on a limited number of well-dated Neolithic occupations. As such, it may radically change as new discoveries are made. This has been the case in Fars Province, southwestern Iran. For decades, the Neolithic period in Fars was mostly known through pottery Neolithic sites dating to between the mid-seventh and the late-sixth millennia cal. BCE. Yet, recent fieldwork in this province, in Cave TB75 in the Tang-e Bolaghi area, has yielded new insights into the initial processes of animal management in this province as early as between the tenth and eighth millennia cal. BCE. Additionally, aceramic Neolithic deposits dating to 7047-6744 cal. BCE were identified at Tepe Rahmatabad (Tsuneki *et al.* 2007; Azizi Kharanaghi *et al.* 2013; Nishiaki *et al.* 2013; Weeks 2013b). It is also important to remember that, over 1400 km east of Fars, the earliest Neolithic occupations at Mehrgarh in Pakistan, which are aceramic, are thought to be no later than the eighth millennium cal. BCE and to have emerged out of an earlier, local background that has yet to be discovered (C. Jarrige *et al.* 1995: 9-19; Jarrige, 2008: 152-153; Jarrige *et al.* 2013: 151-152). One issue with this claim, however, is that many radiocarbon dates from the Neolithic period at this site (from aceramic Period I and pottery Period II) are between 6000-4000 cal. BCE (C. Jarrige *et al.* 1995: 9-11, 555-556; Jarrige *et al.* 2013: 151-152). Mehrgarh is the single Neolithic site in Pakistan that has been extensively studied. Therefore, resolving this chronological conundrum is crucial to understanding the emergence of agriculture in South Asia, including whether and how it relates to developments on the Iranian Plateau and further west.

In summary, although a set of evidence tends to show that agriculture developed across the Iranian Plateau and northwest South Asia as a result of diffusion from the Fertile Crescent, the possibility remains, and part of current data tends to show, that local experiments leading to agriculture occurred independently from a western influence. Furthermore, considering the diffusion hypothesis, it is "not readily apparent whether there was demic diffusion, involving movement of agropastoralist populations; cultural diffusion, involving the adoption of agropastoralism by populations previously using other subsistence strategies; or nuanced combinations of the two." (Kingwell-Banham *et al.* 2015: 270). Again, the fact that current chronology of the Neolithic period east of the Fertile Crescent is not firmly established does not help answering these questions. Additionally, although thinking big picture is fundamental, it is important to remember that numerous, likely diverse Neolithic communities populated the stretches of lands between Mesopotamia and the Indus Valley. Yet, we still know very little about these communities at the regional and local scales. In other words, one of the most urgent tasks is to renew data on this topic through multi-scalar field projects that consider both locally and regionally focused studies as well as broader comparative approaches.

Just east of Fars and halfway between the Zagros Mountains and South Asia, southeastern Iran (Fig. 1) is a key area with great potential for answering the above-mentioned questions relating to the emergence of agriculture east of the Fertile Crescent. As of today, field investigations that inform us on the Neolithic period in southeastern Iran are mostly limited to: an excavation at Tepe Yahya in the Soghun Valley (Beale and Lamberg-Karlovsky, 1986a); a test-trench at Tepe Gaz Tavila and surveys in the Daulatabad Plain (Prickett, 1986a, 1986b); an excavation at Tal-i Iblis in the Bardsir Plain (Caldwell, 1967); and an excavation at Tepe Gav Koshi in the Esfandagheh Plain (Soleimani and Fazeli Nashli, 2018). All these places are west of the Jebal Barez Mountains in western Kerman Province, and, except for the sites presented in this article, no Neolithic site has been reported further east and south in Iran, including in Sistan-va-Baluchestan Province (see Mutin *et al.* 2017; Sarhaddi-Dadian *et al.* 2019). Data from these fieldworks shows that agriculture emerged in southeastern Iran during the seventh (at Tepe Gav Koshi) or sixth (at Tepe Gaz Tavila and Tepe Yahya) millennium cal. BCE (Prickett, 1986a: 410 Tab. 3.1, 416-429, 544-545, 576-579; Soleimani and Fazeli Nashli, 2018), therefore considerably later than in the Fertile Crescent. The Neolithic material culture in western Kerman generally parallels assemblages from other Neolithic sites across Iran and from Mehrgarh in Pakistan. It seems more specifically connected to assemblages in eastern Fars Province, just west of Kerman, especially its pottery (Piperno, 1973; Beale, 1986b: 86; Beale, 1986c; Heskell and Lamberg-Karlovsky, 1986; Prickett, 1986a: 576-577, 762-763; Vandiver, 1986, 1987; Soleimani and Fazeli Nashli, 2018). The subsistence economy of Neolithic Tepe Yahya and Tepe Gaz Tavila, which is based on domesticated barley, wheat, goat, and sheep (as well as cattle) (Meadow, 1986), is also consistent with what is observed elsewhere in Iran and Pakistan during this period. In summary, “[t]hese shared attributes of production technology [likely] reflect some degree of communication and diffusion” (Lamberg-Karlovsky and Beale, 1986: 266), but it remains unclear whether agriculture and additional technologies associated with the Neolithic emerged in southeastern Iran as a result of local developments, outside forces—which could be demic or cultural diffusion—or both combined. At the scale of southeastern Iran, we also do not know well what the Neolithic period consists of in the regions east of the Jebal Barez.

In 2016, we developed a new field research project in the southern Lut Desert region, southeastern Iran. One objective of this project is to get more data on the Neolithic communities in southeastern Iran and on their relationships to their neighbors on the Iranian Plateau and in northwest South Asia. Our overarching goal is to contribute to current research on the emergence of agriculture east of the Fertile Crescent. This project is in the Bam region, in the lowlands east of the Jebal Barez, eastern Kerman. Previous research in this area revealed the existence of a few Neolithic sites including Tell-e Atashi, where aceramic deposits were exposed in a test-trench in 2008⁴ (Adle, 2006; Garazhian, 2009; Garazhian, 2016). Starting from these encouraging results, we systematically surveyed significant portions of the Bam region and recorded many additional Neolithic sites. We also resumed excavation at Tell-e Atashi. In this article, we summarize our survey results with a focus on the Neolithic sites we recorded. We provide in a first section information on the ancient climate and topography in the Bam region, as these are key elements to understanding settlement pattern during the Neolithic period. We present in a second section selected results from our excavation at Tell-e Atashi. This site is the only Neolithic site that has been excavated in the southern Lut Desert area and as such our single reference point for the chronology of this period in this area. We then present our survey results in a third section.

⁴ Tell-e Atashi was inscribed on the List of the Historical Monuments of Iran (no. 3343) in 2001 per the effort of N.A. Soleimani.

Lastly, we discuss this new data with consideration of the above-mentioned broader questions relating to the emergence of agriculture east of the Fertile Crescent. Certainly, answering these questions would require incorporation of more data than that presented here. Yet, this fieldwork already allows us to offer new insights into this topic.

2 Topography and climate

The city of Bam is located in the southern margins of the Lut Desert, in a plain east of the Jebel Barez Mountains (Fig. 2). Seasonal torrents running from the mountains have brought clastic materials into the lowland area, creating alluvial fans which have formed an accumulation of ca. 10-15 km wide and up to 500 m thick deposits (Fouache *et al.* 2013: 564). The average altitude in the lowlands decreases from west to east, from ca. 1250 m at Darzin, 1000-1100 m around Bam, to 750 m in Darestan east of Bam. The city sits at the confluence of two seasonal rivers, the Posht-e Rud and the Chelekhoneh, a river system that then continues further east. The Bam region is today one of the most inhospitable places on earth.⁵ It has a desert climate with extremely high surface temperatures, a very low humidity rate, and strong winds (Adle, 2006: 35; Fouache *et al.* 2013: 563-564⁶). However, about 10,000 years ago, southeastern Iran had a humid monsoonal climate with heavy summer precipitation. By around 8000 years ago, the monsoon intensity started to decline and finally retreated from southeastern Iran ca. 6000 years ago. As generally observed in the Middle East, climate became more arid with phases of extreme droughts such as around 4200 years ago (Fouache *et al.* 2013; see Petrie and Weeks 2019).

Despite an increasing arid climate, access to water in the Bam region has been facilitated by a north-south scarp visible in the southeastern periphery of Bam, west of Baravat. This scarp is believed to have formed ca. 10,000 years ago as a result of the seismic fault that runs through the city (Fouache *et al.* 2013: 563 fig. 3). Water from rainfalls and melting snow is caught by the mountains in the western part of the region. It then runs eastward into large and thick, permeable alluvial fans and is collected by the scarp, which, being less permeable, acts as an underground dam (Anseri *et al.* 2006). The scarp also has modified water flow east of Bam. Originally, the Posht-e Rud divided into two riverbeds east of Bam: one going east to Darestan and one going southeast toward the Narmashir Basin. The scarp is thought to have prevented surface water from running into the southern riverbed, most water now running through the northern riverbed. Further east, in Darestan, this water has had to pass over a zone where bedrock outcrops (Fouache *et al.* 2013: 564-566; Fig. 3). This configuration is reminiscent of what Nials *et al.* (2011: 736-737) define as a “reach boundary” created by “[r]esistant bedrock or sediments in or immediately adjacent to the stream channel...[They] typically alter the velocity of underflow, and result in a water table rise upstream from the boundary...[T]he unconfined floodplains above and below bedrock-related boundaries tend to be wider. If [steep-sided gullies] are not present...floodwaters...spread over a large area, thus reducing water depth and velocity during floods...increasing duration of floodwater residence and infiltration.” Various resources are available, including water, arable land, and a rich and diverse ecosystem. This observation is certainly worth keeping in mind considering that the Neolithic settlement we have observed in the Bam region clusters within the braided plain of Darestan, precisely east of what we believe is a reach boundary. Altitude

⁵ <https://whc.unesco.org/en/list/1505>; <https://earthobservatory.nasa.gov/features/HottestSpot/page2.php>.

⁶ <https://en.climate-data.org/asia/iran/kerman/bam-796/#climate-graph>.

decreases from that point eastward and increases again with the mountains located just east of this settlement, creating a depression within which the sites are located.

3 Summary of three excavation-seasons at Tell-e Atashi

Tell-e Atashi (site DA250) is located in the eastern part of the Neolithic settlement in Darestan. It is a ca. 5.4 ha mound, surrounded by a ca. 6.6 ha “scatter site,” a flat expanse of archaeological materials (Garazhian and Shakooie, 2013: 274; Fig. 3; Fig. 4: 1-3; Fig. 5). In 2008, one of us (O.G.) opened a test-trench in the southwestern portion of the mound. This test-trench studied the uppermost occupation deposits of the site, consisting of mudbrick architectural levels radiocarbon dated to between the late-sixth and mid-fifth millennia cal. BCE (Garazhian, 2016). In 2017 and 2018, two of us (O.G. and B.M.) opened additional test-trenches (TT1-7) to evaluate the nature of the archaeological deposits in other locations of the site. We also opened a 33 x 2 m stratigraphic trench (Excavation 1) to reach its oldest deposits and get a complete view of its stratigraphy. We reached the virgin soil at about nine meters deep relative to the surface of the 2008 test-trench, and new radiocarbon dates from Excavation 1 confirmed those from the 2008 field-season, as they cluster within the late-sixth millennium cal. BCE.⁷ Additionally, we opened a planimetric, ca. 165 m² excavation (Excavation 2) to get a better sense than in Excavation 1 of how the communities at Tell-e Atashi built and organized their habitat. We studied well-preserved living spaces, which yielded an abundant material assemblage. Although we have no radiocarbon dates from Excavation 2, the architecture and objects were recovered from this excavation are very similar to those from Excavation 1, making it likely that they date to sometime between the mid-sixth and mid-fifth millennia cal. BCE.

The radiocarbon dates from Tell-e Atashi make this site generally contemporary with Neolithic Tepe Yahya Period VII (ca. 5600-4600 cal. BCE) and slightly later than Tepe Gaz Tavila (ca. 5800-5400 cal. BCE) (Prickett, 1986a: 410 Tab. 3.1; 416-429, 544-545, 576-579; see Beale, 1986a). The mudbricks we found at Tell-e Atashi are “thumb-impressed.” They are similar to those from Neolithic-Chalcolithic Tepe Yahya Periods VII-VB as well as Tal-i Iblis Period I, Tepe Sialk Period II, and Mehrgarh Period I (see Evett, 1967: 219, 222; Caldwell and Sarraf, 1967: 283, 304 Pl. 7 lower, 306; Beale, 1986c; Beale and Lamberg-Karlovsky, 1986b: 248-249; Jarrige, 2008: 140 fig. 6). The rest of the material culture from Tell-e Atashi (including lithics; bone objects; stone beads, vessels, perforated discs; and grinding stones) has general parallels at Neolithic and Chalcolithic sites in Iran and Pakistan. We found no pottery, which is unusual considering the radiocarbon dates of the deposits we excavated, but we collected numerous unfired clay objects including figurines, cones, pawns, balls, and miniature dishes. Although several of these categories of clay objects have equivalents at other sites in Iran, including in Kerman and Fars (e.g., Tepe Yahya: Beale, 1986d: 190-199; Tol-e Nurabad: Weeks *et al.* 2006: 438 fig. 3.189 TN-113, TN-163, TN-226, TN-268; Tappeh Mianroud: Ebrahimi *et al.* 2016: 47 fig. 19), as well as at Mehrgarh (Jarrige *et al.* 2013: 267 fig. 69⁸), their abundance at Tell-e Atashi is noteworthy. As for the subsistence economy, it typically includes domesticated wheat and barley as well as wild grasses (gramineae, wild rye, bromes, oats), wild pulses (astragalus, fabaceae), and oil seeds (flax).⁹

⁷ Beta 500073: 6160 +/- 30 BP, 5214-5022 cal. BC (95.4%); Beta 500074: 6240 +/- 30 BP, 5306-5204 cal. BC (74.7%), 5167-5076 cal. BC (20.7%).

⁸ Several of the figurines we found are very similar to those from Neolithic Mehrgarh (C. Jarrige, 2008).

⁹ Preliminary analysis by Z. Shirazi (Archaeobotanical Laboratory at Shahr-i Sokhta). The faunal remains await analysis.

4 Surface survey in the Bam region

4.1 Methodology and limitations

We surveyed by foot and car, aided with prior study of satellite images on Google Earth and of available published data (e.g., Adle, 2006; Garazhian, 2009). We recorded the sites locations using a GPS smartphone application named "Field GPS." This application allows for a fast and easy capture of large series of GPS coordinates with horizontal and vertical accuracies of 5 m and 3 m, respectively. We collected a sample of diagnostic surface materials at each site, mostly lithics and ceramic fragments, which permitted us to date the occupation(s) present at these sites. We calculated the sites areas based on the surface distribution of archaeological materials and features and using numerous GPS coordinates recorded at close, regular intervals. This data was then processed through Google Earth and ArcMap. Although we recorded many GPS coordinates, the sites areas indicated in the present article (Table 1) should be considered approximations for three reasons. One is that the GPS coordinates we used to calculate these areas bear a margin of error. The second one is that some of these sites may contain archaeological deposits that are now buried below current ground surface, which we obviously could not detect and measure from just their surfaces. The third reason is that almost half of the Neolithic sites we recorded also yielded more recent material. Therefore, the areas we measured at these sites likely also include surfaces corresponding to more recent occupations, and not only Neolithic deposits.

Our strategy for recording, classifying and dating the sites has largely followed the methodology developed by M. Prickett in the Daulatabad Plain (Prickett, 1986a; 1986b; see below) and used the ceramic chrono-typology established in that region as well as at Tepe Yahya and Tal-i Iblis (Beale and Lamberg-Karlovsky, 1986a; Caldwell, 1967). Before describing our survey results, we need to address one limitation that concerns a ceramic criterion we used to date the sites. At sites with pottery, vegetal-tempered pottery, a typical marker of the Neolithic period in Iran (e.g., Weeks, 2013b), served as our primary criterion to distinguish pottery Neolithic sites from more recent sites. Yet, at Tepe Yahya, vegetal-tempered vessels continued to be made during the following Chalcolithic period, Periods VI-V, alongside new, mineral-tempered ceramics (Beale, 1986b: 39-47, fig. 4.1). In the Bam region, the oldest Chalcolithic sites we identified are precisely characterized by Yahya V-related mineral-tempered ceramics. The sites we have defined in this area as pottery Neolithic sites are sites where we recorded vegetal-tempered material only, as well as sites with mostly vegetal-tempered material and rare mineral-tempered sherds. Eight sites with vegetal-tempered pottery yielded mineral-tempered ceramics clearly connected to Yahya V. Thus, considering the above-mentioned observation made at Tepe Yahya, it is possible that these sites date to the Chalcolithic period only. Conversely, some sites we have defined as Chalcolithic may also enclose Neolithic deposits that we could not identify from just their surfaces.

4.2 Site locations, numbers and characteristics

Between 2016 and 2017, we surveyed: in and around Bam; west of this city along the Posht-e Rud from Bam to Abaregh; east of Bam in Darestan up to Allahabad; along the scarp west of Baravat; and ca. 30-35 km southwest of Bam along the Jebal Barez (Mutin and Garazhian, 2019; Fig. 2). We started from areas where archaeological sites had been identified before (see Adle, 2006). We recorded sites dating to between the Paleolithic and Islamic periods, including 64 Neolithic sites all in Darestan. Except for

site DAK110, which is next to the above-mentioned outcropping of bedrock, these Neolithic sites are all concentrated within a ca. 6.15 by 7 km (43.05 km²) area further east (Fig. 5). We have identified no other Neolithic site in any of the other areas we surveyed. It is nonetheless important to note that Adle reported Neolithic lithics inside the Bam citadel (Arg-e Bam) in the city as well as west of this citadel between Bam and Darzin (Adle, 2006: 38-41). It certainly is possible that Neolithic communities settled in these locations as well as between Bam and Darestan. We are keeping this possibility open for the latter area, as we have not systematically surveyed it. On the other hand, our intensive survey between Bam and Darzin did not yield any convincing Neolithic evidence. If Neolithic sites existed in this area, they clearly were not as substantial and numerous as those in Darestan (see Mutin and Garazhian, 2019).

In Darestan, we recorded 39 Neolithic sites with pottery and 25 aceramic Neolithic sites. Compared to a previous report (Mutin and Garazhian, 2019), we have consolidated here sites that, after closer examination, seem to be part of a single site and discarded sites with little or no clear Neolithic diagnostics. These 64 sites divide into 23 "mounded sites" (Fig. 4: 1-5) and 41 "scatter sites" (Fig. 4: 6-7). "A mounded site is an accumulation of silt and occupation debris raised above the surrounding ground surface. A scatter site is a ground surface accumulation of sherds [and other types of artifacts] lacking both mounding and architectural debris. It can be either a site-related scatter site contiguous to a mounded site or an independent scatter site not associated with other archaeological materials" (Prickett, 1986b: 216). An issue with the mounded sites we recorded is that it is not always clear whether they consist of an actual accumulation of silt and occupation debris, or a superficial occupation layer on top of a natural hilltop. As for the scatter sites, they are generally well-materialized by stones visible from a distance, although some yielded very small amounts of artifacts (Fig. 4: 6-7). These stones include a few grinding stones and hammerstones and mostly consist of unworked, natural stones that may have served as building material and as raw material for tool production. These sites are most likely partly deflated occupation sites. However, even considering the erosion factor, they were more transient than the mounded sites.

These 64 sites in Darestan cover ca. 61 ha (61,0834 m²), excluding Tell-e Atashi, the largest of the Neolithic sites in this area (site DA250). With Tell-e Atashi (ca. 12 ha including both its mounded and scatter parts), this occupation area is ca. 73 ha. However, since almost half of these sites (30) also yielded more recent material (mineral-tempered ceramics at 27 sites, including Yahya V-related diagnostics; Islamic remains at one site; and more recent ceramics at two sites), the areas we measured at these sites likely also incorporate surfaces relating to more recent occupations. When discarding these 30 multi-period sites from our calculation, we get ca. 36 ha. Out of the remaining 34 sites with Neolithic material only, just six sites are larger than 2.5 ha (DA230A-G, DA248, DA250, DA177, DA196, DA211A-C), including Tell-e Atashi (ca. 12 ha) and site DA196 (ca. 4.6 ha), the largest sites. Seven sites are mounded sites, all less than 1 ha save for Tell-e Atashi's mounded part (ca. 5.4 ha). As for the scatter sites, 20 are less than 0.5 ha, six are between ca. 0.7-2.5 ha, one is ca. 3 ha, one is ca. 4.6 ha (site DA196), and Tell-e Atashi's scatter site is ca. 6.6 ha. For the sake of calculation, still considering these 34 sites only, the mounded sites represent ca. 7.9 ha (including Tell-e Atashi's mounded part), and the scatter sites represent ca. 28 ha (or ca. 21.4 ha without Tell-e Atashi's scatter site).¹⁰

¹⁰ Even considering all the Neolithic sites including sites containing more recent materials, Tell-e Atashi remains the largest, and both mounded and scatter sites mostly remain of much smaller size relative to this site: 37 sites are ca.

The Neolithic settlement in Darestan thus emerges as a substantial one and probably among the largest Neolithic regional settlements reported so far in southeastern Iran, if not Iran. Furthermore, it remains possible that additional Neolithic sites are buried under the alluvial plain, a factor that might explain an apparent absence of archaeological remains between DAK110 and the other Neolithic sites. In comparison, in the Daulatabad Plain, Prickett (1986b: 223-224) recorded 19.68 ha of mounded sites within a 20 km² area for the 1,200 years-period corresponding to Yahya VII. This includes Tepe Gaz Tavila (ca. 9.9 ha consisting of four mounds), two sites nearby (ca. 1.67 ha), and seven other mounds, in addition to a few other sites that may date to the Neolithic period too. Interestingly, although less Neolithic sites and a smaller Neolithic occupation area were recorded in the Daulatabad Plain, the Neolithic landscape in both this region and Darestan appear to be characterized by a single large site associated with smaller sites.

An important parameter that we have no good control on is the absolute and relative chronology of these sites in Darestan. Over the course of the Neolithic period, some sites were probably abandoned while new ones were settled, some older ones may have been reoccupied, and so on. Yet, the only chronological information we have on this period is that the aceramic deposits we excavated at Tell-e Atashi date to between the late-sixth and mid-fifth millennia cal. BCE, while we have no solid grasp onto the evolution of the material culture. Consequently, we presently cannot delineate the potential multiple shifts in settlement pattern that most likely occurred in Neolithic Darestan. One pattern however clearly emerges from the distribution map on Fig. 5: the 39 Neolithic sites where we recorded vegetal-tempered pottery are distributed all over this Neolithic settlement, whereas the 25 aceramic sites are concentrated within its southern half. Furthermore, only two of the sites with pottery within this southern cluster (DA242, DA247) are sites with Neolithic material only. The rest of the pottery Neolithic sites (eight sites) in this cluster also yielded more recent ceramics. Therefore, for the reason explained above, the vegetal-tempered fragments from these sites, and these sites themselves, may be more recent. This would tentatively make this southern cluster virtually entirely aceramic Neolithic. Additionally, the mounded sites with Neolithic material only consist of just six sites within the southeastern part of the Neolithic settlement. All are aceramic except for site DA247. Similarly, 18 of the 21 scatter sites we recorded in the southern cluster are aceramic. This apparent spatial dichotomy possibly reflects a shift in settlement pattern between two chronological phases: one with pottery and one without. Certainly, it is possible that pottery was present and completely disappeared from the surfaces of the sites we recorded as aceramic, or that the activities conducted at these sites did not require pottery. Yet, these scenarios may explain dearth of pottery at some of, but not all, these aceramic sites. Indeed, our extensive excavations at Tell-e Atashi have clearly shown that this site is aceramic, and there is no reason not to believe that this was not the case at other sites in Darestan. The reasons for this apparent shift now need be explored. A possibility is that it followed the shifting availability of water over time. This hypothesis will need to be tested in the future with consideration of geomorphological data. Ideally, it certainly would be best to also get more accurate chronological data from these sites through excavation.

0.5 ha to the maximum; 19 sites are between ca. 0.5-2.5 ha; six sites are between ca. 2.5-4.6 ha; and one site is ca. 6.6 ha.

4.3 Lithic assemblage

We collected 1388 lithics from 58 of these Neolithic sites (excluding Tell-e Atashi), with quantities ranging from two to 75 records per site. By and large, this survey assemblage is homogeneous as far as the raw material, technology and typology of the tools are concerned. The raw material mostly consists of locally available brown to grey chert as well as small quantities of andesite and red and black chert. Technologically, the assemblage is characterized by the pressure technique in core reduction (Fig. 6: 1), which is typical of the Neolithic period (e.g., Kozłowski, 1994). This technique is evidenced by elements such as crested blades (Fig. 6: 11-12), core tablets (Fig. 6: 14), and standardized blade/lets with parallel ridges (Fig. 6: 1, 3, 5). Preliminary comparative analysis between the lithic assemblage from aceramic Tell-e Atashi and that of pottery site DA226 has shown that few unidirectional bladelet cores were present at the former whereas more elaborate bullet cores were recorded at the latter (Jayez, 2015).¹¹ Most tools are made on blade/let. The tools include backed (Fig. 6: 6-7), naturally backed, notched-denticulated (Fig. 6: 16) and mostly retouched and used pieces (Fig. 6: 1, 4-5). Scrapers (Fig. 6: 18), geometrics (Fig. 6: 10), borers (Fig. 6: 17) and burins are recorded in smaller amounts. The technology and tool typology identified in the survey lithic collection are consistent with other Neolithic assemblages found in Iran and Pakistan. Pressure technique and tools such as backed pieces and geometrics are recorded at Tepe Gaz Tavila and Tepe Yahya in Kerman; Mehrgarh and Kili Ghul Mohammed in Pakistan; and in Neolithic Fars, although the sites in Fars are older (Jayez, 2015; Nishiaki, 2018).

4.4 Ceramic assemblage

The Neolithic pottery we recorded at 39 sites is typically vegetal-tempered, and its color varies from buff to red (Fig. 7). It mostly includes deep bowls or beakers (Fig. 7: 4-9), although we found other forms such as larger vessels (Fig. 7: 10-11), a small necked-jar with a S-profile (Fig. 7: 1), a small bowl (Fig. 7: 2), carinated wall fragments (Fig. 7: 13-15), and a wall fragment with a ledge (Fig. 7: 3). The bases we collected are flat or concave (Fig. 7: 16-20), and one is flat and has a ledge (Fig. 7: 12). This vegetal-tempered pottery is conforming to the generic label "Soft-Ware Horizon," a label that defines the earliest pottery vessels recorded in Iran and Pakistan. Vessels with a similar type of fabric were found in Tepe Yahya Neolithic-Chalcolithic Periods VII-V (Chaff-tempered Coarse Ware) as well as at Tal-i Iblis (Lalehzar Coarse Ware). These ceramics have parallels in Fars, including mid-late sixth/early-fifth millennia cal. BCE Shamsabad ware from Tall-i Bakun (Dyson, 1965; Chase *et al.* 1967: 32, 149-151; Beale, 1986b: 39-47, 86; Vandiver, 1987; C. Jarrige *et al.* 1995: 422-423, 437 fig. 9.7, 514, 539 fig. 11.14b, 540 fig. 11.15b; Weeks, 2013b: 57-66). Chaff-tempered Coarse Ware from Tepe Yahya includes flat- and concave-bottomed vessels as well as a few rim profiles comparable to those from Darestan (Beale, 1986b: 41 fig. 4.2 a, f; 42 fig. 4.4 b, c). However, our surface collection lacks the typical handles from Yahya VII (Beale, 1986b: 41 fig. 4.2 n, p-w) and the type of carinated jar characteristic of Yahya VI-V (Beale, 1986b: 44 fig. 4.4 i; 45 fig. 4.5) and Tal-i Iblis (Evet, 1967: 206 fig. 1 no. 1; Caldwell and Sarraf, 1967: 285 fig. 7). Additionally, we have observed no parallels at Tepe Yahya for the above-mentioned necked-jar with a S-profile and base with a ledge (Beale, 1986b: 39-47). One necked-jar from Tal-i Iblis (Caldwell and Sarraf, 1967: 284 fig. 6 no. 1) is however reminiscent of the former. Lastly, the carinated

¹¹ It is important to note that site DA226 is one of the eight sites in the above-mentioned southern cluster that yielded vegetal-tempered pottery as well as ceramics relating to more recent periods. Therefore, for the reason explained above, the vegetal-tempered fragments at this site and this site may be more recent.

fragments we found have profiles different from the vegetal-tempered carinated vessels from Tepe Yahya and Tal-i Iblis.

4.5 Other categories of artifacts

The other finds we collected include vessels, perforated objects (Fig. 8: 12), one axe or celt (Fig. 8: 13), one cone (Fig. 8: 9), and one bead (Fig. 8: 6) in stone; two beads (Fig. 8: 1-2) and one pendant (Fig. 8: 3) in lapis lazuli; one turquoise bead (Fig. 8: 4); one carnelian bead (Fig. 8: 5); one cone (Fig. 8: 10), one bead (Fig. 8: 7), and one pendant (Fig. 8: 8) in clay; a ceramic disc (Fig. 8: 11); one pin (Fig. 8: 14) and one fragment in copper. We also found hammerstones and grinding stones. Part of this survey assemblage has equivalents at Tell-e Atashi, and most of these categories of artifacts have general parallels at many Neolithic and Chalcolithic sites in Iran, including Tepe Yahya and Tal-i Iblis.

Stone vessels are ubiquitous in the Middle East and are not specifically characteristic of these periods. Stone axes or celts are recorded at Tal-i Iblis and Tepe Yahya Period V, although the latter examples are not illustrated and the single illustrated example from the former site does not resemble our specimen from site DA152 (Evett, 1967: 213; Caldwell and Sarraf, 1967: 280, 290 fig. 10 no. 1; Beale, 1986d: 187). We also are lacking parallels in Kerman for the perforated stone objects from Darestan.

Lapis lazuli beads are recorded in Yahya VB-VA, carnelian beads in Yahya VIA-V, and turquoise beads in Yahya VIIC-VA (Beale, 1986d: 167-171). No lapis lazuli is mentioned at Tal-i Iblis, whereas turquoise and carnelian beads are recorded at this site from contexts relating to Yahya V (Chase *et al.* 1967: 159 Tab. V, 160 Tab. VI, 161 Tab. VII, 165, 166 fig. 34 no. 2, 167 fig. 35 no. 10, 168 fig. 36 no. 6, 185 fig. 37 no. 5; Evett, 1967: 204 Tab. 1, 216 fig. 7 nos. 8-9, 217, 221 Pl. 2, 244-245 Tab. 15; Caldwell and Sarraf, 1967: 302 fig. 15 nos. 3-4; Caldwell, 1967: 406-407). As far as the bead shapes are concerned, we observed in Darestan eight types that are recorded at Neolithic and Chalcolithic Tepe Yahya (Beale, 1986d: 167-168, 172-173 Tab. 7.2). Three clay beads from Tal-i Iblis resemble the above-mentioned single clay bead from site DA231 (Chase *et al.* 1967: 168 fig. 36 nos. 3, 15; Evett, 1967: 218 fig. 8 no. 10). The shape of one turquoise bead from Tal-i Iblis resembles those of our lapis lazuli bead from site DA106 and turquoise bead from site DA123 (Chase *et al.* 1967: 166 fig. 34 no. 2). The above-mentioned lapis lazuli pendant from site DA171 has no parallel, although one cruciform, bone or ivory object from Tal-i Iblis is somewhat reminiscent of it (Chase *et al.* 1967: 168 fig. 36 no. 11). Lastly, we have found no clear parallel for the clay pendant from site DA231, at least not in Kerman.

The clay cone from site DA109 (and the stone example from site DA171) has parallels in Yahya VII-V and at Tal-i Iblis (Caldwell and Sarraf, 1967: 302 fig. 15 no. 8; Beale, 1986d: 192 fig. 7.18 h, i, 197) as well as outside of Kerman including in Fars and Susiana (Weeks *et al.* 2006: 64-65, 438 fig. 3.189 TN-113, TN-163). While they are interpreted as counting devices at Tepe Yahya (Beale, 1986d: 197), they are elsewhere sometimes considered lip- or ear-plugs and termed "labrets." The clay disc from site DA123 is made out of mineral-tempered pottery, which essentially appeared during the Chalcolithic period. Such artifact is frequently recorded in southeastern Iran, including at Tal-i Iblis (see Chase *et al.* 1967: 155; 165; 199 Tab. XIV; Evett, 1967: 218 fig. 8 no. 9).

Lastly, regarding the copper items from Darestan, one should recall that native copper has been used in Iran since the Neolithic period. Copper objects are recorded at Tepe Yahya in contexts dating to the sixth and fifth millennia cal. BCE (Yahya VII-V) and in fifth millennium cal. BCE deposits at Tal-i Iblis, where the earliest evidence for extractive copper metallurgy was identified (e.g., Caldwell and Sarraf,

1967: 286 fig. 8 no. 4, 300 fig. 14 nos. 3-5, 302 fig. 15 nos. 5, 7, 10; Heskell and Lamberg-Karlovsky, 1986; Weeks, 2013a: 278).

5 Discussion and concluding remarks

Many Neolithic sites lie within the southern Lut Desert area, in the lowlands of Darestan east of the Jebel Barez. We believe that climate at that time and the specific topographic conditions of this area encouraged settlement, for they facilitated access to water, arable lands, and various vegetal and animal resources. Such configuration is referred to as “geological opportunism,” whereby early farming communities exploited areas that were periodically inundated and where water and fertile silt could be easily captured and diverted (Petrie and Thomas 2012: 1056-1058). One should add that the location of these Neolithic sites on alluvial fans is consistent with the pattern observed at early farming villages in the Daulatabad Plain and Pakistani Balochistan (see Petrie and Thomas, 2012). These similarities in subsistence strategies across the Neolithic landscape of southeastern Iran and Pakistan are important to keep in mind for understanding “both the dispersal of wheat, barley, sheep, goat and cattle-based agro-pastoralism and also the interactive relationships between populations” (Petrie and Thomas, 2012: 1064). An additional, more preliminary observation that needs be remembered is that both in the Daulatabad Plain and Darestan the Neolithic regional area appears to be dominated by a single major site.

Another important characteristic of Neolithic Darestan is that many of its sites yielded no pottery. Certainly, lack of pottery in survey assemblage may be an effect of site preservation and the way surface material is collected. It may also be explained by the fact that the activities that were carried out at the aceramic sites did not call for pottery. Yet, there is no doubt that Tell-e Atashi enclosed aceramic dwellings, and it seems unlikely that at least part of the 24 additional aceramic Neolithic sites we recorded in Darestan were not used by aceramic communities. This characteristic has implications and merits discussion at different geographic scales. Locally, since these aceramic sites are mostly clustered within the southern half of the Neolithic settlement area, we hypothesize that a shift in settlement pattern occurred between one chronological phase characterized by aceramic sites and one phase characterized by sites with pottery. We cannot definitely tell which phase came first, and at this point of our regional analysis, it certainly is appropriate to keep all possibilities open. One possibility could be that pottery was produced for some time in Darestan and then stopped being made. A reason for this could be that wood (or another type of fuel) suitable for pottery firing became at some point increasingly difficult to obtain and was saved for other activities.¹² However, current evidence tends to point to the opposite scenario in which aceramic sites are older than pottery sites. First, comparative analysis of the lithic assemblages from aceramic Tell-e Atashi and pottery site DA226 has revealed that more elaborate bullet cores are present at the latter site, tentatively implying that this site is more recent. Second, vegetal-tempered pottery of the same general type as the one we collected at the pottery Neolithic sites in Darestan is known to have been produced also during part of the following Chalcolithic period in southeastern Iran. This suggests more continuity than a break between the

¹² On this note, Prickett argued that the fact that the rooms of Neolithic Tepe Yahya are smaller than those found less than 50 km apart at Tepe Gaz Tavila may simply “reflect difficulty in obtaining adequate beams and roof support posts [near the former site] to span larger areas” (Prickett, 1986a: 574). This hypothesis reminds us that resource availability and lack thereof considerably affects the material record, even within spatially and culturally close regions and sites.

pottery Neolithic sites and Chalcolithic sites in Darestan. Third, the fact that we recorded many Chalcolithic sites with large quantities of pottery and with evidence for pottery production at some of them (Mutin and Garazhian, 2019) argues against the hypothesis that an increasing lack of fuel led to the end of pottery production in this region. Thus, we are currently more inclined to believe that pottery began being made in Darestan after a phase during which no pottery was produced. Considering this scenario, the radiocarbon dates from aceramic Tell-e Atashi suggest that pottery did not occur in this region before the fifth millennium cal. BCE, at a time corresponding to the late Neolithic and even the Chalcolithic periods elsewhere. The earliest pottery vessels observed in Darestan are then generally conform to those recorded west of the Jebal Barez, including in Tepe Yahya Neolithic and Chalcolithic occupations.

Absence of pottery is unusual at sixth and fifth millennia cal. BCE sites in Iran. As noted above, pottery is known in Fars since the seventh and sixth millennia cal. BCE, and the aceramic deposits identified at Tepe Rahmatabad in this province date to ca. 7000 cal. BCE. In Kerman, deposits with pottery dating to the seventh millennium cal. BCE were recently excavated at Tepe Gav Koshi, while the pottery Neolithic settlements of Tepe Gaz Tavila and Tepe Yahya Period VII are respectively closer in time to and contemporary with Tell-e Atashi. Yet, in contrast to the regions west of the Jebal Barez, no pottery appears to have been produced for some time during the Neolithic period in the southern Lut Desert region, at a time not coincident with the early Neolithic sites in central Zagros and the Fertile Crescent but much later. This characteristic suggests that southeastern Iran's Neolithic population included communities who not only did not engage part of their activities in pottery production but potentially did not store, cook, and eat the same ways as their western neighbors. We are currently not able to explain this situation, but we may note that it is quite unexpected considering that these communities were not isolated. Indeed, in view of the relatively short distances between Neolithic Darestan and the rest of the known Neolithic sites in southeastern Iran,¹³ we believe that the similarities we have observed between the material cultures from both sides of the Jebal Barez (mudbricks with thumb-impressions, lithic industry, and other types of objects) are not coincidental but reflect connections between western and eastern Kerman. It remains unclear whether these relationships result from interactions or dispersals, although the facts that we have found no previous local settlement in Darestan out of which its Neolithic settlement could have emerged, and that western Kerman includes older Neolithic settlements, do not contradict the latter hypothesis. Regardless, in addition to these parallels with western Kerman, the carnelian, turquoise and lapis lazuli ornaments we found in Darestan show that this region was part of interregional and long-distance exchange networks. While a possibility remains that turquoise and carnelian came from sources in southeastern Iran, there is no doubt that lapis lazuli originally came from northeastern Afghanistan (Prickett, 1986a: 381-399).

Absence of pottery appears less unusual when considering more distant areas to the east in Pakistan. In this regard, Darestan recalls Mehrgarh aceramic Neolithic Period I, with which Tell-e Atashi also shares similar clay figurines and thumb-impressed mudbricks (Mutin and Garazhian, in preparation). We noted above that this period is thought to date to the eighth/seventh millennia cal. BCE (see Jarrige *et al.* 2013: 148, 151-154), although most available radiocarbon dates (C. Jarrige *et al.* 1995: 555-556) are more recent. Certainly, potential samples contamination and calibration issues need be kept in mind. Yet, we have to admit that these dates from Mehrgarh are generally consistent with those from Tell-e Atashi.

¹³ For instance, Tepe Yahya is only ca. 200 km southwest of Tell-e Atashi.

Lack of pottery is also observed in southwestern Pakistan (Kech-Makran) in the late fifth millennium cal. BCE as well as in the coastal regions of the northeastern Arabian Peninsula until the fourth millennium cal. BCE. The present new data from the southern Lut Desert region makes it increasingly rational to think that a late aceramic Neolithic horizon existed in the Indo-Iranian Borderlands (see Mutin, 2012: 176-177). It also makes it increasingly reasonable to hypothesize that Mehrgarh Period I was part of this horizon, and not an isolated, older, aceramic Neolithic site. Such scenario is consistent with the models that view the emergence of agriculture in the Indo-Iranian Borderlands as the result of late, demic or cultural diffusion. It has yet to be solidly proven with incorporation of more comparative analyses of more aspects of the archaeological and environmental records in these regions than presented in this article. Hopefully, the results reported here have at least served to address the necessity of reevaluating Mehrgarh's chronology together with available data from southern Iran, and taken us one step forward toward greater comprehension of the emergence of agriculture east of the Fertile Crescent.

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References

- Adle, C., 2006. Qanats of Bam: an Archaeological Perspective. Irrigation System in Bam, its Birth and Evolution from the Prehistoric Period up to Modern Times, in: Honari, N., Salamat, A., Salih, A., Sutton, J., Taniguchi, J. (Eds.), *Qanats of Bam. A multidisciplinary approach*. UNESCO Tehran Cluster Office, Tehran, pp. 33–85.
- Anseri, F., Javad Bolourchi, M., Entezam Soltani, I., 2006. Geological Characteristics of Bam Region with Special Reference to Qanat Systems Development and Effects of the December 26, 2003 Earthquake, in: Honari, N., Salamat, A., Salih, A., Sutton, J., Taniguchi, J. (Eds.), *Qanats of Bam. A multidisciplinary approach*. UNESCO Tehran Cluster Office, Tehran, pp. 1–20.
- Azizi Kharanaghi, H., Fazeli Nashli, H., Nishiaki, Y., 2013. Tepe Rahmatabad: a Pre-Pottery and Pottery Neolithic Site in Fars Province, in: Matthews, R., Fazeli Nashli, H. (Eds.), *The Neolithisation of Iran. The Formation of New Societies*. British Association for Near Eastern Archaeology. Oxbow Books, Oxford and Oakville, pp. 108–123.
- Bar-Yosef, O., 2014. The origins of sedentism and agriculture in western Asia, in: Renfrew, C., Bahn, P. (Eds.), *The Cambridge World Prehistory*. Cambridge University Press, Cambridge, pp. 1408–1438.
- Beale, T.W., 1986a. The Site, in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 11–20.
- Beale, T.W., 1986b. The Ceramics, in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 39–89.

- Beale, T.W., 1986c. The Architecture, in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 101–165.
- Beale, T.W., 1986d. The Small Finds, in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 167–206.
- Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), 1986a. Excavations at Tepe Yahya, Iran 1967–1975. The Early Periods. American School of Prehistoric Research Bulletin 38. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge MA.
- Beale, T.W., Lamberg-Karlovsky, C.C., 1986b. Summary of Change and Development in the Early Periods at Tepe Yahya, 4900–3300 B.C., in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 247–264.
- Bellwood, P. 2005. First Farmers. The Origins of Agricultural Societies. Blackwell Publishing, Malden, Oxford, Carlton.
- Caldwell, J.R. (Ed.), 1967. Investigations at Tal-i Iblis. Illinois State Museum Preliminary Reports 9. Illinois State Museum Society, Springfield.
- Caldwell, J.R., Sarraf, M., 1967. Exploration of Excavation Area B, in: Caldwell, J.R. (Ed.), pp. 272–308.
- Chase, D.W., Caldwell, J.R., Fehervari, I., 1967: The Iblis Sequence and the Exploration of Excavation Areas A, C, and E, in: Caldwell, J.R. (Ed.), pp. 111–201.
- Dyson, R.H. Jr., 1965. Problems in the relative chronology of Iran, 6000–2000 BC, in: Ehrich, R.W. (Ed.), *Chronologies in Old World archaeology*, 2nd ed. University of Chicago Press, Chicago, pp. 215–56.
- Ebrahimi, S., Abolahrar, A., Zare, M., 2016. Preliminary Report on the Excavations at Tappeh Mianround, Fars, in: Roustaei, K., Mashkour, M. (Eds.), *The Neolithic of the Iranian Plateau. Recent Research. Studies in Early Near Eastern Production, Subsistence, and Environment* 18. Ex oriente, Berlin, pp. 31–48.
- Evet, D., 1967. Artifacts and Architecture of the Iblis I Period: Areas D, F, and G, in: Caldwell, J.R. (Ed.), pp. 202–255.
- Fouache, E., Francfort, H.-P., Cosandey, C., Adle, C., Bendezu-Sarmiento, J., Vahdati, A.A., 2013. Les régions de Bam et de Sabzevar (Iran) : une évolution dans l'implantation des sites archéologiques et dans la gestion des ressources en eau compatible avec l'hypothèse d'une aridification croissante du climat entre 2500–1900 BC, in: Bendezu-Sarmiento, J. (Ed.), *L'archéologie française en Asie centrale. Nouvelles recherches et enjeux socioculturels. Cahiers d'Asie Centrale* 21/22. Édition-Diffusion de Boccard, Paris, pp. 559–572.
- Garazhian, O. 2009. Darestan: a group of Pre-Pottery Neolithic (PPN) sites in south-eastern Iran. *Antiquity Project Gallery* 83(319). <http://www.antiquity.ac.uk/projgall/garazhian319/>.
- Garazhian, O., 2016. Stratigraphic Excavation at Tal-e Atashi, Darestan, Bam: Living Floors of a Pre-Pottery Neolithic Site, Southeastern Iran, in: Roustaei, K., Mashkour, M. (Eds.), *The Neolithic of the Iranian Plateau. Recent Research. Studies in Early Near Eastern Production, Subsistence, and Environment* 18. Ex oriente, Berlin, pp. 49–74.
- Garazhian, O., Shakooie, M. 2013. Tell-e Atashi (Bam, southeastern Iran) and the Neolithic of the eastern Near East, in: Matthews, R., Fazeli Nashli, H. (Eds.), *The Neolithisation of Iran. The Formation*

of New Societies. British Association for Near Eastern Archaeology. Oxbow Books, Oxford and Oakville, pp. 284–296.

Harris, D. 2010. The Beginnings of Agriculture in Western Central Asia, in: Harris, D. (Ed.), *Origins of Agriculture in Western Central Asia*. University of Pennsylvania Press, Philadelphia, pp. 225–236.

Heskel, D., Lamberg-Karlovsky, C.C., 1986. Metallurgical Technology, in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 207–213.

Jarrige, C., 2008. The figurines of the first farmers at Mehrgarh and their offshoots. *Pragdhara* 18, 155–166.

Jarrige, C., Jarrige, J.-F., Meadow, R.H., Quivron, G., 1995. Mehrgarh. Field Reports 1974–1985. From Neolithic times to the Indus Civilization. Department of Culture and Tourism, Government of Sindh, Pakistan, Karachi.

Jarrige, J.-F., 2008. Mehrgarh Neolithic. *Pragdhara* 18, 135–154.

Jarrige, J.-F., Quivron, G., Jarrige, C., 2013. Mehrgarh: Neolithic Period. Seasons 1997–2000. *Mémoires des Missions Archéologiques Françaises en Asie Centrale et en Asie Moyenne* 15. Série Indus-Balochistan. De Boccard, Paris.

Jayez, M., 2015. Techno-typological Analysis of Neolithic Chipped Stone Industry in Southeast of Iran and Pakistan based on Lithic Industry of Tell-e Atashi. Post-Doctoral thesis, Tarbiat Modares University, Faculty of Humanities.

Kingwell-Banham, E., Petrie, C.A., Fuller, D.Q., 2015. Early agriculture in South Asia, in: Barker, G., Goucher, C. (Eds.), *Cambridge World History, 2: A World with Agriculture, 12,000 BCE–500 CE*. Cambridge University Press, Cambridge, pp. 261–288.

Kozłowski, S.K., 1994. Chipped Neolithic Industries at the Eastern Wing of the Fertile Crescent (synthesis Contribution). *Neolithic Chipped Stone Industries Of the Fertile Crescent*, 143–172.

Lamberg-Karlovsky, C.C., Beale, T.W., 1986. Conclusion: Tepe Yahya in the Context of a Wider Core-Periphery Interaction Sphere in the Fifth and Fourth Millennia B.C., in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 265–268.

Meadow, R., 1986. The Geographical and Paleoenvironmental Setting of Tepe Yahya, in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 21–38.

Mutin, B., 2012. Cultural Dynamics in Southern Middle-Asia in the Fifth and Fourth Millennia BC: A Reconstruction based on Ceramic Traditions. *Paléorient* 38(1), 161–186.

Mutin, B., Garazhian, O., 2019. Iranian-French Archaeological Mission in Bam, Kerman: Summary of Field-seasons 2016-2017. *Journal of Archaeology* 2, 93–105.

Mutin, B., Garazhian, O., in preparation. Migrations, transfers, exchanges, convergences? Assessing similarities and differences among the earliest farmers between the Daulatabad and Kachi Plains (Southern Iran and Pakistan). *Proceedings of the International Congress The East 1*.

- Mutin, B., Moradi, H., Sarhaddi-Dadian, H., Fazeli Nashli, H., Soltani, M., 2017. New discoveries in the Bampur Valley (south-eastern Iran) and their implications for the understanding of settlement pattern in the Indo-Iranian borderlands during the Chalcolithic Period. *Iran* 55, 99–119.
- Narasimhan, V.M., Patterson, N., Moorjani, P., Lazaridi, I. *et al.* 2019. The formation of human populations in South and Central Asia. *Science* 365 (6457), eaat7487.
- Nials, F.L., Gregory, D.A., Hill, J.B., 2011. The Stream Reach Concept and the Macro-Scale Study of Riverine Agriculture and Semiarid Environments. *Geoarchaeology: An International Journal* 26(5), 724–761.
- Nishiaki, Y., 2018. The development of Neolithic lithic industries in Fars, Southwest Iran, in: Azizi Kharanaghi, M.H., Shanipour, M., Naseri, R. (Eds.), *Proceedings of the 4th International Conference of Young Archaeologists*. The University of Tehran, Tehran, pp. 44–59.
- Nishiaki, Y., Azizi Kharanaghi, H., Abe, M., 2013. The Late Aceramic Neolithic Flaked Stone Assemblage from Tepe Rahmatabad, Fars, South-West Iran. *Iran* 51, 1–15.
- Patel, A.K., Meadow, R.H., 2017. South Asian Contributions to Animal Domestication and Pastoralism: Bones, Genes, and Archaeology in: Albarella, U., Rizzetto, M., Russ, H., Vickers, K., Viner-Daniels, S. (Eds.), *The Oxford Handbook of Zooarchaeology*. Oxford University Press, Oxford, UK, pp. 280–303.
- Petrie, C.A., Thomas, K.D., 2012. The topographic and environmental context of the earliest village sites in western South Asia. *Antiquity* 86, 1055–1067.
- Petrie, C.A., Weeks, L., 2019. The Iranian Plateau and the Indus River Basin, in: Chiotis, E. (Ed.), *Climate Changes in the Holocene. Impacts and Human Adaptation*. CRC Press, Taylor and Francis Group, Boca Raton, pp. 293–325.
- Prickett, M.E., 1986a. *Man, Land and Ware: Settlement Distribution and the Development of Irrigation Agriculture in the Upper Rud-i Gushk Drainage, Southeastern-Iran*. PhD Dissertation, Harvard University, Department of Anthropology (U.M.I. Dissertation Information Service).
- Prickett, M.E., 1986b. Settlement during the Early Periods, in: Beale, T.W., Lamberg-Karlovsky, C.C. (Eds.), pp. 215–246.
- Sarhaddi-Dadian, H., Mutin, B., Moradi, H., 2019. New Data on the Chalcolithic and Bronze Age periods in the South-Eastern Greater Periphery of the Jazmurian Basin: Archaeological Survey along the Sarbaz Valley and in Adjacent Areas in Iranian Baluchestan. Iran. <https://doi-org.ezp-prod1.hul.harvard.edu/10.1080/05786967.2019.1566762>.
- Silva, F., Vander Linden, M., 2017. Amplitude of travelling front as inferred from ¹⁴C predicts levels of genetic admixture among European early farmers. *Nature Scientific Reports* 7: 11985. DOI:10.1038/s41598-017-12318-2.
- Soleimani, N.A., Fazeli Nashli, H., 2018. The Re-evaluation of Kerman Neolithic Chronology based on the Excavation of Tepe Gav Koshi. Esfandagheh-Jiroft. *Journal of Research on Archaeometry* 4(2), 61–79.

Tsuneki, A., Zeidi, M., Ohnuma, K., 2007. Proto-Neolithic Caves in the Bolaghi Valley, South Iran. *Iran* 45, pp. 1–22.

Vandiver, P.B., 1987. Sequential Slab Construction; A Conservative Southwest Asiatic Ceramic Tradition, ca. 7000–3000 B.C. *Paléorient* 13(2), 9–35.

Weeks, L.R., 2013a. Iranian metallurgy of the fourth millennium BC in its wider technological and cultural contexts, in: Petrie, C.A. (Ed.), *Ancient Iran and Its Neighbours – Local Developments and Long-range Interactions in the 4th Millennium BC*. British Institute of Persian Studies Archaeological Monographs Series 3. Oxbow Books, Oxford, pp. 277–291.

Weeks, L.R., 2013b. The development and expansion of a neolithic way of life, in: Potts, D.T. (Ed.), *The Oxford Handbook of Ancient Iran*. Oxford University Press, Oxford, pp. 49–75.

Weeks, L.R., Alizadeh, K.S., Niakan, L., Alamdari, K., Khosrowzadeh, A., Zeidi, M., 2006. Excavations at Tol-e Nurabad, in: Potts, D.T., Roustaei, K. (Eds.), *The Mamasani Archaeological Project Stage One. A report on the first two seasons of the ICAR - University of Sydney expedition to the Mamasani District, Fars Province, Iran*. Iranian Center for Archaeological Research, Deputy of Research, Tehran, pp. 31–88.

Images

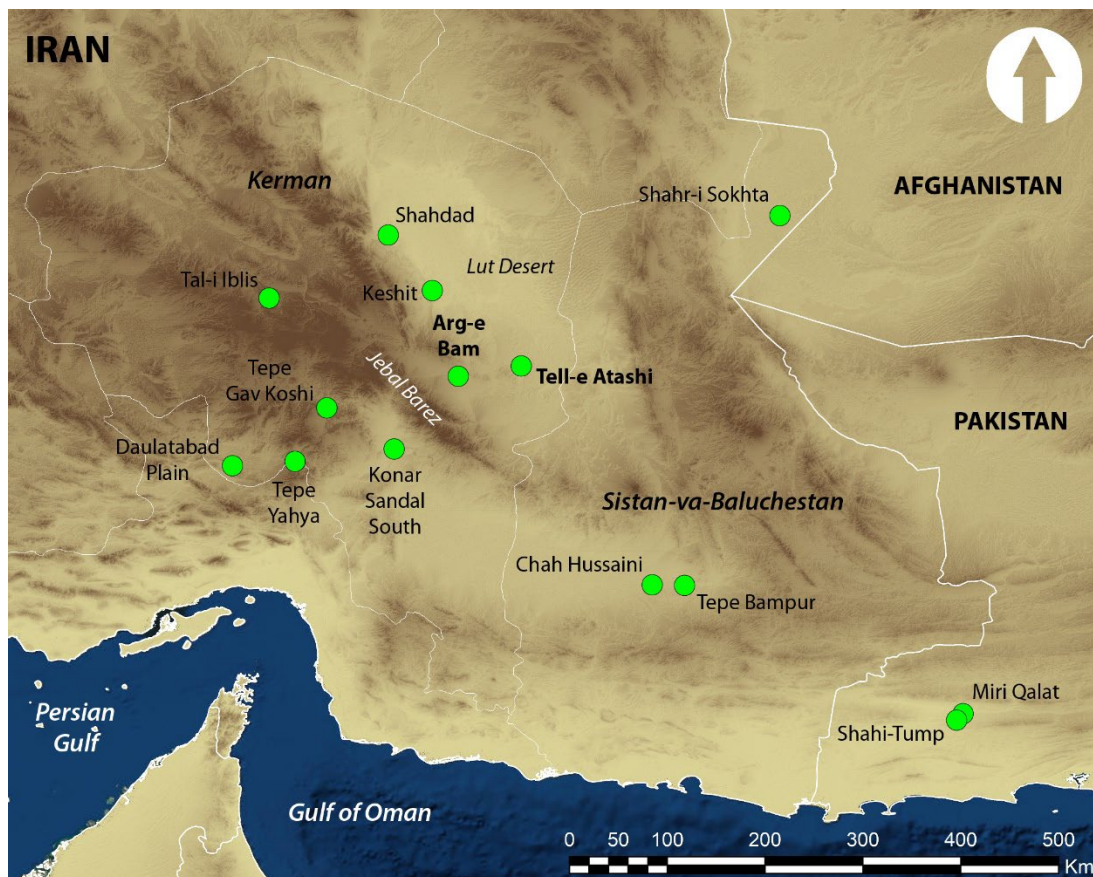


Figure 1: Map of the southeastern Iranian Plateau with location of the main archaeological sites and places mentioned in the text. Basemap created on ArcMap (ESRI).

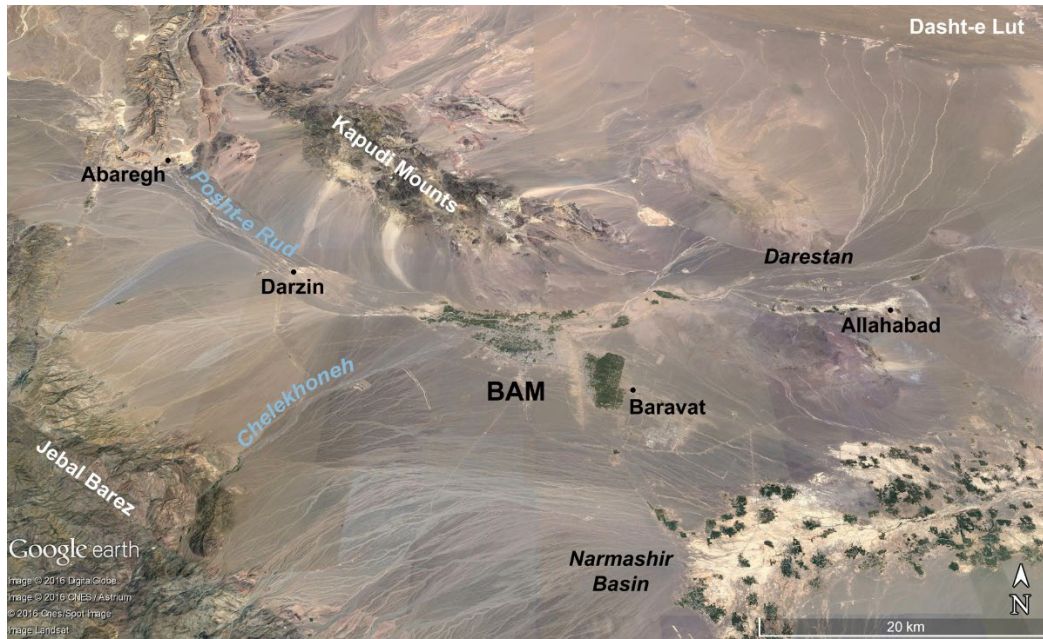


Figure 2: Map of the Bam-Narmashir region with location of the main places and features mentioned in the text. Basemap: ©GoogleEarth.

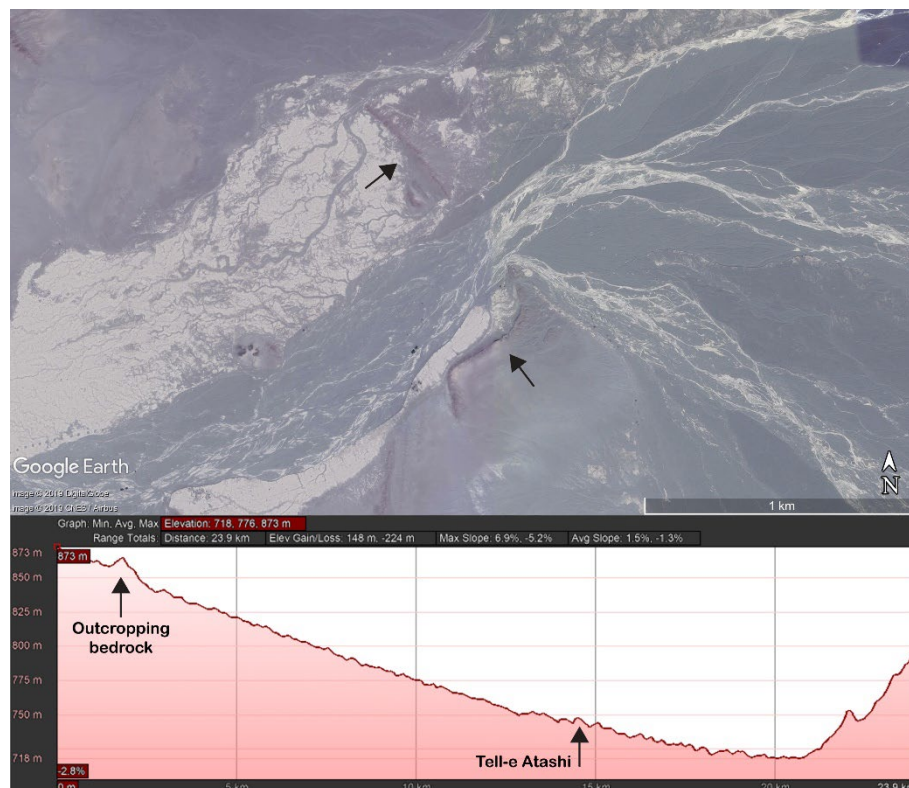


Figure 3: Up: View of outcropping bedrock (indicated by the arrows) near site DAK110 (Fig. 5) in Darestan; Down: West-East elevation profile (with vertical exaggeration) of Darestan, generated on Google Earth, with location of the outcropping bedrock near site DAK110 and Tell-e Atashi. ©Bam Archaeological Mission (up), ©GoogleEarth (down).

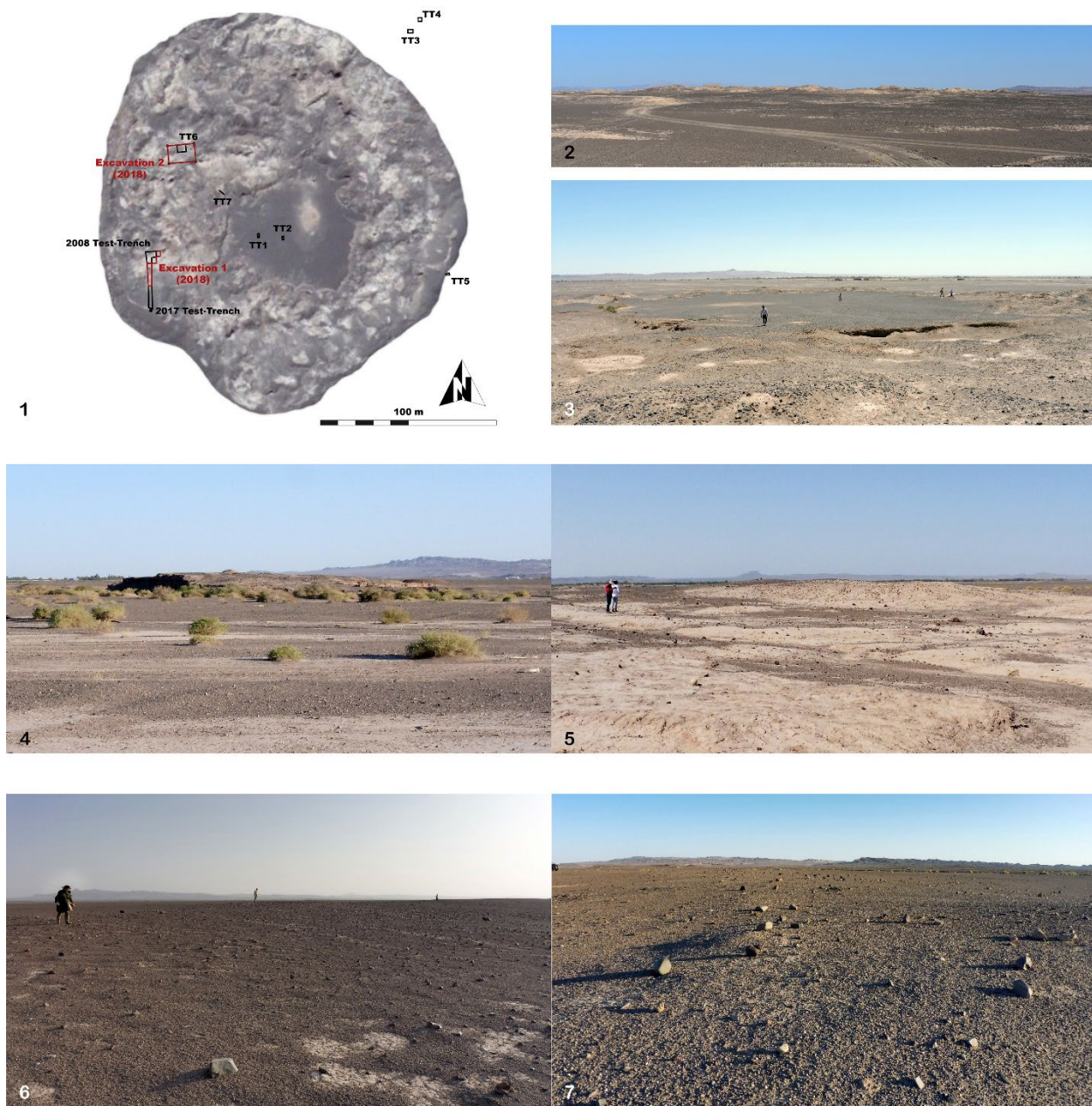


Figure 4: Views of Neolithic sites in Darestan. 1-3: Tell-e Atashi with location of excavation areas and test-trenches in 1; 4: Site DA239; 5: Site DA135A; 6: Site DA123; 7: Site DA206. ©Bam Archaeological Mission.

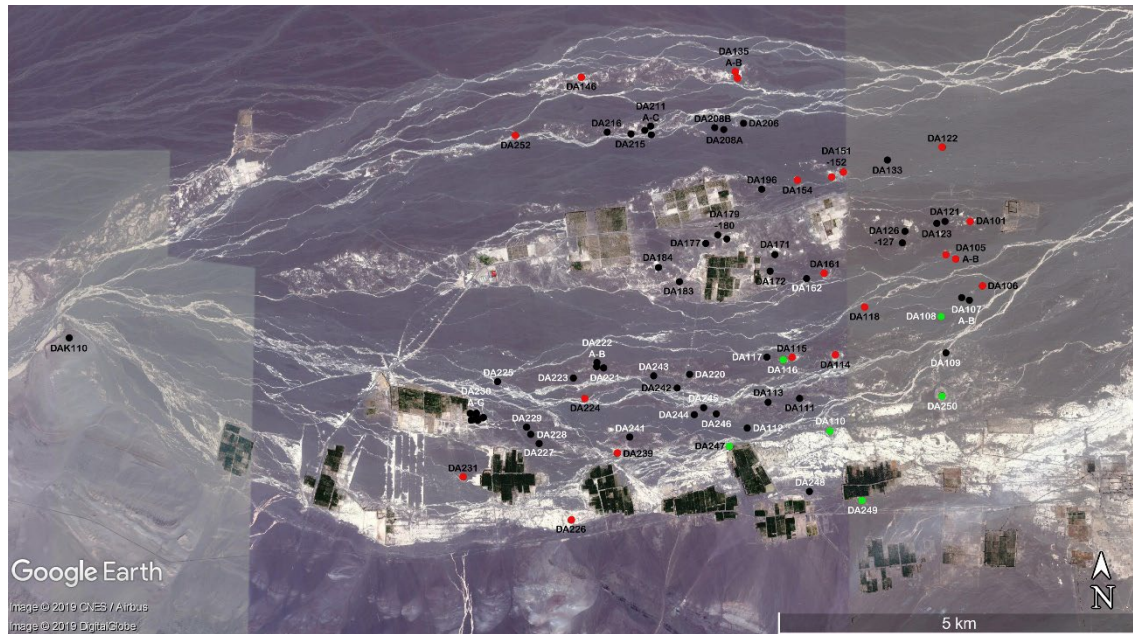


Figure 5: Map of the Neolithic sites in Darestan. Sites with black numbers are pottery sites, and sites with white numbers are aceramic sites. Sites marked with red dots are mounded sites, and sites marked with black dots are scatter sites. Sites marked with green dots are mounded sites with Neolithic material only. Basemap: ©GoogleEarth.

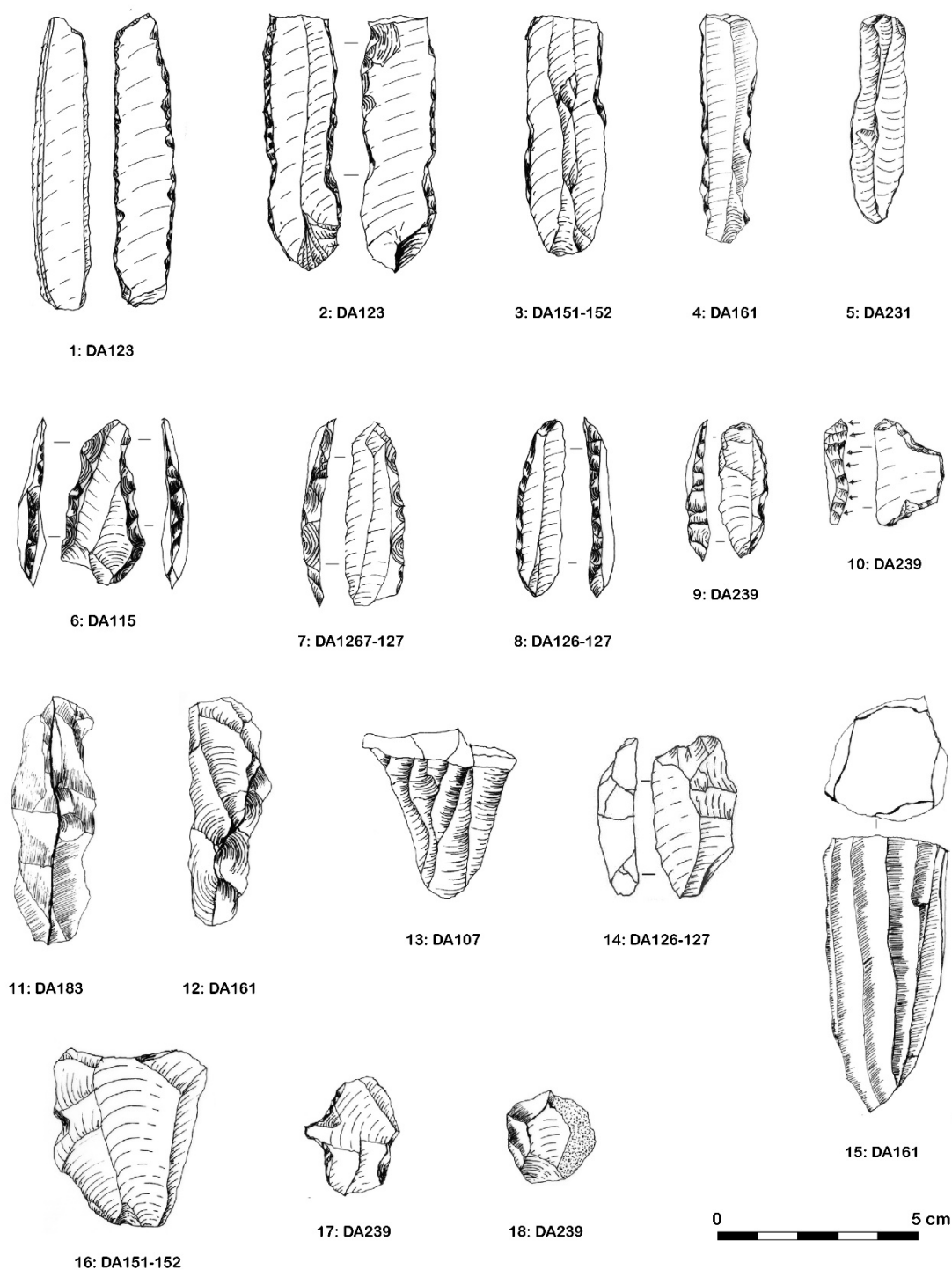


Figure 6: Lithic industry from Neolithic sites surveyed in Darestan. 1: used blade; 2: retouched blade; 3: proximal end of notched blade; 4: retouched blade; 5: used blade; 6: double backed bladelet; 7: backed blade; 8-9: backed bladelet; 10: trapezoid; 11-12: crested blade; 13: flake with bladelet removals; 14: core tablet; 15: unidirectional bladelet core; 16: notched flake; 17: drill; 18: side scraper. ©Bam Archaeological Mission.

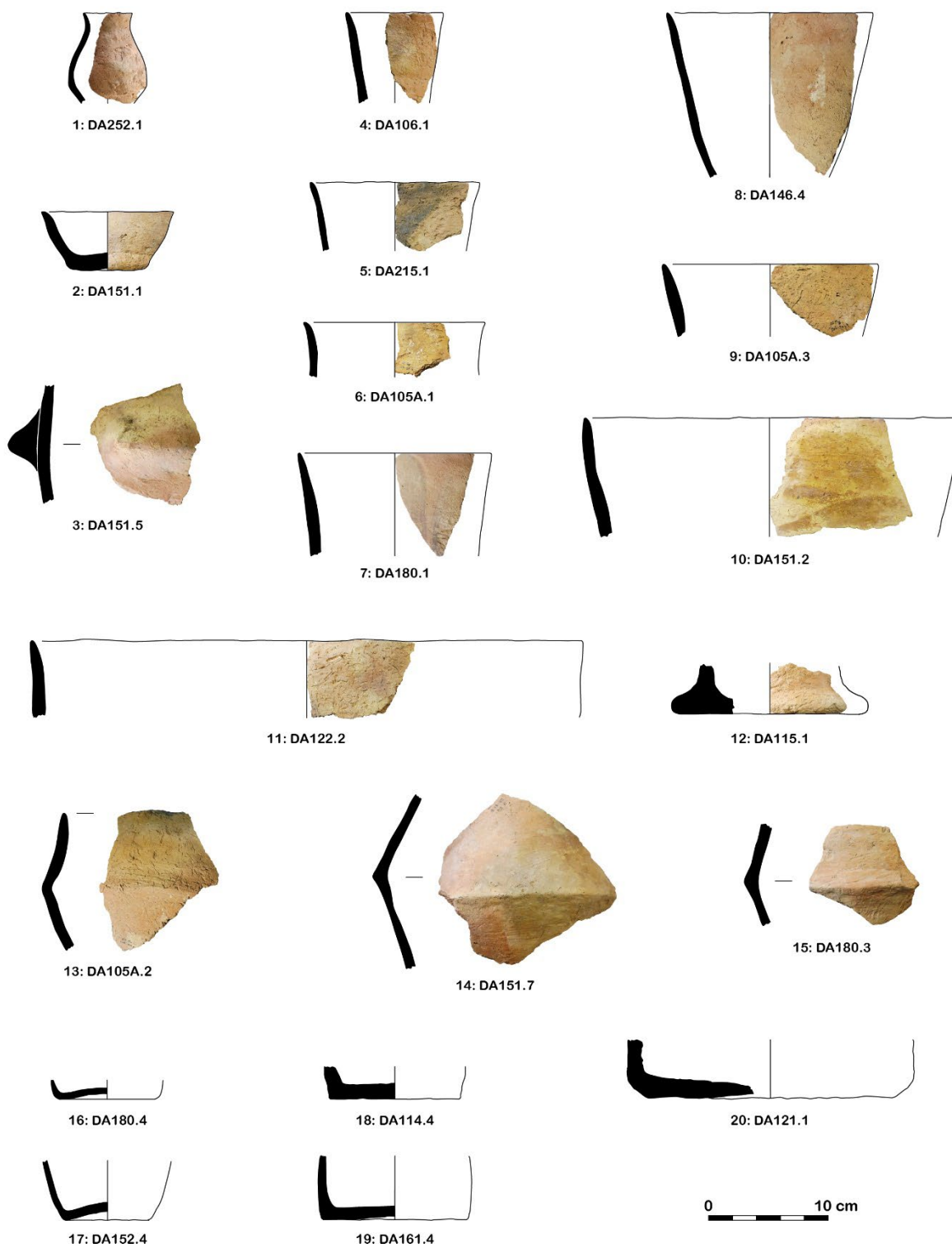
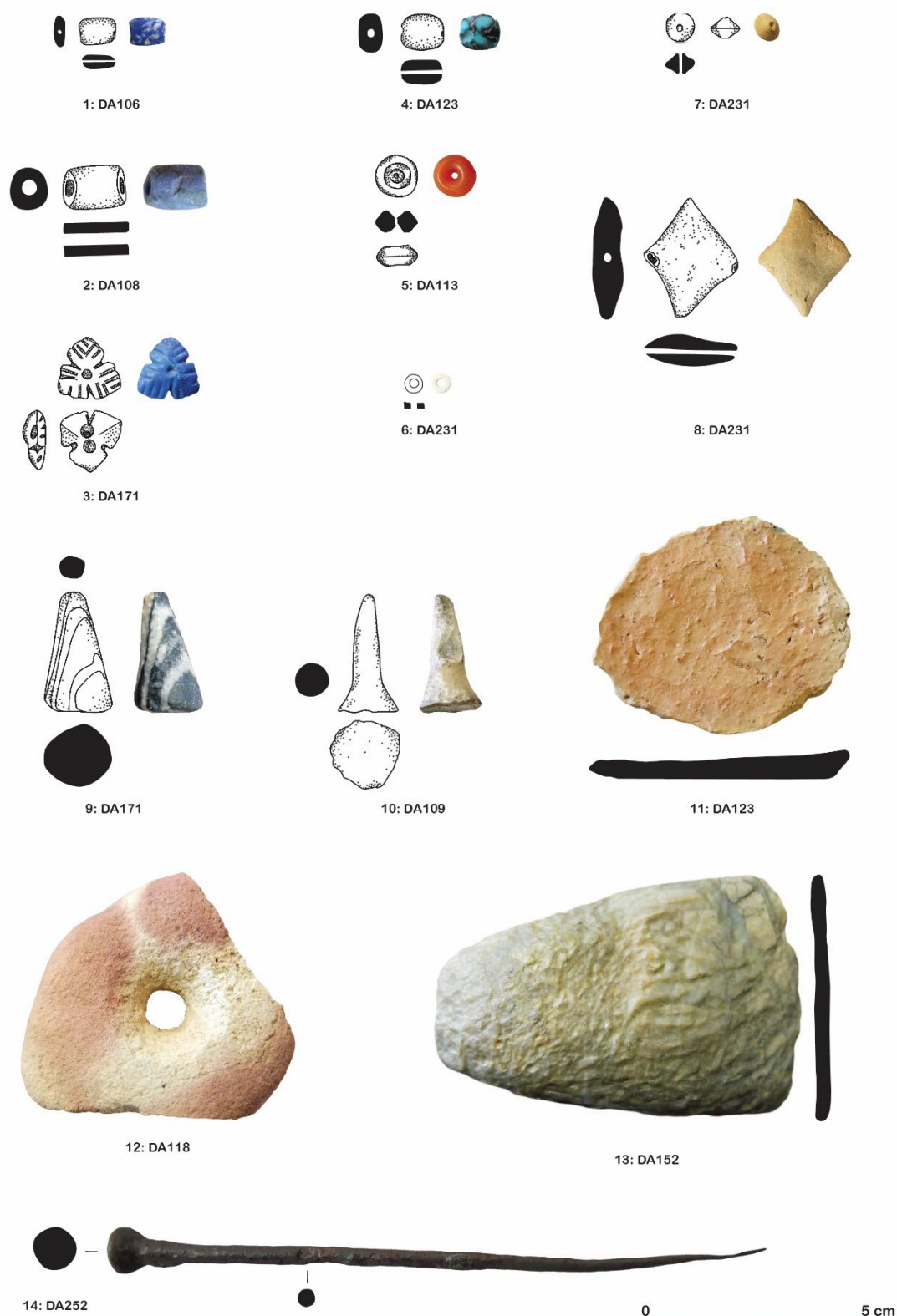


Figure 7: Pottery from Neolithic sites surveyed in Darestan. ©Bam Archaeological Mission.



Figure

8: Small finds from Neolithic sites surveyed in Darestan. ©Bam Archaeological Mission.

Site #	approx. L (m)	approx. w (m)	approx. area (m ²)	Type	Aceramic/Ceramic	Lithic	Vegetal-tempered pottery	Mineral-tempered pottery	Diagnostic Chalcolithic Yahya V-related material	Presence of more recent occupation/material
DA101	70	70	4900	Mounded site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA105A-B	165	150	24750	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA106	70	60	4200	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA107A-B	90	50	4500	Scatter site	Aceramic	Yes				
DA108	42	32	1344	Mounded site	Aceramic	Yes				
DA109	95	45	4275	Scatter site	Aceramic	Yes				
DA110	100	100	10000	Mounded site	Aceramic	Yes				Yes
DA111	70	50	3500	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA112	55	42	2310	Scatter site	Aceramic	Yes				
DA113	52	35	1820	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA114	150	107	16050	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA115	135	110	14850	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA116	95	75	7125	Mounded site	Aceramic	Yes				
DA117	27	24	648	Scatter site	Aceramic	Yes				
DA118	63	42	2646	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA121	117	80	9360	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA122	54	47	2538	Mounded site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA123	167	117	19539	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA126-127	300	220	66000	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA133	55	40	2200	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA135A-B	140	100	14000	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA146	60	50	3000	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA151-152	280	150	42000	Mounded site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA154	110	75	8250	Mounded site	Ceramic	Yes	Yes			
DA161	95	60	5700	Mounded site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA162	72	25	1800	Scatter site	Aceramic	Yes				
DA171	115	45	5175	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA172	80	35	2800	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA177	225	110	24750	Scatter site	Ceramic	Yes	Yes			
DA179-180	200	130	26000	Scatter site	Ceramic	Yes	Yes	Yes		Yes
DA183	130	80	10400	Scatter site	Ceramic	Yes	Yes			
DA184	115	60	6900	Scatter site	Ceramic	Yes	Yes			
DA196	225	205	46125	Scatter site	Ceramic	Yes	Yes			
DA206	150	100	15000	Scatter site	Ceramic	Yes	Yes			
DA208A	40	25	1000	Scatter site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA208B	20	15	300	Scatter site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA211A-C	200	150	30000	Scatter site	Ceramic	Yes	Yes			
DA215	15	10	150	Scatter site	Ceramic	Yes	Yes			
DA216	175	120	21000	Scatter site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA220	80	40	3200	Scatter site	Aceramic	Yes				
DA221	22	10	220	Scatter site	Aceramic	Yes				
DA222A-B	85	30	2550	Scatter site	Aceramic	Yes				
DA223	55	25	1375	Scatter site	Aceramic	Yes				
DA224	115	20	2300	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA225	20	10	200	Scatter site	Aceramic	Yes				
DA226	75	57	4275	Mounded site	Ceramic	Yes	Yes	Yes	Yes	Yes
DA227	28	6	168	Scatter site	Aceramic	Yes				
DA228	33	10	330	Scatter site	Aceramic	Yes				
DA229	36	5	180	Scatter site	Aceramic	Yes				
DA230A-G	225	115	25875	Scatter site	Aceramic	Yes				
DA231	100	50	5000	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA239	120	65	7800	Mounded site	Ceramic	Yes	Yes	Yes		Yes
DA241	130	30	3900	Scatter site	Aceramic	Yes				
DA242	100	20	2000	Scatter site	Ceramic	Yes	Yes			
DA243	30	10	300	Scatter site	Aceramic	Yes				
DA244	60	30	1800	Scatter site	Aceramic	Yes				
DA245	9	9	81	Scatter site	Aceramic	Yes				
DA246	35	10	350	Scatter site	Aceramic	Yes				
DA247	40	35	1400	Mounded site	Ceramic	Yes	Yes			
DA248	185	135	24975	Scatter site	Aceramic	Yes				
DA249	100	75	7500	Mounded site	Aceramic	Yes				
DA250-Mound	250	215	53750	Mounded site	Aceramic	Yes				
DA250-Scatter site			66250	Scatter site	Aceramic	Yes				
DA252	70	45	3150	Mounded site	Ceramic	Yes	Yes			Yes
DAK110	250	180	45000	Scatter site	Ceramic	Yes	Yes			Yes

Table 1: List of the Neolithic sites recorded in Darestan.