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# Excavations at Monjukli Depe, *Meana-Čaača* Region, Turkmenistan, 2010

By Susan Pollock and Reinhard Bernbeck

with contributions by Norbert Benecke, Gabriela Castro Gessner, Małgorzata Daszkiewicz, Jana Eger, Arnica Keßeler, Naomi Miller, Melody Pope, Philippa Ryan and Peter Sturm

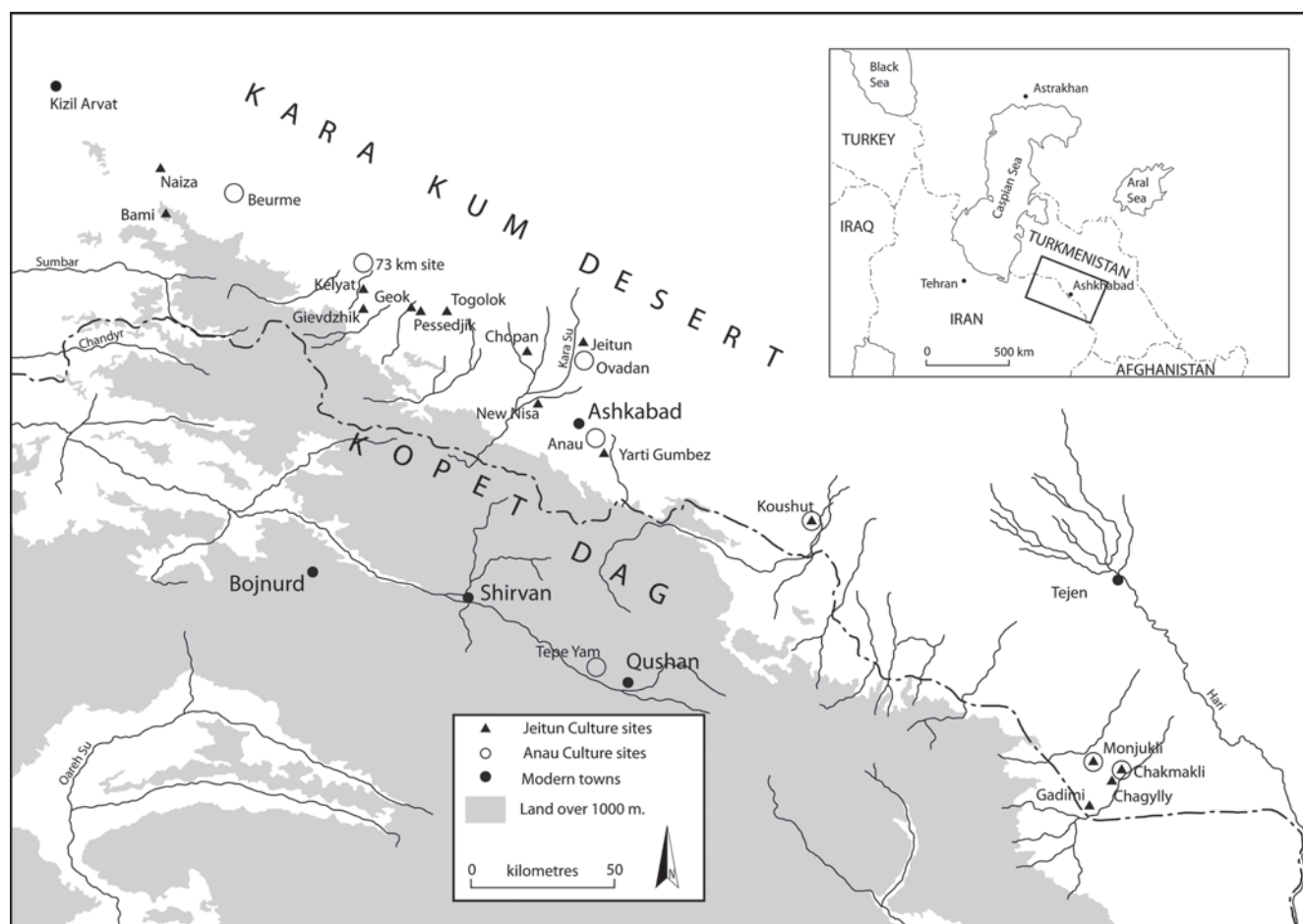
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## Introduction

In the summer of 2010 the first season of excavations was conducted by a team from Berlin and Kaka, Turkmenistan at the Neolithic – Aeneolithic site of Monjukli Depe in the *Meana-Čaača* region of the eastern Kopet Dag foothills of Turkmenistan

(Fig. 1). Thanks to the generous support of numerous individuals and institutions, we were able to begin what we hope will be a multi-year project examining early village life in this region. In this report we present an overview of the work we carried out, its goals, and the results of analyses completed at the time of this writing (July 2011).

**Fig. 1**  
Regional map, showing location of Monjukli in Čaača region



### History of research on the Neolithic and Early Aeneolithic in the Kopet Dag foothills

The focus of our work is on the transition from the Late Neolithic to the Early Aeneolithic<sup>1</sup> period in the eastern Kopet Dag foothills, with an emphasis on the Aeneolithic, as this period is less well understood than the Late Neolithic. Southern Turkmenistan became a focus of intensive research on both periods in Soviet times. The Late Neolithic is locally referred to as the Džejtun culture. The eponymous site, originally excavated on a grand scale by Masson<sup>2</sup> from 1958 to 1963, has been re-investigated recently by a multinational team under the leadership of David Harris.<sup>3</sup> Since the 1960s, numerous other settlements of this period have been discovered and excavated. Ph. Kohl,<sup>4</sup> H. Müller-Karpe<sup>5</sup> and most recently F. Hiebert<sup>6</sup> provide useful overviews in English and German of the complexity of the Džejtun tradition and its three sub-phases. The Džejtun tradition exhibits all the characteristics of Late Neolithic subsistence and technology known from sites on the Iranian plateau and further west: sites are mostly small with no apparent internal hierarchization or public buildings; agriculture and herding comprise the subsistence base; a coarse, sometimes painted, chaff-tempered pottery was used; the lithic industry is blade-based, with a low diversity of tool types; other artifacts include grinding stones, animal and stylized anthropomorphic figurines, as well as small clay “labrets” or perhaps tokens.

The Early Aeneolithic, Anau IA tradition is named after the most ancient stratum at Anau North.<sup>7</sup> Sites of this period were also identified along the northern foothills of the Kopet Dag and in the plains at the southernmost edge of the Karakum desert<sup>8</sup> as well as in the upper Atrek valley in the middle of the Kopet Dag chain.<sup>9</sup> Material somewhat similar to Anau IA was found at Aq Tepe in the Gorgan plain<sup>10</sup> and at Šir-e Šiān near Damghan.<sup>11</sup> Distant ceramic parallels come from the Tehrān basin (Češme ‘Ali and Tappe Pardis) as well

as the Qazvin region (Kara Tappe and Esmā’il Ābād).<sup>12</sup> Parallels with material from much further afield on the Iranian plateau and southwestern lowlands (Tappe Sialk and Susa) seem less convincing.<sup>13</sup>

In the Kopet Dag foothills of southern Turkmenistan, the westernmost Anau IA settlement identified to date is at Beurme, while the easternmost sites are located in the Meana-Čaača and Serakhs regions.<sup>14</sup> Although the densest concentrations of settlements with an Anau IA component are located in the western part of the Kopet Dag foothills, we possess more detailed knowledge from excavations in the eastern Etek region (Fig. 1), especially from the Meana-Čaača district, which includes the sites of Čakmakli Depe and Monjukli Depe. Monjukli Depe is the only published excavation where Anau IA strata are directly superimposed over Džejtun levels. Other places that may have a similar sequence, such as Koushut, are known only from very brief descriptions.<sup>15</sup>

At both Monjukli and Čakmakli Depe earlier excavations exposed architecture over a substantial proportion of the site. Houses consist of multiple rooms of varying sizes. The settlement plan is characterized by a straight lane that splits the village into two segments, a pattern that is clearer at Čakmakli than at Monjukli Depe. This settlement layout differs sharply from Džejtun-period settlements, which have small, free-standing, one-room buildings without any apparent planned arrangement.<sup>16</sup>

Despite the extensive exposure of Anau IA architecture in the upper levels at Monjukli and Čakmakli Depe, our understanding of this period is still extremely limited for a number of reasons. First, the artifacts from the Soviet excavations were classified into general types and reported by level at best; the details of find contexts are unknown. Second, while an extensive body of analyses has dealt with the Late Neolithic cultures, studies of production and use of Aeneolithic artifacts remain limited in scope. Third, there are very few radiocarbon dates from the earlier work. Finally, paleoecological data and evidence of subsistence activities are scarce.<sup>17</sup> As a result, Kohl’s<sup>18</sup> statement that “perhaps no prehistoric period within the Western Turkestan sequence is more enigmatic than the Anau IA period” remains largely true.

<sup>1</sup> We adopt the local chronological terminology of “Aeneolithic”, a term that corresponds to the “Chalcolithic” in Western Asian archaeology.

<sup>2</sup> Masson 1971.

<sup>3</sup> Harris (ed.) 2010.

<sup>4</sup> Kohl 1984.

<sup>5</sup> Müller-Karpe 1982.

<sup>6</sup> Hiebert 2002.

<sup>7</sup> Pumpelly 1908.

<sup>8</sup> Kohl 1984, 65–67; Hiebert 2002.

<sup>9</sup> Venco Ricciardi 1980.

<sup>10</sup> Malek Shahmirzadeh/Nokandeh 2001.

<sup>11</sup> Dyson/Thornton 2009.

<sup>12</sup> Fazeli Nashli et al. 2004; Fazeli Nashli et al. 2010.

<sup>13</sup> Masson/Sarianidi 1972, 50–51; Hiebert/Kurbansakhatov 2003, 18–19.

<sup>14</sup> Kohl 1984, 67.

<sup>15</sup> Бердыев 1974.

<sup>16</sup> Masson/Sarianidi 1972, 36–40.

<sup>17</sup> But s. Lisitsina 1969; Harris (ed.) 2010.

<sup>18</sup> Kohl 1984, 65.

Despite the spotty evidence, there is widespread agreement that the Anau IA period is characterized by numerous technological innovations that set it apart from the Neolithic Džejtun period.<sup>19</sup>

- Anau IA pottery is a fine, hard-fired ware that is easily distinguishable from the chaff-tempered Džejtun wares, all of which are fired at low temperatures;
- Anau IA contexts often contain spindle whorls. They document the important role of textile production. In contrast, spindle whorls are rare in the Džejtun period.
- Copper items such as awls and needles occur for the first time in the early Aeneolithic; only one (doubtful) copper artifact is known from the Neolithic site of Chaglyly Depe.<sup>20</sup> Analysis of some copper artifacts from Koushut show that at least one was manufactured in a mold.<sup>21</sup>
- Plant remains from excavations at Anau North suggest that new techniques of water management may have been introduced to the Kopet Dag foothills in this period.<sup>22</sup>
- Stone hoes are unknown from Džejtun sites, but one was found by Berdiev at Čakmakli Depe,<sup>23</sup> implying a change in agricultural practices.
- A variety of materials testify to an extensive exchange network. These materials include lapis lazuli, alabaster and shell.
- Internal settlement layouts change from the haphazard arrangement of Džejtun villages to a structured plan with a bipartite division of sites.
- Finally, in addition to new technologies, materials and spatial structures, stratigraphic sequences themselves indicate important distinctions. While in the eastern Etek region, Anau IA layers occur as terminal levels of long sequences, they often constitute the basal layer of sequences in the Akhal region around Ashgabat.<sup>24</sup>

Interpretations of the early (pre)history of the region, in particular the Neolithic and Aeneolithic, have been heavily colored by the idea that a Neolithic way of life, incorporating agriculture, herding and the beginnings of sedentary village life, was introduced by migrants from Southwest Asia.<sup>25</sup> Similar explanations that rely on the diffusion of technologies and their products from the Iranian plateau served as the basis for understanding the appearance of copper production and high-fired pottery in early Aeneolithic, or Anau IA, settlements.<sup>26</sup> In these scenarios, early vil-

lage communities along the Kopet Dag foothills were simply the receivers of new technological and social developments from elsewhere. Most Soviet researchers concluded that the Anau IA tradition came from the highlands of Iran, with the Češme 'Ali complex as the source most frequently cited. Hiebert and Kurbansakhatov<sup>27</sup> rejected the possibility of Iranian origins for the Anau IA complex because Češme 'Ali materials were thought to date too early to have been the source of these innovations. However, recent re-dating of the Češme 'Ali tradition<sup>28</sup> has reopened the possibility of an Iranian origin for Anau IA.<sup>29</sup>

In contrast to a reconstruction based on an equation of material culture and social groups and thereby a heavy reliance on notions of cultural diffusion, Kohl postulates a local development of culture and technology from late Džejtun to the Anau IA horizon. He constructs continuities by noting parallels in some building types, such as storage structures, from the two periods, as well as vague similarities in painted motifs on pottery.<sup>30</sup>

Within the dominant diffusion model used to understand the Anau IA horizon, some other variants have also been proposed. These include a combination of immigration from the Iranian highlands and "mixing" with local populations,<sup>31</sup> the spread of new ideas and technologies through a vast network of interaction spheres<sup>32</sup> and a combination of both processes.<sup>33</sup> For the Meana-Čaača region, Berdiev assumed that newcomers from the southwest first settled at Čakmakli Depe and brought a new ceramic technology with them. They co-existed for some time with Late Džejtun settlers at Monjukli Depe, a site to which he assumed the Anau IA complex spread slightly later.<sup>34</sup>

From the perspective of contemporary social theory, it is clear that the strong equation of "pots and people"<sup>35</sup> that underlies most of the older diffusionist scenarios cannot stand up to closer scrutiny. Histories of the "longue durée" kind are highly problematic when they rely on "Kulturkreis" ideas that consist principally of reconstructions of people moving in well-defined groups or "waves" across the landscape<sup>36</sup> or as taking place in clearly bounded techno-evolutionary stages.

<sup>19</sup> Masson/Sarianidi 1972; Kohl 1984; Hiebert 2002.

<sup>20</sup> Kohl 1984, 53.

<sup>21</sup> Kohl 1984, 71.

<sup>22</sup> Harris et al. 1996; Miller 2003, 137–138.

<sup>23</sup> Бердыев 1968, 34.

<sup>24</sup> Hiebert/Kurbansakhatov 2003, 18.

<sup>25</sup> Masson/Sarianidi 1972, 47–52.

<sup>26</sup> Kohl 1984, 67.

<sup>27</sup> Hiebert/Kurbansakhatov 2003, 169.

<sup>28</sup> Fazeli Nashli et al. 2004.

<sup>29</sup> Dyson/Thornton 2009, 14.

<sup>30</sup> Kohl 1984, 71.

<sup>31</sup> Бердыев 1972.

<sup>32</sup> Lamberg-Karlovsky/Tosi 1973.

<sup>33</sup> Masson/Sarianidi 1972, 47–52; Hiebert/Kurbansakhatov 2003, 1; Coolidge 2005, 38.

<sup>34</sup> Бердыев 1972; Бердыев 1974, 36.

<sup>35</sup> Kramer 1977.

<sup>36</sup> Burmeister 2000; Kohl 2007, 233–241.

### Goals of the project

In contrast to the heavily diffusionist approaches of Soviet archaeology, anthropological and sociological research in the last several decades has demonstrated that the emergence and implementation of new technologies cannot be conceptualized as the automatic result of contact between cultures or other macro-social entities.<sup>37</sup> Rather, encounters among people, objects and materials occur on an everyday basis and can have unpredictable outcomes. Small changes in one sphere of life can lead to major transformations, even if the initial changes are so small as to be barely perceptible at the time.<sup>38</sup> New technologies are not unthinkingly adopted; they can only be successfully anchored in social environments if they can be fit into a pre-existing technological culture.<sup>39</sup> Technological changes happen in at least two ways. The standard assumption is that they must be perceived as in some way advantageous in order to be implemented. However, they can also become included in a new social environment by way of curiosity, in which their original uses are tinkered with to a point at which their initial impetus is completely altered. Furthermore, new technologies may be modified in smaller or more substantial ways, taken over by some people in a community but not by others, or they may be completely rejected. Equally important is the recognition that as new technologies come into being, others fall out of use and are forgotten. Thus, the history of technological development cannot be seen as a straightforward additive process, nor as a simple success story in which ever better technologies replace outmoded ones.

Our project sets as its overarching goal the investigation of microhistories of technological change in the eastern Kopet Dag foothills in Neolithic and Aeneolithic times. By technology we refer to the ways in which knowledge, both discursive/explicit and embodied/practical, is brought to bear through practices and gestures (“Kulturtechniken”) on materials and objects.<sup>40</sup> By focusing on small spatial and social scales, for example individual residences or work areas within a settlement, we aim to track the differential implementations of new technologies, such as high-fired pottery, copper working, and thread spinning, as well as their social and economic implications. By studying small-scale changes, we also hope to be able to document technologies that were lost over time as others

were implemented. Finally, we aim to examine the implications of technological changes for the generation of new subjectivities, who produced a changing material world over the course of Neolithic and Aeneolithic times in the Meana-Čaača region.

### Specific objectives of the 2010 season

In order to address these long-term issues, a range of foundational information is essential, much of which is not available or not in an adequate form from older archaeological investigations in the region.

(1) A top priority is to build a reliable chronology for these periods in the Kopet Dag foothills. The older Soviet excavations in southern Turkmenistan used absolute dating methods only very rarely, and most excavators constructed a scenario of temporal, but not cultural continuity from the Late Neolithic to Early Aeneolithic. Available dates contradict these conclusions.<sup>41</sup> More recent work at Džejtun and Anau North has provided a set of new calendrical dates that point to a lengthy hiatus between these two periods. The only four reliable radiocarbon determinations for the Anau IA horizon from Anau North suggest a date after 4500 BCE for the Aeneolithic.<sup>42</sup> A series of eleven new determinations from the Neolithic type site of Džejtun<sup>43</sup> date the occupation to the late 7<sup>th</sup> to early 6<sup>th</sup> mill. BCE, implying a region-wide hiatus of almost 1500 years. However, these results must be regarded with caution, as in each case the dates derive from a single site. Furthermore, both sites are located some 200 kilometers to the northwest of the Meana-Čaača area.

We therefore placed considerable emphasis on obtaining securely stratified organic samples, especially charcoal, from well defined archaeological contexts at Monjukli Depe in order to permit accurate dating of successive occupations. Our work aims 1) to produce a detailed relative and radiocarbon-dated sequence for the Meana-Čaača region, and 2) to determine whether the apparent hiatus between Džejtun and Anau 1A, as indicated by the radiocarbon dates from Džejtun and Anau North can be substantiated.

(2) A second goal was to begin the systematic collection of faunal and floral data that will ultimately enable us to understand subsistence practices and their temporal as well as spatial variations. Soviet studies from the 1960s were interested in modes of subsistence. However, fau-

<sup>37</sup> Cornell/Fahlander 2007.

<sup>38</sup> Goffman 1963; Giddens 1984.

<sup>39</sup> Pinch/Bijker 1987, 24.

<sup>40</sup> Ingold 1987, 31; Dobres 2000.

<sup>41</sup> Kohl 1992, Tab. 3.

<sup>42</sup> Hiebert/Kurbansakhatov 2003, 55–56.

<sup>43</sup> Harris et al. 2010, 119–123.





**Fig. 2**  
The landscape around  
Monjukli Depe today.  
View toward the Kopet  
Dag

nal materials and plant remains were collected unsystematically, with little or no indication of the use of screening or flotation. More importantly, available findings cannot be related to specific contexts, such as structures or open spaces, nor to specific strata. The Turkmen-Russian-British research at Džejtun<sup>44</sup> provides an important contribution to our understanding of Neolithic subsistence in the region of Ashgabat, but there was nothing comparable for Anau IA at the start of our work.

(3) Our long-term research interests also require a detailed understanding of potential socioeconomic distinctions among inhabitants of Monjukli Depe. Although older excavations at Monjukli and Čakmakli Depe uncovered large expanses of architecture, we have no knowledge of findspots for ceramics, lithic tools and small finds. Our work emphasizes the collection of samples of artifacts (including pottery, chipped, ground, and worked stone, spindle whorls, etc.) from well documented contexts in order to be able to compare what kinds of materials and goods were produced and consumed as well as how they were made and used in different residential units at the site.

### Monjukli Depe and its local setting

by Gabriela Castro Gessner

Today the piedmont region of *Meana-Čaača*, where Monjukli Depe is located, is an arid, flat plain with sparse vegetation, bordered to the south by the imposing rise of the eastern Kopet Dag and to the north by the Karakum desert (**Fig. 2**).

The Cretaceous sediments carried by streams from the Kopet Dag consist of loess deposits of heavy and light loams atop coarse and fine alluvial fractions that contribute to a fertile piedmont, currently used to grow grapes, cotton, vegetables and other fruits with the aid of irrigation.<sup>45</sup> At the height of summer and early fall, however, the region around the site of Monjukli appears dry and barren, with sparsely scattered small shrubs and bushes, most likely sedges and bluegrass vegetation.<sup>46</sup> High temperatures in summer reaching the upper 30°/s C. (or more), subzero temperatures in winter (−6°C., but as low as −30°C. with Siberian wind intrusions), and an annual rainfall between ca. 140–250 mm in the piedmont contribute to the relatively

<sup>44</sup> Harris (ed.) 2010.

<sup>45</sup> Babaev 1994, 20.

<sup>46</sup> Dolukhanov 1981, 371 Fig. 6.

harsh conditions.<sup>47</sup> Lisitsina<sup>48</sup> contends that the prehistoric environment was not significantly different from that of today, but others, such as Dolukhanov,<sup>49</sup> propose that a moister environment prevailed during the Middle Holocene (c. 7000–6000 uncal BCE) and that more or less constant water sources existed in the Kopet Dag piedmont. The record of changing shorelines of the Caspian Sea also indicate cycles of wetter and drier environments, with recession events pointing to an increase in evaporation that produced precipitation in the Kopet Dag mountains and contributed to a wetter environment up until the second half of the 5<sup>th</sup> millennium BCE.<sup>50</sup>

Macrobotanical evidence from the area around the site of Džejtun in the central Kopet Dag region suggests that cereals were cultivated (wheat and barley) in prehistoric times, but whether these were the result of dry farming or irrigation is not yet certain.<sup>51</sup> Nonetheless, the environment during Džejtun times appears different from the modern one, as indicated by the quantity of charcoal in archaeological deposits, which suggests that wood was not scarce.<sup>52</sup> A similar situation may have prevailed around Monjukli Depe.<sup>53</sup> Future palaeoenvironmental analyses will be necessary to ascertain the details and dynamics of ancient climatic conditions.

Monjukli Depe is located at N 36°50'54", E 60°25'10" (lat. 36.8486°, long. 60.4194°), at an elevation of about 290 m, and approximately eight km from the foot of the Kopet Dag, 2.5 km east of the village of Meana and 1.5 km from the large Bronze Age site of Altyn Depe. Alluvial fans cover much of the Meana-Čaača region, with Monjukli Depe being located at the eastern edge of the Meana fan. Today, the Kopet Dag streams that created these alluvial fans are active primarily in the spring during heavy rains and contribute to the water supply and irrigation needs of villages and towns.<sup>54</sup> The current variable discharge of these streams, with little or no water in summer and the possibility of high peaks of flow in the spring and fall,<sup>55</sup> may not have prevailed in the past. Dolukhanov<sup>56</sup> suggests that during the 6<sup>th</sup> and 5<sup>th</sup> mill.

BCE, natural underground water systems ensured a stable flow, at a time when greater rainfall contributed to spring floods.

The small site of Monjukli Depe was chosen as a focus for our work for a number of reasons. From the earlier excavations carried out by A. Maruščenko and O. Berdiev, the site was known to have both Džejtun and Anau IA occupations. In 1959, Maruščenko excavated deep stratigraphic soundings at Monjukli Depe and Čakmakli Depe. Subsequently, Berdiev<sup>57</sup> conducted large-scale excavations of the uppermost layers of both sites. Maruščenko's work remains unpublished, while the main results of Berdiev's work are available in a few articles only. At Čakmakli Depe, Strata II to IV were assigned to the Anau IA period, with the lowest Stratum V thought potentially to be an aceramic level.<sup>58</sup> If so, that would mean that there was a lengthy hiatus in occupation that spanned the entire Džejtun period. Among the nine levels at Monjukli Depe, the top four (6–9) are ascribed by Berdiev to Anau IA and the lower four (4–1) to the Neolithic Džejtun horizon. Layer 5 is supposed to be transitional. This makes Monjukli Depe one of the very few known sites to potentially have a direct continuity from Džejtun to Anau IA times. At both Monjukli Depe and Čakmakli Depe architecture was exposed over a substantial proportion of the site. The extensive plan from Berdiev's Level 8 at Monjukli Depe<sup>59</sup> made it possible for us to target specific architectural units and outdoor areas for excavation.

## The excavation season 2010

by Susan Pollock and Reinhard Bernbeck

Our excavations at Monjukli Depe lasted from 19 August to 13 September 2010, followed by one week to process finds and complete trench summaries. During this brief season we excavated three trenches, Units A, B and C. Each was located with reference to a central East-West and North-South line laid across the site (**Fig. 3**). In addition, we removed Berdiev's backdirt, which filled the deep sounding dug by Maruščenko in 1959 and was then piled up on top of this trench, creating a small hill approximately 3 m high and 10 m in diameter at the center of the site (**Fig. 4**).<sup>60</sup>

<sup>47</sup> Babaev 1994, 20; Dolukhanov 1981, 367–368; Harris/Gosden 1996, 374.

<sup>48</sup> Lisitsina 1981.

<sup>49</sup> Dolukhanov 1981.

<sup>50</sup> Marcolongo/Mozzi 1998, 3 Fig 2. It is unclear whether this date should be understood as calibrated or uncalibrated years BCE.

<sup>51</sup> Charles/Bogaard 2010, 163–164.

<sup>52</sup> Charles/Bogaard 2010, 164.

<sup>53</sup> See Miller, this report.

<sup>54</sup> Babaev 1994, 14.

<sup>55</sup> Marcolongo/Mozzi 1998, 6.

<sup>56</sup> Dolukhanov 1981, 366, 375.

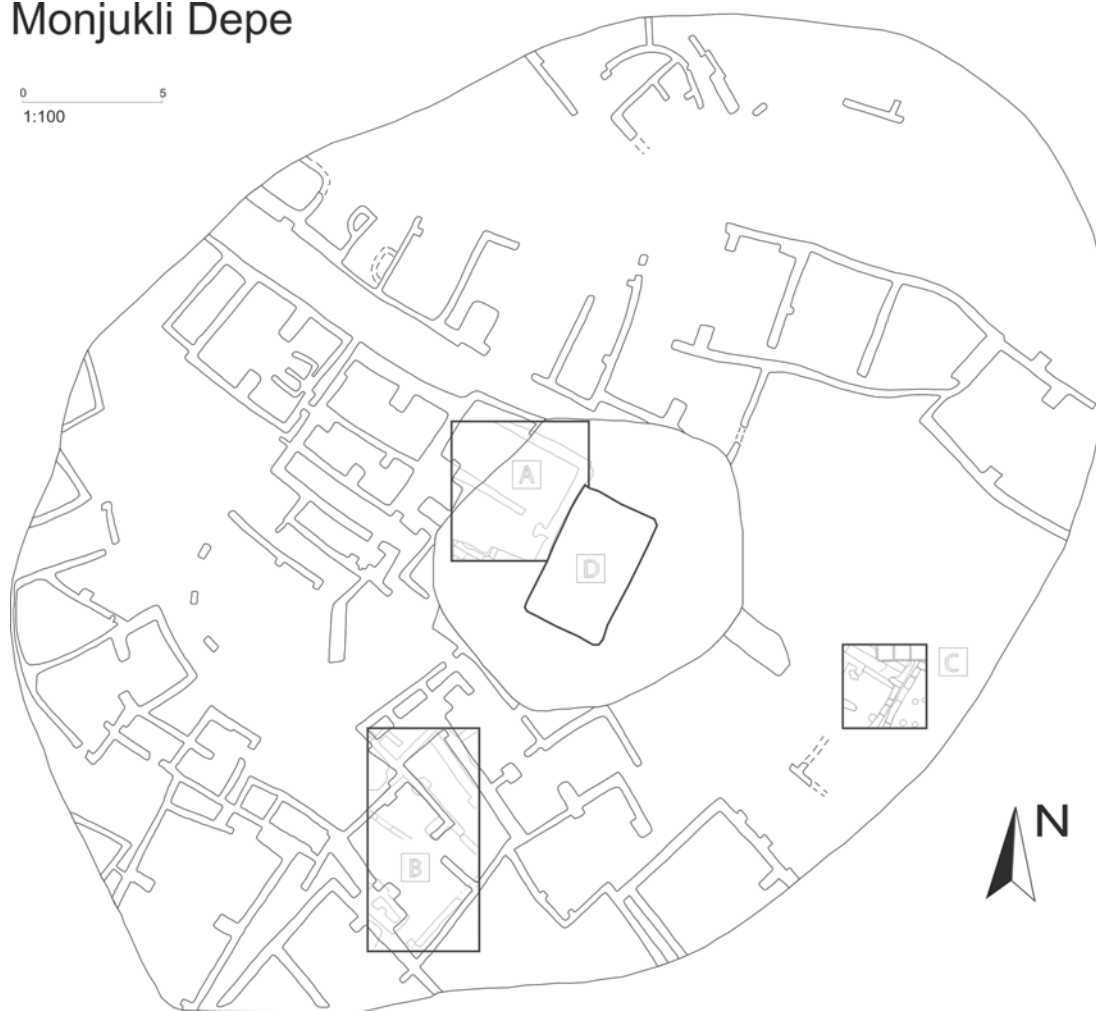
<sup>57</sup> Бердыев 1968; Бердыев 1972.

<sup>58</sup> Бердыев 1968.

<sup>59</sup> Бердыев 1972.

<sup>60</sup> Бердыев 1972, footnote 2.

## Monjukli Depe



**Fig. 3**  
Monjukli Depe. Plan  
showing the location of  
excavation units in  
2010

### Excavation methods

Excavation followed recognizable stratigraphic levels, rather than the Soviet strategy of excavating in artificial layers or “štyki”.<sup>61</sup> In cases where no stratigraphic distinctions could be recognized, we generally changed to a new locus after 8–10 cm of deposit had been removed.

Excavated deposits were documented by means of a locus system, in which every context is given a unique locus number. A locus may be a well defined unit (for example, a surface, or a level of stratified deposit in an oven), but it may also be a depositional unit that at the time of excavation cannot be clearly interpreted (for example, undiffer-

entiated fill). Each locus was evaluated, both in the course of excavation and then again at the conclusion of work, in terms of its integrity. We distinguish primary, secondary and tertiary contexts. Primary contexts are those in which the deposits and associated artifacts are *in situ* as they were accidentally left (for example, a small tool lost in a corner) or purposely deposited (such as grave goods or an object in storage) by people in the past. Secondary context refers to material disposed as refuse, for example, in a midden or trash pit. Tertiary contexts may be redisposed trash, material brought in from another place for leveling purposes, or other deposits of uncertain integrity.

All deposits considered at the time of excavation as primary or secondary contexts, as well as most tertiary contexts, were dry screened using 5 mm mesh. In addition to collecting all artifacts recognized

<sup>61</sup> Kohl 1984, 69.



**Fig. 4**  
Monjukli Depe.  
Photo of the site at the  
beginning of work with  
Berdiev's backdirt pile  
in the middle

in the screens, the volume of excavated deposit was recorded (in liters), based on the number of buckets of excavated deposit. This procedure allows us to calculate the densities of materials (counts or weights per volume excavated) and thus to make systematic comparisons across excavation units and contexts.<sup>62</sup>

Primary and secondary contexts were also sampled for flotation, and small quantities of deposits collected for phytolith analysis.<sup>63</sup> Flotation samples were processed in the field, with light fractions retrieved for macrobotanical analysis and the heavy fractions collected in order to study micro-debris.<sup>64</sup>

### Excavated trenches

Unit A was placed at the top of the mound, below the northern portion of Berdiev's backdirt pile. After removing the backdirt, a 5 × 5 meter trench was laid out. This location was chosen in order to explore whether the uppermost level of architecture

at the site, presumably Berdiev's Level 9, was preserved and to see what kinds of structures were present in the central part of the site.

Unit B was a 4 × 8 m trench located to the south and slightly west of Unit A (**Fig. 3**). It was placed in an area where Berdiev's plan revealed substantial architecture. Our aims were to determine how well the architecture of Berdiev's Level 8 is preserved, to re-expose that architecture in order to produce a reliable reference that would permit us to connect our own topographic reference points to Berdiev's plan, and to take samples from the various rooms and spaces identified.

Unit C was excavated as a deep sounding to explore the stratigraphic sequence of occupation at the site. The 3 × 3 m unit was placed in the south-eastern sector of the site where Berdiev's plan showed little or no architecture.

Following the removal of the backdirt pile deposited by Berdiev in the middle of the mound, the outlines of the trench excavated by Maruščenko as a deep sounding were clearly identifiable. We thereupon decided to empty the old trench, clean and document the profile, and take samples from well defined layers for radiocarbon dating and phytolith analysis. We designated this trench Unit D.

<sup>62</sup> Wright 1981; Pollock 1999.

<sup>63</sup> See Ryan, this report.

<sup>64</sup> See Miller, Sturm, this report.



	Period	Unit A	Unit B	Unit C
Stratum I	Meana Horizon	1a–1b		
Stratum II	Meana Horizon		1a–1b	
Stratum III	Meana Horizon		2	2a–2e
Stratum IV	Hiatus			3a
Stratum V	Džejtun			3b

**Tab. 1**  
Monjukli Depe. The five strata identified at the site. The entries under each excavation unit refer to the levels distinguished in each trench

## Stratigraphy

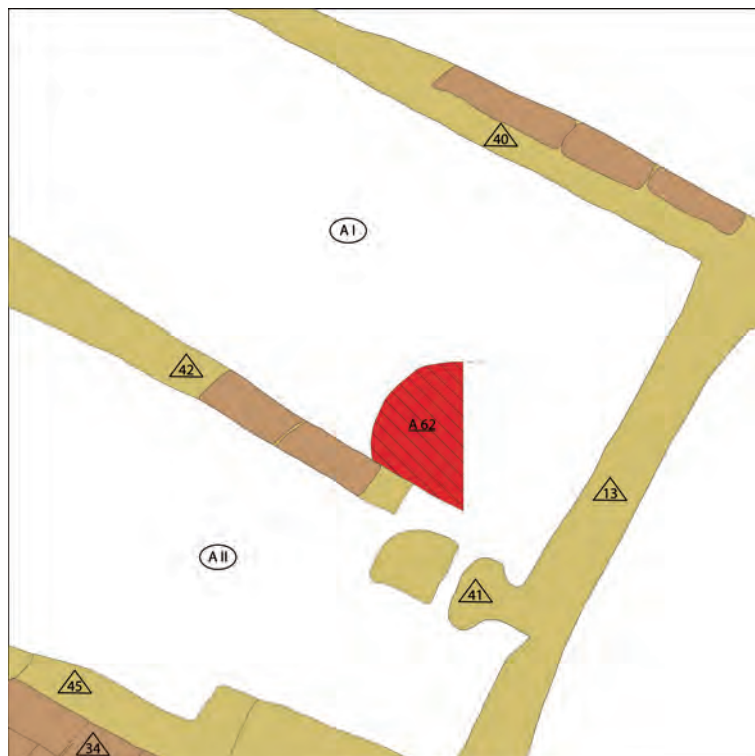
Constructing a coherent, site-wide stratigraphy based on the strata from each trench and associated finds proved surprisingly difficult. The main reason is the very low quantity of pottery recovered, which would lend itself to the analysis of stratum-specific assemblages that could be systematically compared. We attempted instead to correlate levels in each excavation unit through a combination of architectural features, artifact comparisons, and absolute elevations. The results of a substantial suite of radiocarbon dates enable us to evaluate how well the strata thereby identified hold up to closer scrutiny.<sup>65</sup>

Terminologically, we differentiate among strata, levels, and building phases.<sup>66</sup> We define strata as overarching chrono-stratigraphic units within the site that are mostly, but not always based on architecture. Levels refer to the main stratigraphic divisions within each unit, with sub-levels designating further distinctions within them. These include divisions between architectural phases but also deposits in which architecture may be absent, such as outdoor work areas or aeolian deposits. Building phases denote small-scale additions or modifications of buildings. A level or sub-level can, but need not, coincide with a building phase.

The strata are discussed here from the most recent (Stratum I) to the oldest (Stratum V) (**Table 1**).

### Stratum I

The most recent architectural stratum is represented only in Unit A. The architecture exposed there does not appear to connect directly to that shown on Berdiev's plan of Level 8 (**Fig. 3**). Due to the fact that it was in this location that Berdiev piled his backdirt, which may mean that the area was unexcavated, we consider the remains to be connected to the latest level of occupation (Berdiev's Level 9) at the site.



**Fig. 5**  
Monjukli Depe. Plan of Unit A, Stratum I

Portions of two distinct architectural spaces were exposed, designated as Space A I and Space A II (**Fig. 5**). In the latest sublevel (Level 1A) exposed, a passageway between the two spaces seems to have been blocked by placing a dense block of rammed mud in front of it. To the south Space A II was relatively large (1.8 m wide and more than 3.5 m long), and it had been frequently resurfaced, with up to nine distinct plaster lines visible. A series of small, semi-rectangular bins with hard, burnt surfaces were constructed in this space in both Levels 1A and 1B. A considerable amount of ashy debris indicates that this area was regularly used in connection with fire. The evidence of the bins, together with the presence of considerable quantities of animal bone and ground stone, suggest that this may have been a food-processing area.

<sup>65</sup> See section on "Dating".

<sup>66</sup> For similar distinctions, see Pfälzner 2001, 58–59.

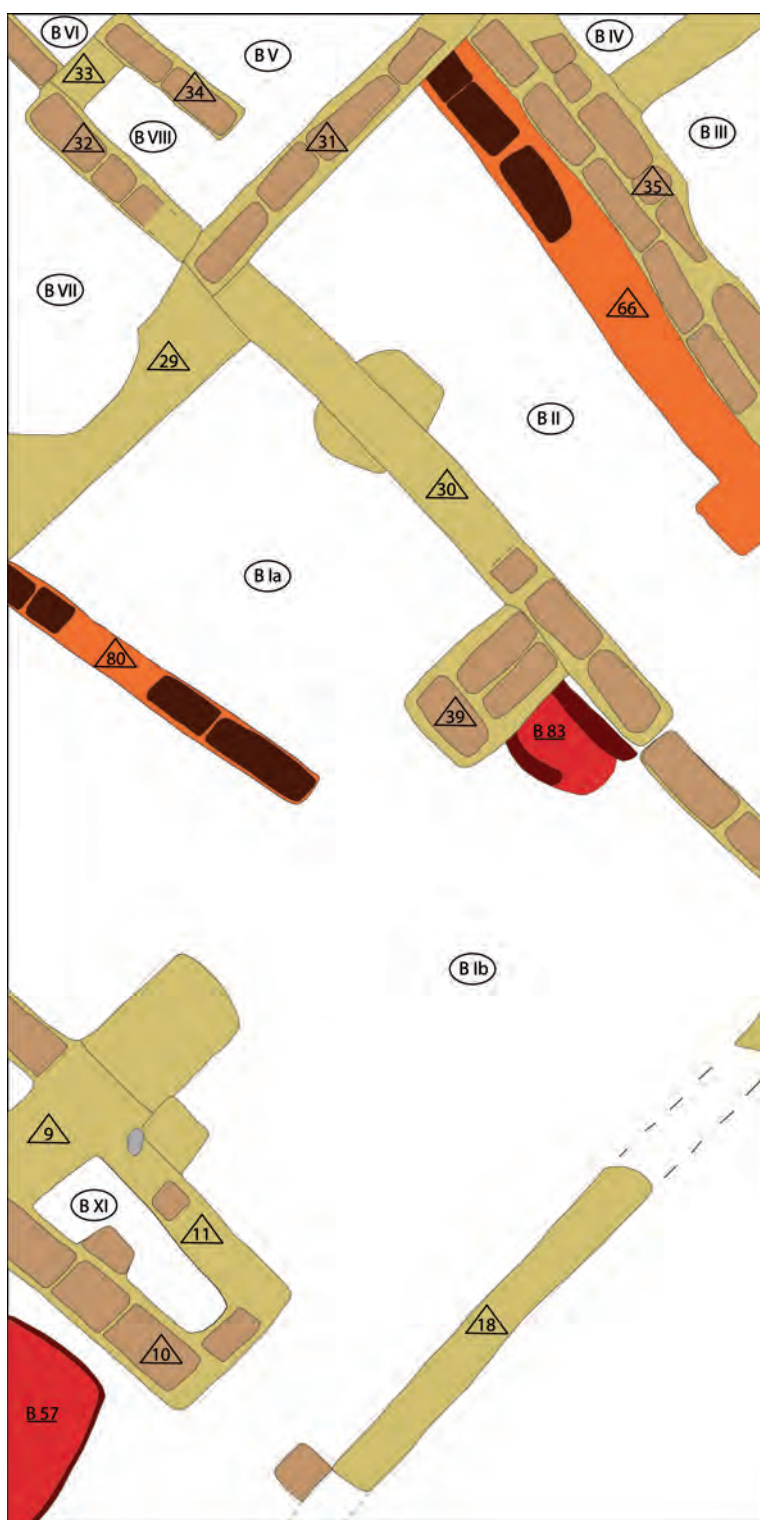


Fig. 6  
Monjukli Depe. Plan of Unit B Level 1, Stratum II

To the north, Space AI was at least 4.8 m long and 2.2 m wide. It was filled with a very dense, homogeneous, light tan to greenish deposit that included repeated resurfacing events. Although the interpretation of this area remains uncertain, it may have consisted of deposits set on a substantial platform of some sort.

In the earlier sublevel 1B, there were some ash lenses in Space AI, especially in the southeastern part of the space, as well as the remains of a fire installation (Locus A62) lined with pebbles that was constructed up against Wall 42. It was in one of these ashy lenses that a large dimpled and incised stone object, probably a weight (comp. Fig. 37a), was discovered.

The pottery recovered from Unit A is closely similar to that from Unit B and the upper levels of Unit C and points to a date in the early Aeneolithic period.

#### Stratum II

The preceding architectural stratum, corresponding to Berdiev's Level 8 and also dating to the early Aeneolithic period, is easily identifiable in Unit B Level 1. The exposed architecture, just 10–15 cm below the present surface of the mound, corresponds quite closely to that of Berdiev's plan (Figs. 3; 6–7).

Unit B Level 1 revealed parts of what appears to be two building complexes.<sup>67</sup> The largest space, designated Space BI, is approximately 4.4 m in length and at least 4.0 m in width. It has at least one internal buttress or small dividing wall (Wall 39). Based on the presence of a series of thick sloping plaster lines that extended from Wall 9 in the direction of this buttress, it appears that there may once have been a partition made out of perishable material that divided Space BI in two.

The northern portion, Space BIa, was characterized by repeatedly replastered walls with a total plaster thickness of up to 8 cm. Many of these plasters were colored red, and in one place there were also traces of black pigment. The floor plasters were also red and frequently renewed. No designs were identified; rather the painting seems to have involved the application of a single, solid color. The frequent replastering and regular use of pigments on both floors and walls are likely indicators that this was an interior, roofed space. The use of the southern portion, Space BIb, is less clear. In most cases the plasters here were thinner, i.e. less fre-

<sup>67</sup> On Berdiev's plan it appears that these are part of a single complex. The exact relationship of Spaces BI and BII to one another remains to be clarified in the course of future excavations.

quently renewed. A bin with a fine, probably fire-hardened floor (Locus B83) was located in the northeastern corner of Space Blb. Large quantities of burnt clay in much of the area may suggest the existence of other installations associated with fire, although none has yet been identified. It appears that this space may have been unroofed.

In the southwesternmost corner of the trench, immediately outside Space Blb, a portion of an oven (B57) was excavated. It was probably originally domed, as indicated by the inward sloping walls. It was lined with a thick pebbled surface, above which were numerous pieces of burnt clay and substantial quantities of ash.

The elongated space BII (>4 m long and 1.3–1.6 m wide) was delimited on one side by a double wall (Wall 35). Inner surfaces of the walls were white plastered, with considerably fewer coats of plaster than in Space Bla. The upper surfaces and the deposits atop them contained large quantities of animal bone, including numerous sheep/goat mandibles. Space BII may have been unroofed, based on its thinner/less frequent plasters and the large quantities and sizes of animal bones present.

To the northeast of Space BII were two others, Spaces BIII and BIV, only corners of which were preserved in the excavation area. They were both filled to a depth of 50 cm with a gray ashy deposit that contained large quantities of charcoal, burnt animal dung, burnt stone, and occasional bits of burnt clay.<sup>68</sup>

### Stratum III

An earlier architectural level in Unit B as well as the well-preserved architecture of Unit C Level 2 constitute the third architectural stratum.

In Unit B Level 2 many walls seem to have been badly damaged, as indicated by a one-meter thick accumulation of brick and roof fall along with a patch of water-lain silt. Nonetheless, the earlier walls were partly reused as the foundations for the subsequent Level 1 constructions, probably indicating that not much time had passed prior to the rebuilding.

Only small portions of this earlier level in Unit B have been explored as yet. A characteristic feature of the earlier architecture is the use of buttresses, which are found on both sides of Wall 30/26 as well as Wall 66. The short and badly eroded Wall 80 divides Space AI along its long axis.

<sup>68</sup> Further work here during the 2011 season showed that this material was re-deposited, probably through the work of Berdiev. This explains the remarkable homogeneity of the layer as well as the lack of burning on the walls of the room.



**Fig. 7**  
Monjukli Depe. Unit B  
architecture

Unit C Level 2 was divided into five sublevels, 2a through 2e. The defining characteristic of this level was dense architecture consisting of portions of two buildings constructed immediately adjacent to one another, House 1 to the southeast and House 2, of which two rooms were partly excavated, to the west. Walls remained standing to as much as 1.50 to 1.60 m in height.

The uppermost two sublevels, 2a and 2b, refer to stages of abandonment of the two buildings (**Fig. 8**). In the earlier of the two, Level 2b, the houses were filled with wall fall. At the same time a third wall, Wall 7, was constructed parallel to the already existing double Wall 9 and 24. What the reason was for adding a third wall parallel to the already double wall 24/9 is so far unclear, but it might be related to stability, as the earlier two walls seem to have developed a split that led to a dangerous leaning of Wall 24 to the west. The northwestern part of the unit consisted of ashy







pieces of bone or pottery. All materials occur at very low densities, and most sherds are extremely small, while the bones contained a characteristic crystalline deposit that probably results from exposure to the weather. The presence of cultural material suggests that the site as a whole was not abandoned; rather, occupation may have contracted, or the center of the village was located in a different part of the site. The predominance of heavily chaff-tempered pottery indicates that the occupation at this time, wherever it was located, was more closely connected to the Neolithic Džejtun period rather than the subsequent Aeneolithic period. Radiocarbon dates confirm this observation.<sup>69</sup>

There also appears to be at least one recognizable hiatus in Unit D. It remains to be seen whether this layer is contemporary with Level 3a in Unit C.

### Stratum V

In Unit C Level 3b, at a depth of 2.5 m from the surface, cultural deposits in the form of charcoal flecks, bone and pottery become denser. This level is characterized by a series of surfaces, most likely external ones, interspersed with relatively thick deposits of sterile wind-blown or water-laid deposits, as in Sublevel 3a. No architecture could be identified, but this may be due to the very small area excavated (1 m<sup>2</sup>).

### Unit D

Unit D refers to the large sounding excavated by Marušenko in 1959. The original trench was not 5 × 3 m as claimed by Berdiev but instead was somewhat irregularly shaped. It is not yet possible to correlate the levels recognized in the profile of Unit D with those excavated in the other three units. However, several important observations can be made on the basis of the profile documentation.

The main goal of work in this trench was to clean the best preserved part of a section in the eastern profile, establish the stratigraphy, and take samples from the profiles. We identified a total of 11 levels. The upper six reveal a dense sequence of ash layers and two building levels. Underneath there are more than three meters of aeolian and/or alluvial sediments, interspersed with ephemeral, irregular surfaces and a few sherds and bones. These layers indicate a phase in which the habitations were likely somewhere else, and the area of the sounding was at the periphery of the settlement.

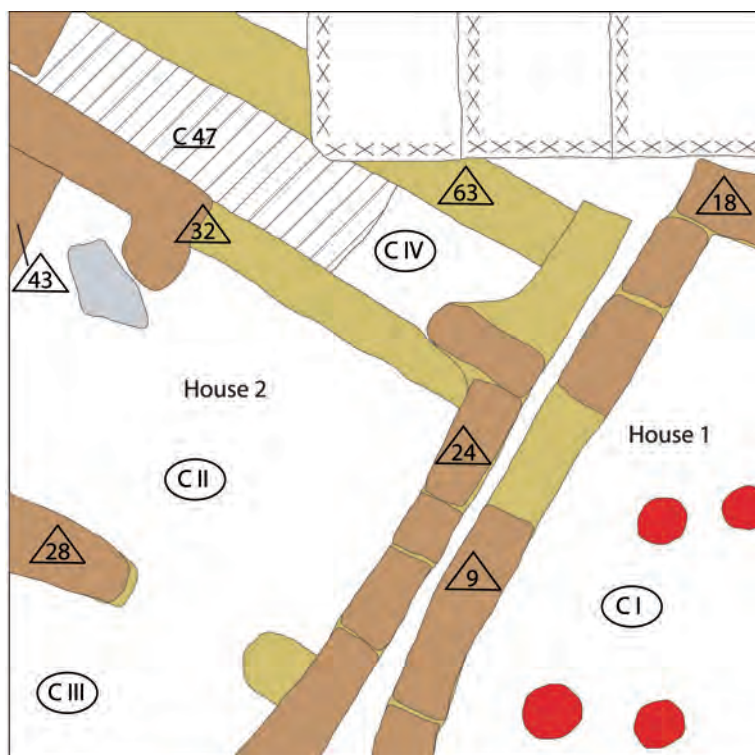


Fig. 10  
Monjukli Depe. Plan of Unit C Levels 2d and 2e, Stratum III



Fig. 11  
Monjukli Depe. Unit C architecture

<sup>69</sup> See "Dating" section.



**Fig. 12**  
Monjukli Depe. A close-up of the red floor plaster in Unit B

Below, another layer with architecture follows, and yet further below we encountered light yellow, clean sand. Since the sounding had a very restricted surface at the bottom (no more than  $0.50 \times 0.50$  m), further work is needed to reconfirm these observations.

### The construction and repair of buildings

Architecture at Monjukli Depe is very well preserved. Walls of the Aeneolithic buildings are built of large, straw-tempered mudbricks of ca. 40 cm length. The bricks were dried before being laid, as is clear from a thin, whitish layer on many of them that resulted from their exposure to the sun and the consequent evaporation of water, leaving a salty layer on the surface where they touch mortar or wall plaster. Thick layers of mortar were used between brick courses, whereas generally much less mortar was used in the vertical joints. Although most walls seem to be only a single brick wide, they stand in some places up to a height of 1.60 m. In several instances double or even triple walls were constructed, perhaps for reasons of stability. There are also several indications of the use of more ephemeral partition walls that may have been constructed at least partially of perishable materials.

The use of buttresses was common, especially in Stratum III. The need for additional support is not surprising, as walls were rarely bonded and bricks were laid in stretchers along the walls with mortar lines in a few cases directly on top of each other. In House 2 there were several cases in which animal bones were set into corners, sometimes under stones, between a buttress and a wall. It seems that these in-

stallations not only had the function of strengthening walls, but were also symbolically important.

Wall faces commonly have multiple coats of plaster, sometimes reaching as much as eight cm in thickness. Plasters were occasionally white but more often red, and in one case traces of black plaster were preserved. Floors were also sometimes colored red (**Fig. 12**). The frequency with which walls and floors were replastered varied considerably according to the type of room or other space. There seems to be an increase in the use of red for floors and wall faces in the upper levels of the settlement.

Where sufficient area was exposed, it appears that most buildings consisted of multiple rooms and often associated unroofed spaces. Some rooms were quite large (4 m or longer), but there were also very small spaces, the use of which is at present difficult to explain. Within and immediately outside houses there were numerous working installations, including ovens and bins.

Roofing material consisted of reeds or other grasses with thick stems (up to 2 cm in diameter). This conclusion is based on the recovery of several large pieces of clay daub with parallel, closely spaced impressions of such plant material. Most likely the stems were placed on wooden beams that spanned the rooms. It is also possible that these were the remains of partition walls within rooms or open courtyard spaces that were made using tough-stemmed plants coated with mud.

### Burials

Several burials were encountered in the course of the excavations. Burial 1 was located in Unit A in Space A1. It was the grave of a child, probably between six and 12 years of age, with the skeleton on its side in a tightly flexed position (**Fig. 13**). Its skull was covered with red ocher. An ocher-covered stone, two animal canines, and a sherd were found associated with the body.

In Unit C a complex burial, Burial 2, was set into the collapsed remains of House 2 after it fell out of use; it is assigned to Unit C Level 1 (**Fig. 14**). How much time passed after the abandonment of the house before the grave was dug could not be ascertained. The burial consisted of an older adult with worn teeth whose body was tightly flexed and covered with red ocher. The rounded sides of the burial pit, which was cut into Wall 28, contained a thin, evenly distributed layer of ocher, most likely deriving from an ocher-covered wrap, perhaps a cloth, into which the body had been placed. Above the adult were the partial remains of three or four children's skeletons that had been interred successively after the burial of the adult.



Within the bricky collapse in House 1 in Unit C Level 2b, the skeletal remains of a single individual, Burial 3, were found. This may not have been an intentional burial but could have been the result of an accident when the house collapsed. The body did not reveal any particular treatment such as the use of ocher, nor could any burial pit be discerned. It lay in a twisted, but flexed position, making a definitive interpretation as accidental or intentional impossible without further assessment by a physical anthropologist.

At the very end of the season, we encountered the skeletal remains of a child within the bricky collapse in Unit B (Burial 4). It was left unexcavated to await the next season.

Judging by these remains burials of both infants and adults in houses seem to occur relatively often. Whether there is a difference, with the children being interred while the houses were still in use and adults buried only in the ruins of already abandoned houses, can only be established once we have a larger sample.

## Dating

On the basis of the ceramics recovered, we were able to make general assignments of levels to broad periods, either Aeneolithic or Neolithic. However, the limited quantities of artifacts made a more precise dating or internal seriation difficult. For this reason, as well as the paucity of radiocarbon or other calendrical dates for these periods, we submitted a large number of samples (23) for AMS dating at the Leibniz-Labor of the Christian-Albrechts-Universität Kiel.

The results are presented in **Table 2**. While a few determinations do not fit the expectations based on stratigraphic observations, most form an internally coherent sequence. Overall they suggest a date of c. 6375–5900 cal BCE for the Neolithic occupation. Since these samples come from relatively high up in the cultural levels – assuming that the depth of occupation is approximately the same in the center of the mound and toward the edges – they presumably date to the later portion of the Neolithic sequence at Monjukli Depe. This is surprising, as the recent suite of radiocarbon determinations from excavations at the type-site of Džejtun yielded a maximal date range from 6300–5600 cal BCE.<sup>70</sup> The determinations from Džejtun are supposed to date to Early Džejtun, whereas the Neolithic occupation at Monjukli Depe had generally been attributed to Middle or Late Džejtun.

<sup>70</sup> Harris et al. 2010, 120–123; a Bayesian analysis of the dates suggests that the total length of occupation was probably no more than 300–400 years and perhaps as brief as 100–200 years.



**Fig. 13**  
Monjukli Depe. Burial 1,  
a child burial in Unit A

Of particular interest are the dates for the Aeneolithic levels at Monjukli Depe, which, with the exception of the few problematic determinations (see below), fall squarely within the first half of the 5<sup>th</sup> millennium cal BCE. In contrast, the four radiocarbon determinations from the recent work at Anau North date to the second half of the 5<sup>th</sup> mill. BCE.<sup>71</sup> The earlier dates from Monjukli Depe confirm the impression, based on the pottery analysis that although the technology is similar to that known from Anau IA ceramics elsewhere, the array

**Fig. 14**  
Monjukli Depe. Burial 2,  
the adult skeleton at  
the base, above which  
partial remains of several  
children had been  
interred



<sup>71</sup> Hiebert/Kurbansakhatov 2003, 55–56.

Lab Nr. Kiel	Unit	Locus	RN	Lab Determination (BP)	Calibrated Date (BCE)	Unit Level	Stratum
Aeneolithic "Meana Horizon"							
43786	A	33	1118	5780 ± 35	4710–4545	A1A	I
43787	A	36	1096	6535 ± 40	5563–5382	A1A	I
43788	A	59	1245	5745 ± 30	4688–4504	A1B	I
43789	A	61	1247	5835 ± 25	4783–4615	A1B	I
43791	B	37	3091	5815 ± 30	4769–4555	B1A	II–III
43792	B	45	3136	5715 ± 30	4678–4462	B1A	II–III
43793	B	51	3162	6165 ± 30	5215–5024	B1	II–III
43790	B	20	3050	5885 ± 25	4827–4706	B1	II–III
43795	B	85	3304	5920 ± 25	4843–4723	B1	II–III
43797	B	74	3257	5925 ± 30	4880–4720	B2	II–III
43794	B	78	3283	5950 ± 30	4931–4729	B2	II–III
43796	B	88	3313	5775 ± 25	4702–4548	B2	II–III
43798	C	30	5106	6005 ± 30	4985–4803	C2b	II–II
43799	C	56	5244	6630 ± 25	5623–5514	C2d	II–III
43800	C	64	5255	5950 ± 35	4932–4728	C2d	II–III
Neolithic Džejtun							
43801	C	74	5303	7090 ± 30	6025–5900	C3a	IV
43802	C	80	5336	7335 ± 35	6330–6076	C3b	V
43804	C	89	5384	7310 ± 30	6230–6084	C3b	V
43805	C	79	5357	7280 ± 30	6219–6073	C3b	V
43803	C	88	5371	7380 ± 35	6376–6104	C3b	V
43807	D	15	113	5940 ± 25	4897–4728	D4a	
43808	D	17	118	5980 ± 30	4944–4791	D4a	
43806	D	20	124	7270 ± 30	6216–6066	D5	

**Tab. 2**  
Monjukli Depe. Radiocarbon dates from the 2010 season

of painted motifs differs. For this reason we refer to this period of occupation at Monjukli Depe as the "Meana Horizon," as it appears to be distinctive in a number of respects. Recent radiocarbon determinations from Češme 'Ali, Tappe Pardis and Ebrāhim Ābād in Iran suggest that the Meana horizon is contemporaneous with the early part of a "Transitional Chalcolithic" in the Tehran plain.<sup>72</sup>

Four of the radiocarbon dates from Monjukli Depe appear to be problematic. Samples 43787 (A36), 43793 (B51) and 43799 (C56) are all considerably older than expected,<sup>73</sup> whereas sample 43796 (B88) appears to date slightly younger than would be expected given its stratigraphic position in Unit B. As reported by the laboratory,<sup>74</sup> two of these samples (43787 and 43799) dissolved completely during an alkali treatment and the third also

was determined to be contaminated with humic acids. Because humic acids are transported through water, they may result in younger or older dates. Given that in each of these cases, laboratory treatment pointed to the possibility of contamination independently of the dated results, it seems clear that the discrepancies within the sequence can be explained by humic acid contamination.

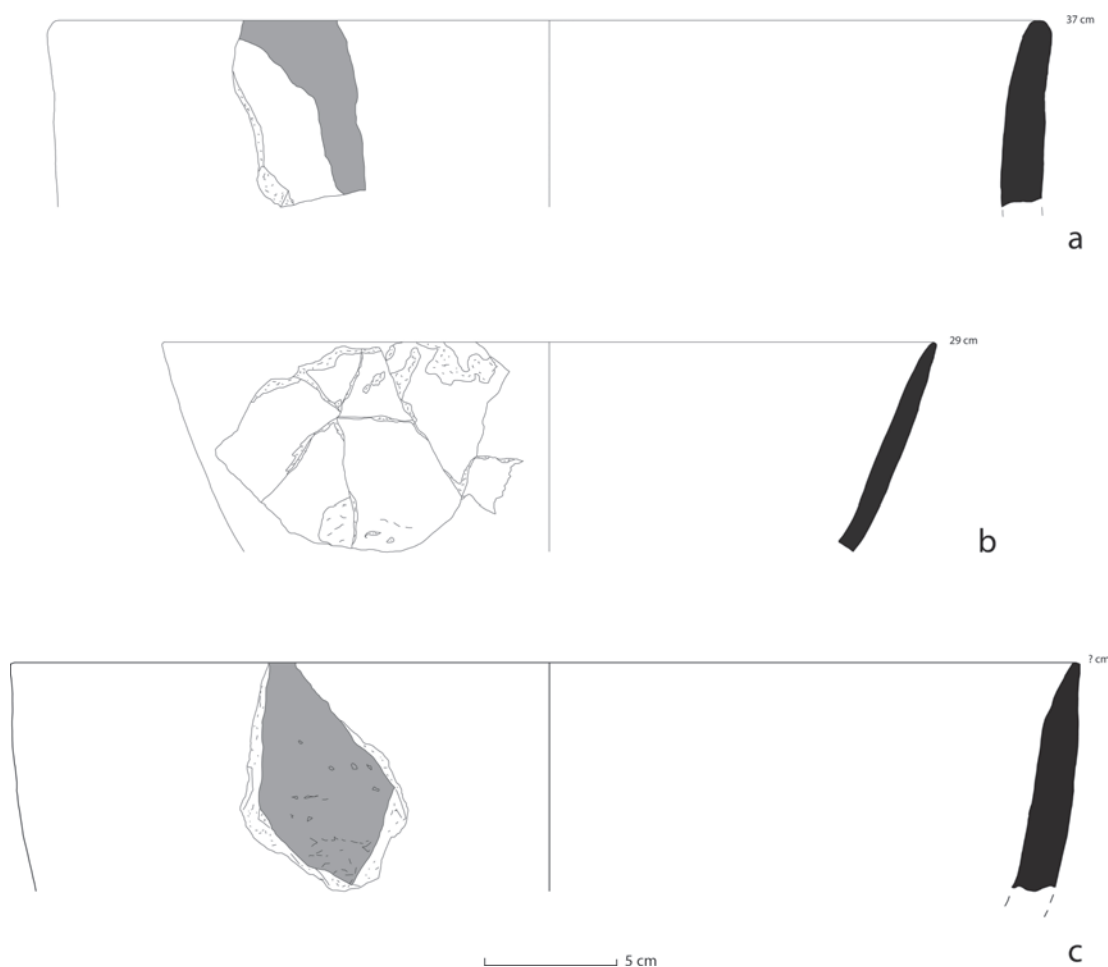
## Artifacts

One of the unexpected results of our work at Monjukli Depe was the low artifact density in the Aeneolithic levels. Only with further excavations will it be possible to ascertain whether this is the result of the specific contexts we encountered this year or if it is characteristic of the settlement as a whole. In the latter case, it will require additional study to determine how and why the inhabitants of this small village made do with a minimum of durable things. It seems that most objects were used very intensely before being discarded.

<sup>72</sup> Fazeli Nashli et al. 2004; Dyson/Thornton 2009, 19–20.

<sup>73</sup> Sample 43793 (B51) is from the deposit that in 2011 was determined to derive from recent redeposition, most likely from Berdiev.

<sup>74</sup> In a letter from Alexander Dreves, 21. June 2011.



**Fig. 15**  
Monjukli Depe. Coarse  
Chaff Plain pottery ves-  
sels. – a RN 5010 (C4);  
b RN 229 (Marusch-  
chenko trench fill);  
c RN 5312 (C75,  
Stratum IV)

## Pottery

Pottery occurs in particularly low densities. We have so far found no indication for pottery production at the site, whether for Early Aeneolithic or Džejtun occupations, other than a single small piece of ceramic slag collected from the mound's surface.<sup>75</sup>

Most of the pottery belongs to three basic wares, preliminarily called Coarse Chaff Plain, Fine Chaff Black-on-Red Painted and Black-on-Red Untempered. Coarse Chaff Plain is a crude ware with a wall thickness that often exceeds 1 cm (**Fig. 15**). The clay is not very well prepared, vessels are hand-formed, most likely by coiling or the “sequential slab” method,<sup>76</sup> and the firing temperature is

low.<sup>77</sup> The surface of some vessels is covered by a thin red to brown wash over a thick slip, with a dull finish. We have not yet been able to reconstruct complete vessel profiles. Rims are simple, bases mostly dimpled. One sharply carinated specimen was identified that also differs from other vessels because of its dark brown, somewhat glossy slip. It is unclear if this was an imported vessel.

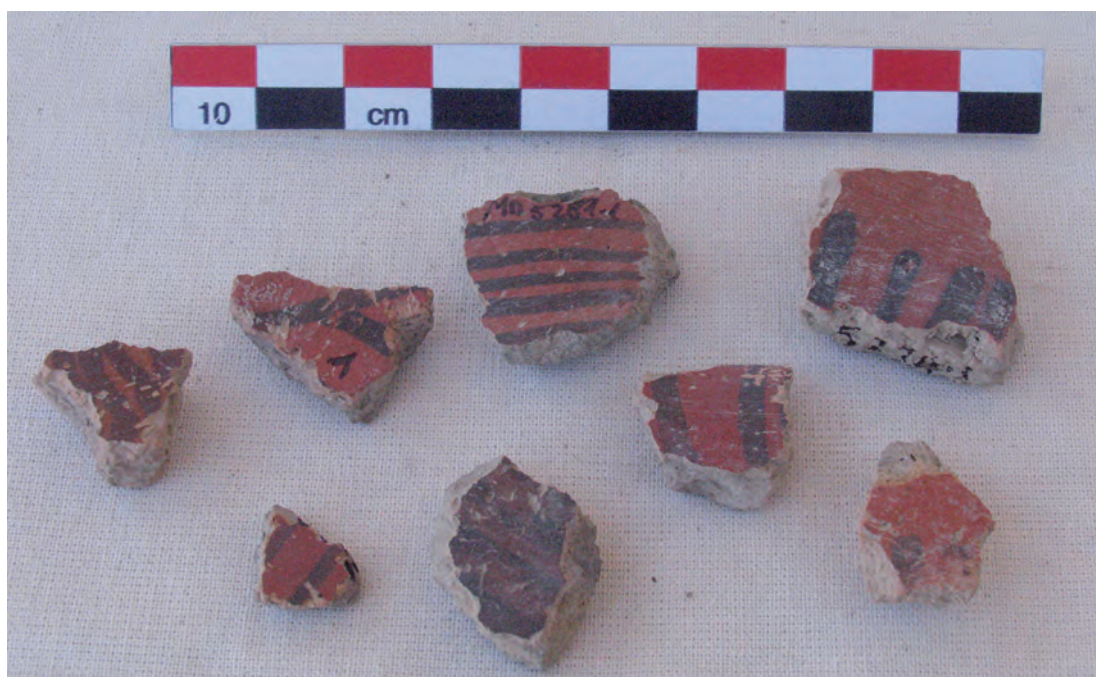
Fine Chaff Black-on-Red ware has much thinner walls, although its fabric is similar to the Coarse Chaff ware. The vegetal temper is somewhat finer, and the vessels of this ware are mostly covered with a glossy red slip and finely painted in black (**Fig. 16**). We found only a small number of tiny sherds of this ware, none of them a rim or base and none large enough to ascertain vessel shapes. Motifs cannot be reconstructed but seem to consist

<sup>75</sup> Collections from Monjukli Depe's surface include a high proportion of Bronze Age pottery, apparently from nearby Altyn Depe, so it is possible that the piece of slag was also introduced after settlement had ended.

<sup>76</sup> Vandiver 1987.

<sup>77</sup> See Daszkiewicz, this report.





**Fig. 16**  
Monjukli Depe. Sherds  
of Fine Chaff Black-on-  
Red ware

mainly of fine painted, parallel lines.<sup>78</sup> It is possible that all of these sherds are intrusive, inclusions in Aeneolithic bricks and other building materials, as they were mostly found in contexts characterized by the high-fired Black-on-Red Untempered ware.

The generally untempered Early Aeneolithic Black-on-Red Ware is much finer than the two chaff-tempered wares. According to X-ray fluorescence analysis,<sup>79</sup> the clay does not contain artificially added temper, and the ware is much harder than the two chaff-tempered types. All of the vessels are fired at higher temperatures, indicating significant technological differences between the Neolithic and Aeneolithic pottery. While many sherds have a reddish wash, some do not. Surfaces are smooth but often show scratches of a tool that was used in a back-and-forth or zig-zag motion during the final stages of shaping, sometimes applied after painting the vessel. The paint is usually black to dark brown. Typical vessel shapes are deep, round-walled bowls with simple, slightly incurved rims and a dimpled base. The structure of the exterior decoration generally consists of a broad band at the rim, sometimes painted solid, but in most cases including geometric motifs that give the impression of a design in the negative. Below this band, four to six evenly spaced vertical lines extend from the lower edge of this band to the vessel's base and often onto the base (**Figs. 17; 18**).

The relative stratigraphic occurrence of the three wares is not yet entirely clear. However, Coarse Chaff Plain is almost never found in association with the Black-on-Red Untempered vessels. The latter are restricted primarily to Strata I to III, while Coarse Chaff Plain ware occurs mainly in Unit C in the pre-Stratum III levels (**Fig. 19**). Fine Chaff Black-on-Red Painted overlaps stratigraphically with both of these wares, occurring in contexts at the very base or just below early Stratum III levels in Unit C. However, because of the overall low quantity of Fine Chaff Black-on-Red Painted, this observation must be considered preliminary. The density of Coarse Chaff Plain Ware in Stratum IV and especially in Stratum V is much higher than the densities of the other two wares in the upper strata.

On a regional level, the two chaff-tempered wares seem to be typical of the Džejtun period. At Monjukli Depe, contrary to assertions by Müller-Karpe,<sup>80</sup> but in agreement with Soviet analyses of much larger corpora of pottery, it is the finer Džejtun wares with wall thicknesses of 0.5–1.0 cm that tend to be painted in black on a glossy red surface, rather than the thick-walled, larger containers. Hiebert and Kurbansakhatov's<sup>81</sup> description of a typical Anau IA pottery assemblage from Anau North as consisting of a dominant component of chaff-tempered pottery and a minority of Anau IA high-fired vessels differs starkly from Monjukli Depe, where

<sup>78</sup> See also Курвансахатов 1992, 39.

<sup>79</sup> See Daszkiewicz, this report.

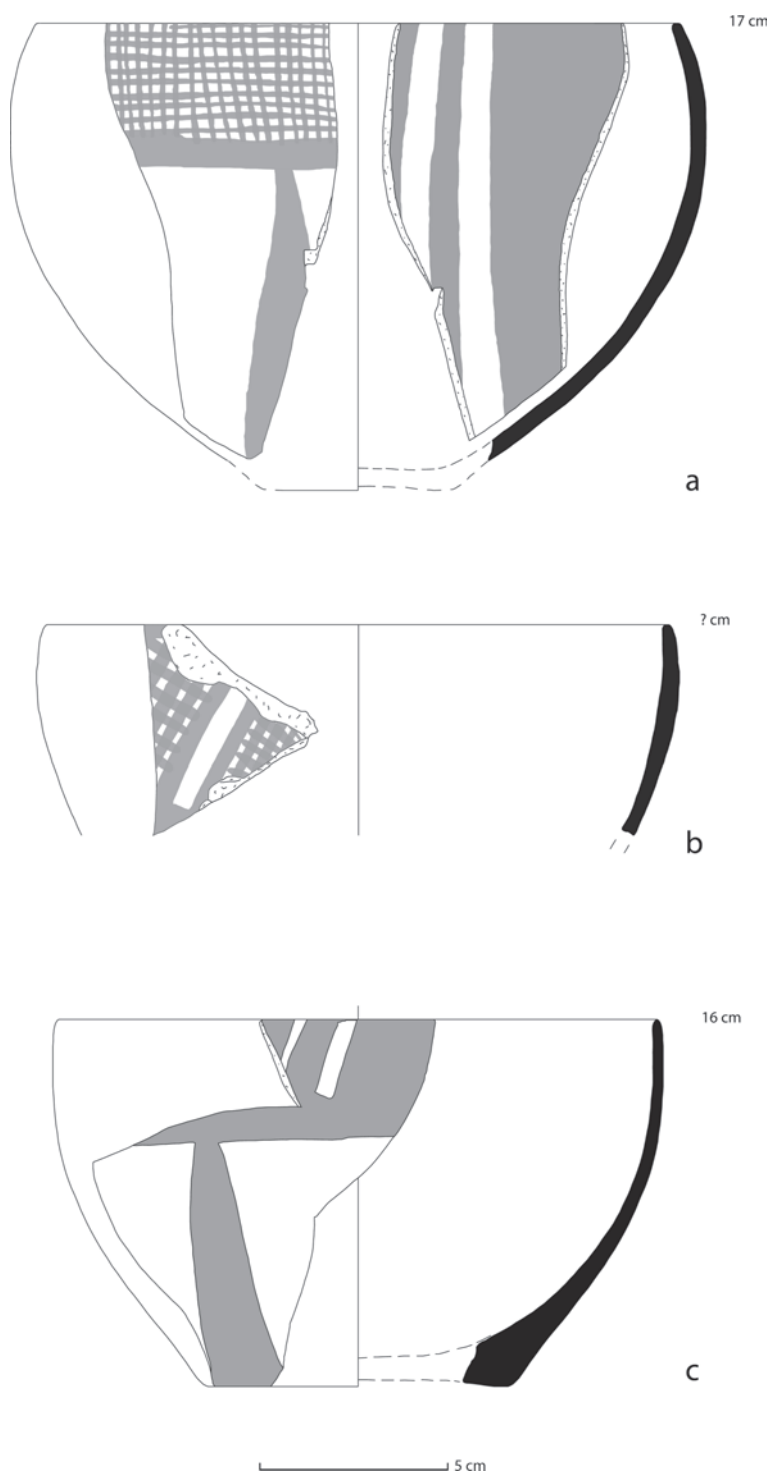
<sup>80</sup> Müller-Karpe 1982, 28.

<sup>81</sup> Hiebert/Kurbansakhatov 2003, 75–77.

these wares tend to be mutually exclusive in their stratigraphic occurrence.

The Black-on-Red Untempered Ware is similar to the pottery published by Berdiev<sup>82</sup> as “Anau IA” wares from Monjukli Depe. However, the motifs of the pottery do not match typical Anau IA decorations that consist mostly of finely drawn, cross-hatched triangles, zig-zags, rows of lozenges and double lozenges. Rather, as already remarked by Berdiev,<sup>83</sup> the pottery from Monjukli Depe is different from the other Anau IA assemblages, and this led him to believe that the material from Monjukli Depe was a late Anau IA manifestation. However, our radiocarbon dates demonstrate that Monjukli Depe’s assemblage is markedly earlier than standard Anau IA pottery at Anau North itself.<sup>84</sup> When looking for parallels, it is not useful to list such general motifs as cross-hatched triangles or lozenges, as they are ubiquitous and unable to help in relative dating. The structuring of the vessel surface into zones seems to be a much better basis for seeking *comparanda*. One of the most distinctive elements of Early Aeneolithic Monjukli pottery is the open shape with a broad painted band on the exterior rim and widely spaced pendant vertical lines that extend from the band to the base of the vessel. Not only is this structure clearly visible in our excavated samples (Figs. 17; 18), but it is also very well attested in the materials excavated by Berdiev.<sup>85</sup>

Parallels from elsewhere are not easy to find. Distant Tappe Sialk has a number of examples with similarly structured pottery decorations.<sup>86</sup> The first two pieces are ascribed to Sialk II, 1, the latter three to Sialk II, 2. There is a sherd from E. F. Schmidt’s excavations at Češme ‘Ali with a similar decorative scheme.<sup>87</sup> Based on the early radiocarbon dates for the strata associated with this ware as well as the differences to standard Anau IA pottery, we have defined the associated occupation at Monjukli Depe as belonging to a “Meana horizon.” From the few and distant parallels, it would seem that the Early Aeneolithic Meana horizon can be compared to early Češme ‘Ali/Sialk II, 1 on the Iranian plateau. However, this needs to be confirmed by further close analysis of stratified finds from the Iranian plateau. According to radiocarbon dates from recent work at Češme ‘Ali and elsewhere in the Tehran



**Fig. 17**  
Monjukli Depe. Black-on-Red Untempered Ware vessels. – a RN 1269 (A56, Stratum I); b RN 1010 (A3); c RN 1070 (A22)

<sup>82</sup> Бердыев 1972, Figs. 3–5.

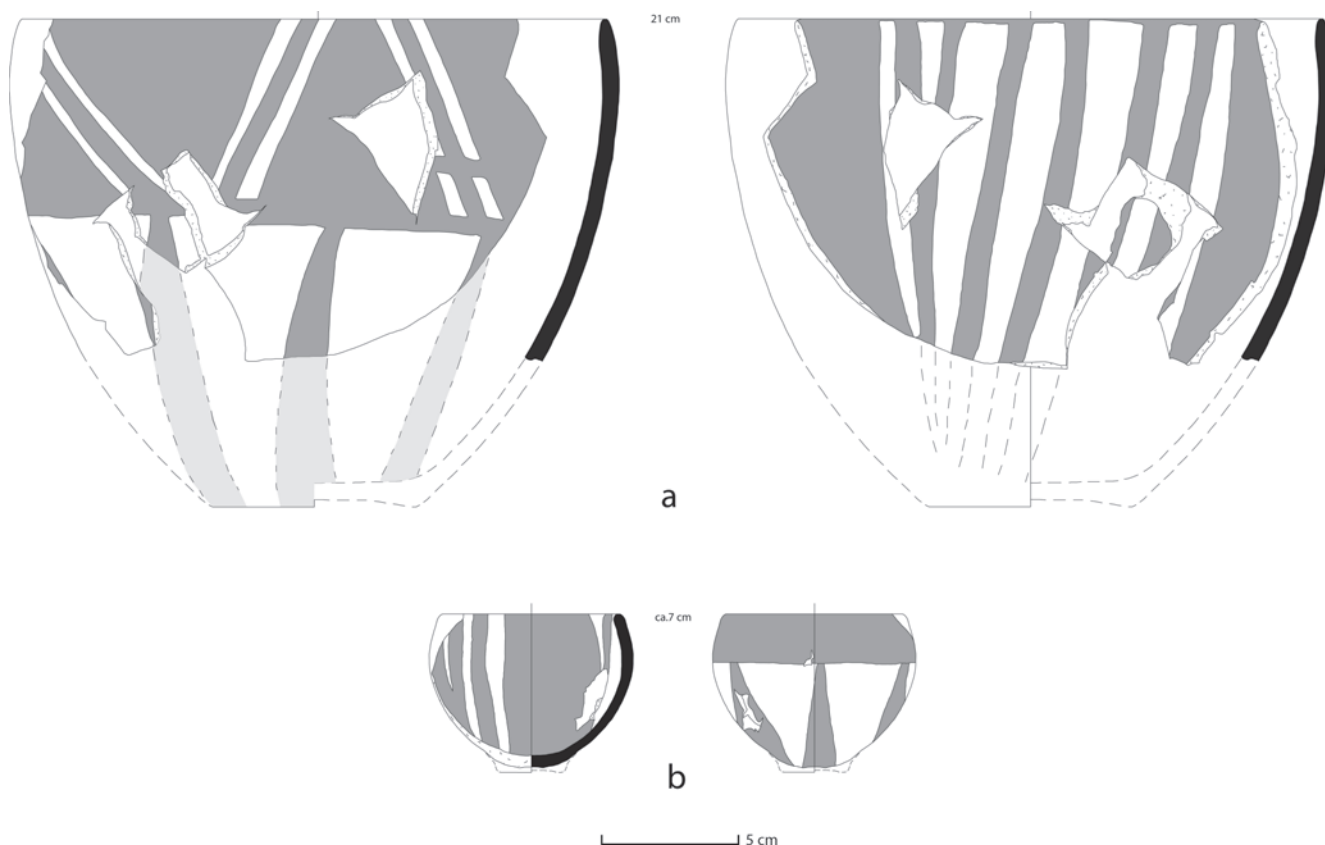
<sup>83</sup> Бердыев 1974, 35–36.

<sup>84</sup> See “Dating”, this report.

<sup>85</sup> Бердыев 1972, Fig. 3, 4. 10. 14. 29 Fig. 4, 10. 21. 24. 27 Fig. 5, 1. 2. 11. 13. 21. 23. 28.

<sup>86</sup> Ghirshman 1938, Planche XLV, S 1552. S 1641. S 1394 Planche XLVII, A13. C14.

<sup>87</sup> RCh 1498.11; see Matney/Pittman/Fazeli <http://www3.uakron.edu/cheshmehali/>.



**Fig. 18**  
Monjukli Depe. Black-on-Red Untempered ware vessels. – a RN 1029 (A8), 1051 (A16), 1070 and 1091 (A22), 1073 (A25, Stratum I), 1087 (A32, Stratum I); b RN 1130 (A37, Stratum I)

plain, the Meana horizon falls somewhere into the “Transitional Chalcolithic”.<sup>88</sup>

### Archaeometric analysis of pottery

by Małgorzata Daszkiewicz

Seven sherds recovered during the first season were exported for laboratory analysis. The aim of the analysis was to detect and interpret the differences between three archaeological pottery groups:

Group A, consisting of two Neolithic pottery fragments, probably locally produced; Group B: two fragments of painted chaff-tempered wares, which also may have been locally produced; Group C: three Aeneolithic pottery fragments, thought perhaps to represent imported pottery. Scans of the analysed samples are shown in **Fig. 20**.

As a first step an MGR-analysis<sup>89</sup> of all seven samples was carried out. This technique highlights even small variations in the composition of the clay used by revealing differences in the behavior and color of the sherd after refiring at a temperature of

1150 or 1200°C. For the purpose of this analysis, four thin slices were cut from each of the seven pottery fragments. One of these sections was left as an indicator of the sample’s original appearance (**Fig. 21**), while the remaining three were fired in a laboratory chamber furnace, each one at a different temperature. Firing was carried out at 1100, 1150 and 1200°C in air, static, with a heating rate of 200°C/hour and a soaking time of one hour at the peak temperature. The fragments were then glued onto paper. Photos of the fragments refired at 1150 and 1200°C are shown in **Fig. 22**.

Based on the appearance of samples when fired at 1200°C, the following two matrix types were identified: melted (MLT = the sample becomes spherical or almost spherical in shape), and semi-melted (sMLT = over-melting of the surface occurs, changes in sample shape are noted, not just rounded edges, but no bloating). Only one sample (MDP 4691 = RN 3018) belongs to the sMLT-matrix type, the other fragments can all be attributed to the MLT-matrix type. If samples display the same thermal behavior (i.e. their surface appearance is the same, as is their color and shade after refiring), it indicates that they were made using the same plastic material (clay). Within the MLT-matrix type

<sup>88</sup> Fazeli Nashli et al. 2004.

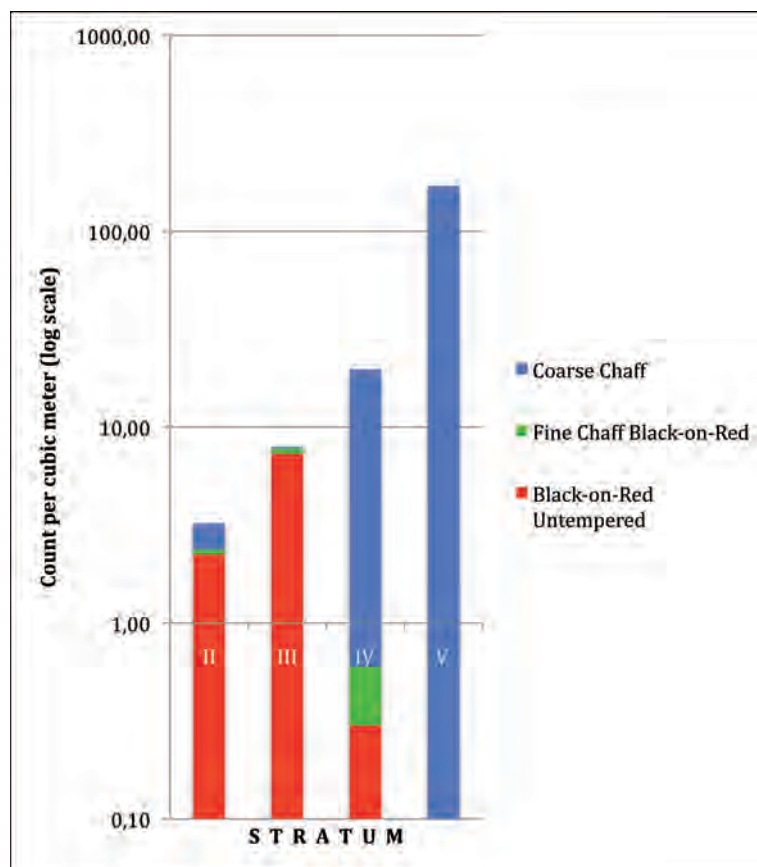
<sup>89</sup> Daszkiewicz/Schneider 2001, 25–32.



Arch. group	MGR group	Lab no. (MDP)	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	MnO	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	V ppm	Cr	Ni	(Cu)	Zn	Rb	Sr	Y	Zr	Nb	Ba	(La)	Ce	Pb	Th	I.o.i. %	TOTAL %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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\* 100 mg sample analyzed  
na = not analyzed

**Tab. 3**  
Monjukli Depe. Results of chemical analysis by WD-XRF (Daszkiewicz-Schneider)



**Fig. 19**  
Monjukli Depe. Densities (counts per cubic meter) of pottery wares by stratum. Note the use of a logarithmic scale

different colors and shades can be distinguished. Bearing in mind the criteria outlined above, the seven samples were grouped according to their thermal behavior into so-called MGR-groups consisting of potsherds made using the same plastic raw material (clay). The MGR-groups are presented in **Table 3**, together with the results of chemical analysis by wavelength-dispersive X-ray fluorescence (WD-XRF).<sup>90</sup> Sample MDP 4689 (= RN 5294.2) was not analyzed by WD-XRF because of its identical refiring

<sup>90</sup> All samples were prepared by pulverizing fragments weighing about 1.5 g, having first removed their surfaces and cleaned the remaining fragments with distilled water in an ultrasonic device. The resulting powders were ignited at 900°C (heating rate 200°C/h, soaking time 1 h), melted with a lithium-borate mixture (Merck Spectromelt A12) and cast into small discs for measurement. These data are therefore valid for ignited samples but, with the ignition losses given, may be recalculated to a dry basis. Total iron is calculated as Fe<sub>2</sub>O<sub>3</sub>. For easier comparison the major elements are normalized to a constant sum of 100%. The precision for major elements is below 1%, for trace elements it rises to 20%, depending on the concentrations. Some trace elements are determined with lower precision (Cu, La, Ce, Pb). The accuracy is tested by analyzing international reference samples and exchanging samples with other laboratories. For major elements and the most important trace elements, the accuracy is between 5 and 10%.

**Monjukli Depe 2010**

original samples

**Group A**

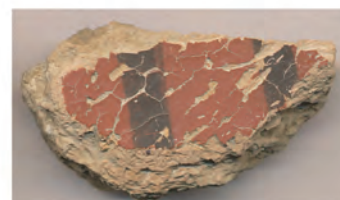
1038, MD 4686



5344, MD 4687

**Group B**

1264, MD 4688



5294.2, MD 4689

**Group C**

1250, MD 4690



3018, MD 4691

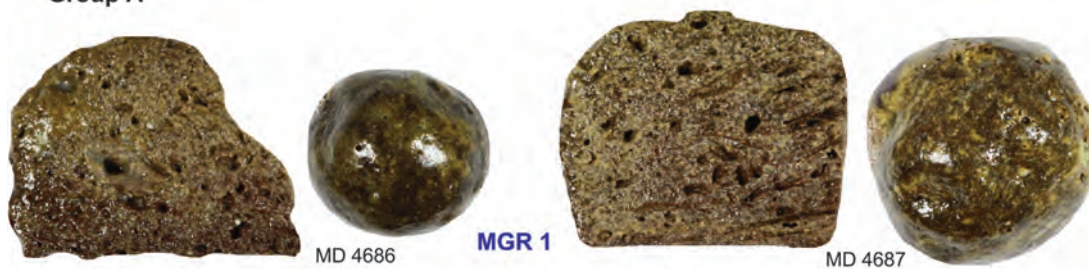
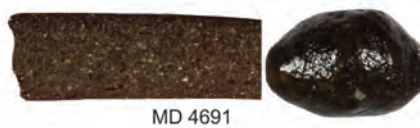


3152, MD 4692

**Fig. 20**  
Monjukli Depe.  
Sherds used in the  
MGR analysis

**Monjukli Depe 2010**

samples after refiring (left = 1150°C; right = 1200°C)

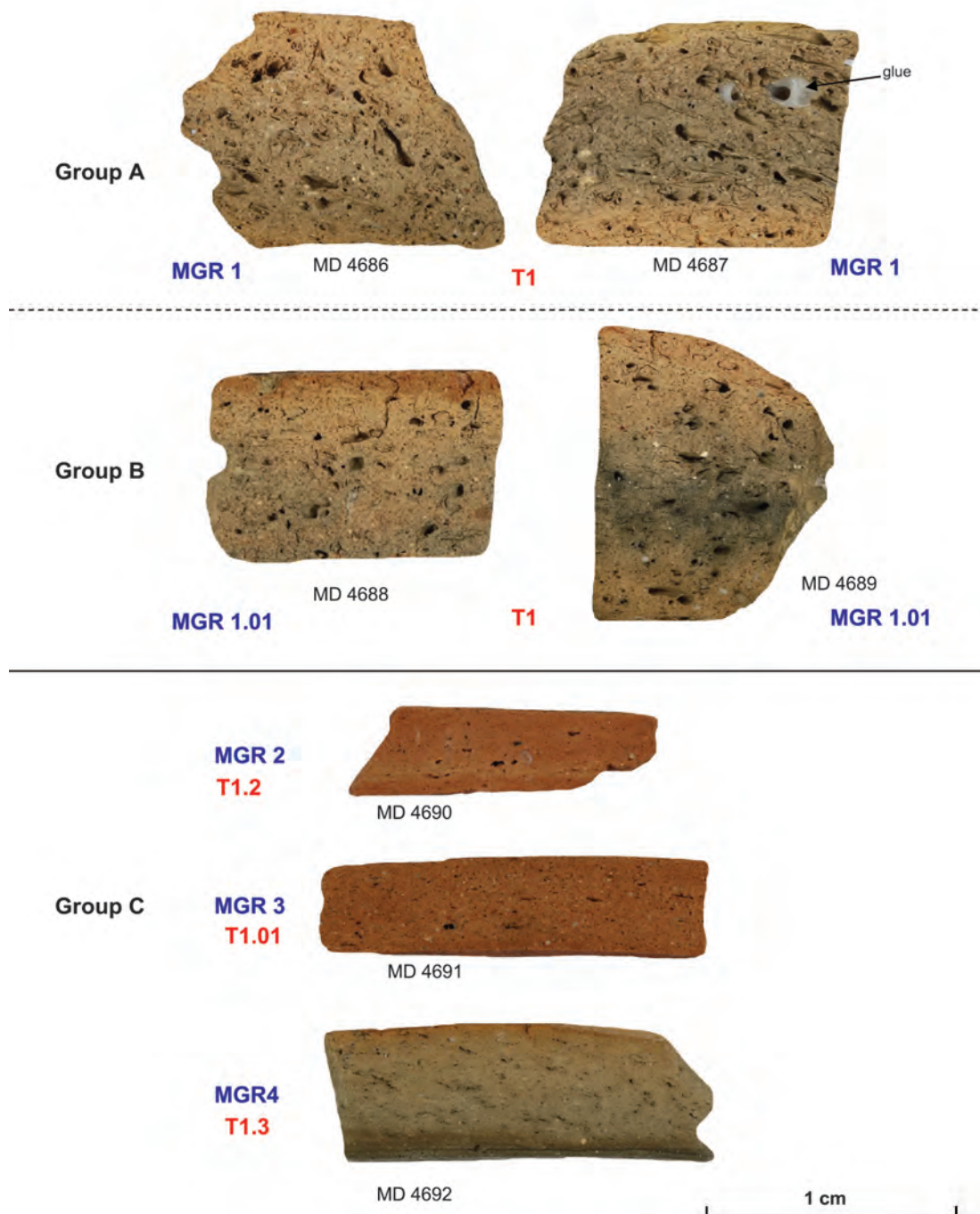
**Group A****Group B**MGR 3  
T1.01**Group C**MGR 2  
T1.2MGR4  
T1.3

1 cm

**Fig. 21**  
Monjukli Depe. Samples after refiring at 1150° and 1200°C grouped according to MGR-groups and chemical composition (macro photos by M. Baranowski)

### Monjukli Depe 2010

original samples (cut sections)



**Fig. 22**  
Monjukli Depe. Cut sections of original samples grouped according to MGR-groups and chemical composition (macro photos by M. Baranowski)



Arch. group	RN/ Unit-locus	Lab number (MDP)	MGR-analysis thermal behavior at 1200 °C.		MGR-group	Chemical group	Temper
			appearance (matrix type)	color			
A	1038/A11	4686	MLT	yellowish-greenish\brown	MGR 1	T1	chaff
A	5344/C82	4687	MLT	yellowish-greenish\brown	MGR 1	T1	chaff
B	1264/A64	4688	MLT	yellowish-greenish\brown	MGR 1.01	T1	chaff
B	5294.2/C72	4689	MLT	yellowish-greenish\brown	MGR 1.01	T1	chaff
C	1250/A61	4690	MLT	brown (yellowish-greenish)	MGR 2	T1.2	m.n.v.
C	3018/B2	4691	sMLT	brown\ yellowish-greenish	MGR 3	T1.01	m.n.v.
C	3152/B50	4692	MLT	yellowish-greenish	MGR 4	T1.3	m.n.v.

**Tab. 4.**  
Final groups resulting from the MGR analysis (\ = irregular; () = few; m.n.v. = macroscopically not visible; T = Turkmenistan; MLT = melted; sMLT = semi-melted)

behavior to sample MDP 4688 (= RN 1264). Only a small remnant of sample MDP 4686 could be analyzed. For this reason some trace elements were not detected with sufficient precision and are therefore not noted in **Table 3**.

From the analysis the following conclusions emerge:

1. All seven pottery fragments were made from clay without any intentional mineral temper, and the non-plastic material is very fine (not visible macroscopically). The four samples of groups A and B are chaff-tempered.
2. The four chaff-tempered pottery fragments were made from a very similar raw material of the MLT matrix type, in which, after refiring, patches of yellowish-greenish fired clay are mixed with patches of brownish fired clay (probably a natural feature of this clay). They differ only very slightly in the ratio of yellowish-greenish to brownish patches (distinguished as MGR-groups 1 and 1.01).
3. The three non-chaff-tempered pottery fragments of archaeological group C differ somewhat from each other and from the four samples described above, but some similarities are observed: the refired samples MDP 4690 (RN 1250) and MDP 4691 (RN 3018) have patches of mixed clay similar to samples of Groups A and B, but the brown fired clay dominates here. Sample MDP 4690 has a MLT matrix type (MGR-group 2) and sample MDP 4691, a sMLT matrix type (MGR-group 3). Sample MDP 4692 (RN 3152) of MLT matrix type differs in its yellowish-greenish color after refiring at 1200°C (MGR-group 4).
4. The results of the chemical analysis show clearly that all MGR-groups represent very similar raw materials with calcium contents of between 7

and 10% CaO, and relatively low contents of titanium, iron, chromium and nickel. Alkali elements sodium and potassium are relatively high, with low rubidium. Looking at this chemical similarity, the data do not give any indication of different provenances. The small differences may be due to different layers within the same clay source.

5. Sherds of groups A and B are nearly identical in terms of matrix type, temper (chaff) and chemical composition. One sherd of group C (MDP 4691) differs only very slightly, with somewhat lower calcium, magnesium and higher aluminium, iron, and potassium. Samples MDP 4690 and MDP 4692 are distinguished from the other samples by less silica and higher calcium, magnesium, and potassium contents. They differ from each other slightly in titanium, aluminum and sodium.
6. The clay used for the seven sherds is very similar and very probably from the same source. The difference between Neolithic (groups A and B) and Aeneolithic (group C) pottery fragments therefore lies in technology (e.g. the use of chaff temper), but not in clay composition (**Table 4**). Thin-section studies would be helpful to obtain more information on clay and non-plastic inclusions, and, combined with refiring studies at temperatures between 400 and 1000°C, on firing technology.

### Chipped Stone

The raw materials used to make chipped stone tools at Monjukli Depe are varied. Which of these materials were locally available and which were acquired from more distant sources remains to be in-



**Fig. 23**  
Monjukli Depe. Unused  
stone flakes from a single con-  
text (B81, Stratum II)

vestigated. A dark, coarse-grained, schist-like stone as well as a coarse sandstone and quartzite, none of which lend themselves very well to chipping, were used mainly for expedient tools. Other materials include a fine red chert, a fine-textured orange-tan variety, and a translucent whitish, strikingly glossy material, all of which were used primarily to produce blade tools. The translucent whitish stone is present almost solely in Aeneolithic levels.

In the case of the fine-textured raw materials, the high proportion of tools in relation to debitage suggests that the tools may have been brought to the site in partially or completely finished form. The debitage that is present consists primarily of unused flakes (**Fig. 23**), some unused blades, chunks and shatter. There are very few cores, core fragments, or rejuvenation flakes, and the number of pieces bearing cortex is also quite low. Overall,

there is a minimum amount of evidence for primary reduction at the site.

The distribution of cores shows both temporal trends and differences based on raw material. Two of the five cores (40%) come from Neolithic levels, whereas only 13% of the total debitage derives from Neolithic deposits. Three of the five cores (60%) are of coarse stone, whereas coarse raw materials account for only 26% of the total debitage present. Total debitage densities are relatively similar in Strata I, II and IV, whereas Stratum III has much lower density. Despite the small sample size, Stratum V has by far the highest density of debitage (**Table 5**). These figures suggest a change in the intensity of chipped stone production over time.

The overwhelming majority of tools consists of simple retouched pieces, mostly blades. In addition, there is a small number of perforators, denticulates, notched pieces, trapezoidal microliths, a burin, and a sickle blade (**Fig. 24**). Although the small sample sizes make conclusions tentative, it is interesting to note that both trapezoidal microliths come from Neolithic levels, whereas the one sickle blade and all perforators date to the Aeneolithic. Tool density is lowest in Strata I and IV, substantially higher in Strata II and V and highest in Stratum III (**Table 6**).

A comparison of the ratios of debitage to tools offers an indication of the relative amount of chipped stone production in relation to tool use/discard. In all strata other than Stratum III the ratios range from 2.6:1 to 5.5:1; in Stratum III the ratio is much lower at 0.7:1. This result implies a lesser proportion of tool production to tool use/discard in Stratum III, reinforcing the observation of a particularly high tool density in this stratum. As Stratum III is principally represented in Unit C, it is also possible that this is a spatial distinction as much as a temporal one.

### A microwear study of a small sample of tools

by Melody Pope

A pilot microwear study was conducted on a sample of nine chipped stone tools, principally blades, recovered during the 2010 season at Monjukli Depe.

The microwear method used follows the high-power approach as outlined by Keeley,<sup>91</sup> Vaughan,<sup>92</sup> and Jensen.<sup>93</sup> The primary changes that result from tool use observed at the microlevel are alterations to the surface topography and reflectiv-

**Tab. 5**  
Monjukli Depe. Chipped  
stone debitage den-  
sities by stratum

	Debitage density (ct/100 lt)
Stratum I	22/2208 lt = 0.996
Stratum II	44/3496 lt = 1.259
Stratum III	18/3323 lt = 0.542
Stratum IV	10/1104 lt = 0.906
Stratum V	6/340 lt = 1.765

**Tab. 6**  
Monjukli Depe. Chipped  
stone tool densities by  
stratum

	Tool density (ct/100 lt)
Stratum I	4/2208 lt = 0.181
Stratum II	17/3496 lt = 0.486
Stratum III	26/3323 lt = 0.782
Stratum IV	2/1104 lt = 0.181
Stratum V	2/340 lt = 0.588

<sup>91</sup> Keeley 1980.

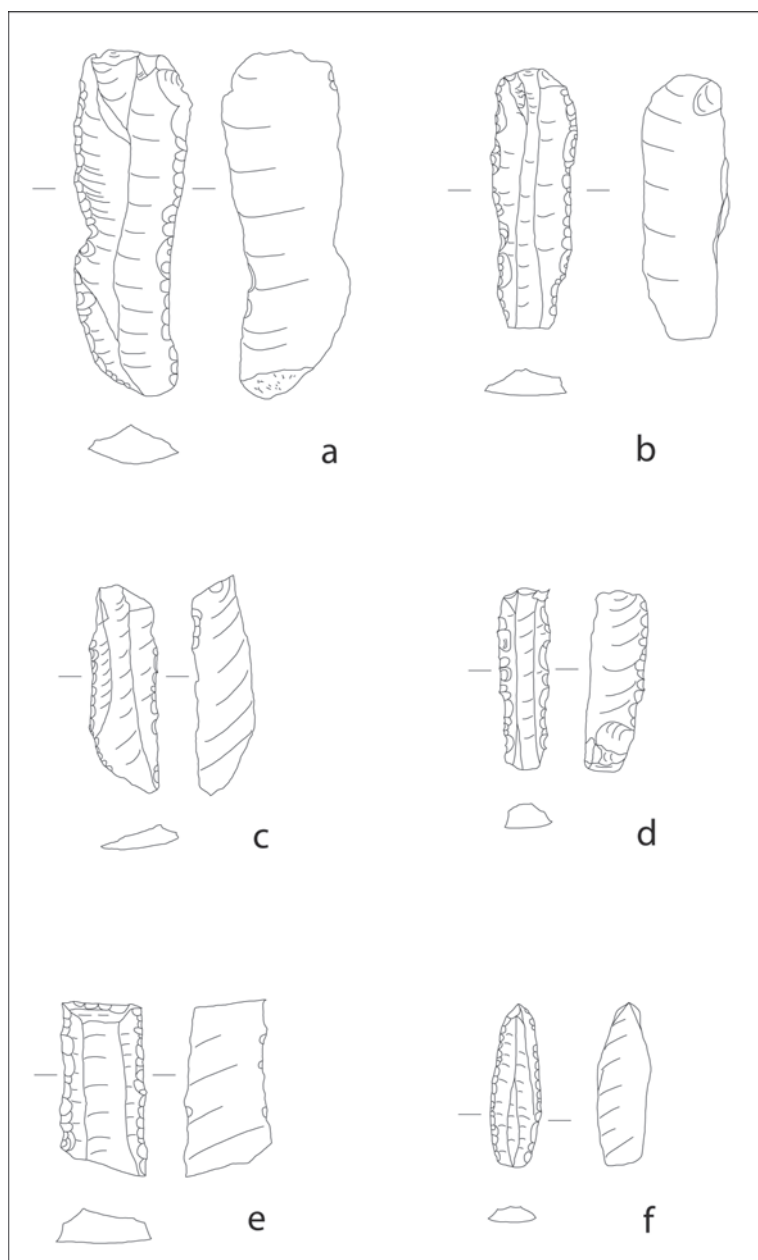
<sup>92</sup> Vaughan 1985.

<sup>93</sup> Jensen 1988; Jensen 1994.

ity of the natural stone surface. An Olympus BX51 optical microscope with magnification capacities between  $50\times$  and  $400\times$  was used to record micropolish and striations, modifications of the original flint surface through contact with other materials that can only be observed at the microscopic level. Micropolishes have distinct morphological and textural characteristics as well as variation that can be used to infer contact with a particular substance such as wood, meat, bone/antler, and silica-rich plants such as cereals and reeds that result in heavy polish or “sickle gloss.” Striations are grooves and scratches of varying dimensions which are often important indicators of either intentional or unintentional motion, such as friction between a stone tool and its haft. Taken together, micropolish and striations provide information on contact material and tool motion.

The analysis followed a two-stage procedure. First, tools were scanned at low and high magnifications to characterize the nature of the use traces. The second phase of the analysis involved recording detailed information on attributes of the micropolish and striations in order to infer information about contact material and tool motion. The location of a particular wear trace was sketched on a line drawing of the tool, and attributes were recorded to identify the active tool edge and mode of use.

Assuming that an assemblage contains preserved microwear traces, a number of factors affect the interpretation of micropolishes, including the duration of work, texture of the material used in tool manufacture, and the nature of the worked material (e.g., amount of moisture, hardness, etc.). In addition, there are three methodological problems that require attention. First is the problem of equifinality, or the convergence of certain wear traces resulting either from the nature of the contact material (e.g., bone and antler, or antler and reed) or from factors such as motion or duration of work. Some kinds of contact materials are more diagnostic than others, and research efforts must continue to explore ways of identifying key attribute states unique to particular use contexts, or one must limit interpretation to a low level of resolution by combining categories such as bone and antler. Second, some activities rarely generate polish that forms beyond what analysts refer to as the generic weak stage.<sup>94</sup> Generic weak polish, regardless of the contact material, does not exhibit characteristic attributes. Thus, tools with generic weak polish can contribute only low level information regarding tool use. A further problem, however, is that generic weak polish resembles soft tissue and some plant



**Fig. 24**

Monjukli Depe. A selection of chipped stone tool types. – a retouched blade (RN 5177.1, C35, Stratum III); b retouched blade (RN 3262.1, B71, Stratum III); c retouched and notched blade (RN 3230.2, B68, Stratum II); d denticulated blade (RN 1182.2, A52, Stratum I); e retouched blade (RN 5110.2, C25, Stratum III); f perforator (RN 1182.1, A52, Stratum I)

polishes. Thus, due to limits of the method, some soft substances will be overlooked or considered ambiguous.<sup>95</sup> Finally, post-depositional processes,

<sup>94</sup> Vaughan 1985, 30; Jensen 1994, 16.

<sup>95</sup> Jensen 1994, 16.

RN	Tool #	Unit-Locus	Context	Raw Material	Description of tool	Use Wear
5110	1	C25	ashy fill	Fine gray	retouched flake; fine retouch on most edges	weak woody plant-like polish
5110	2	C25	ashy fill	Fine orange-tan	medial segment of blade; steep retouch on both edges	woody plant-like polish
5110	4	C25	ashy fill	Translucent white	flake with fine retouch on one edge	generic weak polish
5198	1	C41	fill	Fine bright red	medial blade segment; edges steeply retouched, sickle gloss on one edge	siliceous plant polish; very extensive
3262	1	B71	bricky collapse	Fine opaque white	retouched blade, possibly once a perforator or drill	woody plant-like polish
3262	2	B71	bricky collapse	Translucent white	complete blade, both edges have fine retouch	indeterminate plant-like, possible tuber polish
3030	1	B13	surfaces and some fill	Translucent white	complete blade, one edge denticulated, distal end retouched nearly to a point	very extensive hide-like polish
3030	2	B13	surfaces and some fill	Translucent white	complete blade, both edges retouched, red staining	very extensive hide and plant-like polish
202	1	D42		Fine orange-tan	retouched blade, one edge irregularly denticulated	indeterminate plant-like polish, possible tuber polish

**Tab. 7**  
Monjukli Depe. Chipped  
stone tools included in  
the microwear study

including the use of some chemical cleaners, can mask or destroy micropolishes. Pieces affected by soil sheen or patina, fire damage, or other destructive processes are generally eliminated from analyses or subject to only a low level of interpretation indicating whether the piece was used or not.

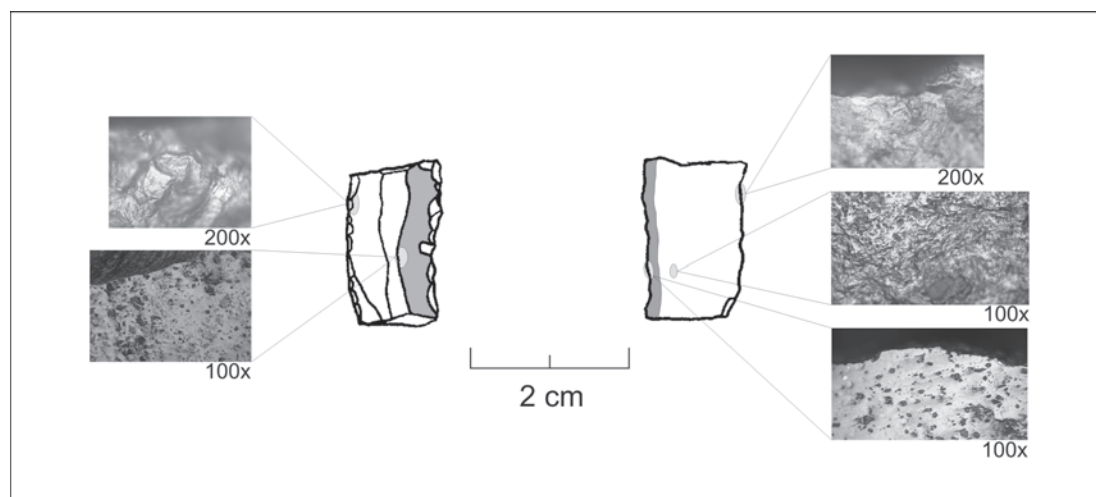
Generally, all of the pieces examined in the context of this analysis exhibit well preserved micropolishes that render the active use of the tool recognizable from the surrounding matrix. Exceptions include cases where blades were used on both edges, a situation that sometimes makes it difficult to differentiate between use and haft traces. The majority of the pieces exhibits well developed wear traces, implying that the tools had been heavily used before discard. Ironically, although well developed polishes generally enable the identification of a contact material, the effects of use intensity or duration of use have been understudied. Nonetheless, the preservation of well developed polishes suggests that with a larger sample size and problem-oriented experimental program it should be possible to achieve a high rate of success in the identification of contact materials. Problems of interpretation due to equifinality specific to the present study include distinguishing reed-processing from cereal-processing gloss and identifying tools that may have been used to process plant and animal fibers.

## Results

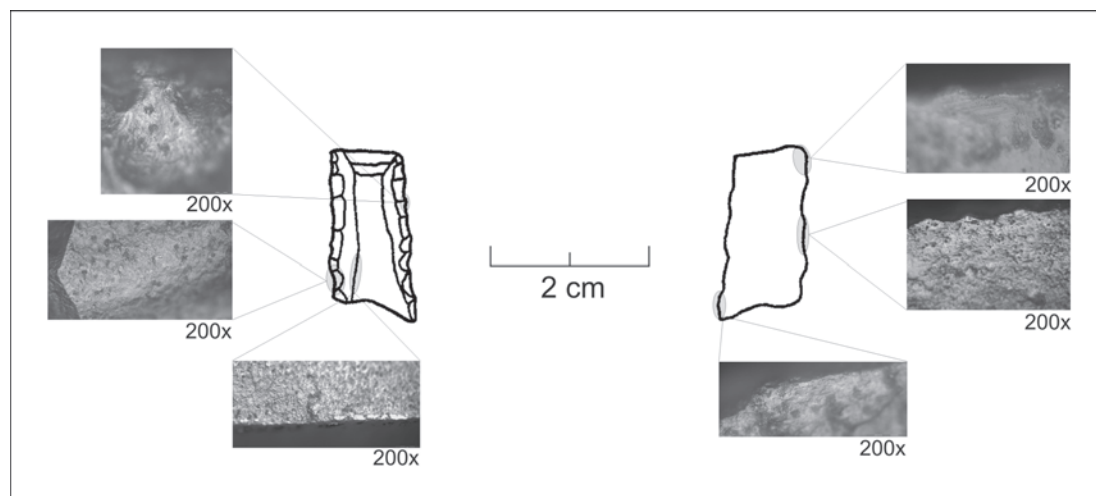
The tools included in the pilot microwear study are presented in **Table 7**. With the exception of two flake tools, all of the examined pieces are blade fragments manufactured on medium to very fine textured chert. Well preserved use-polish was observed on all of the examined pieces, and evidence of haft-related polish was also found on some of them. Flake scars indicative of either intentional or use-related flake removals were noted on all of the examined pieces. Many of the tools were extensively used, as shown by the extent of wear and polish development, which is in keeping with the high incidence of both intentional and use-related retouch edge scars. The majority of the tools exhibits wear traces consistent with processing plants, including at least one clear example (RN 5198) of use on silica-accumulator plants like reeds, rushes, and cereal grasses (wheat and barley).

Two blades carry a visible gloss on one edge. Tool RN 5198 (C41) has gloss along both the ventral and dorsal aspects of one edge. The gloss is more invasive on the dorsal aspect, extending to the right interior dorsal ridge scar as illustrated in **Fig. 25**. The polish is very smooth and bright, features that are consistent with tools used to process silica-accumulator plants. The presence of linear depressions that intersect the polish and give it a

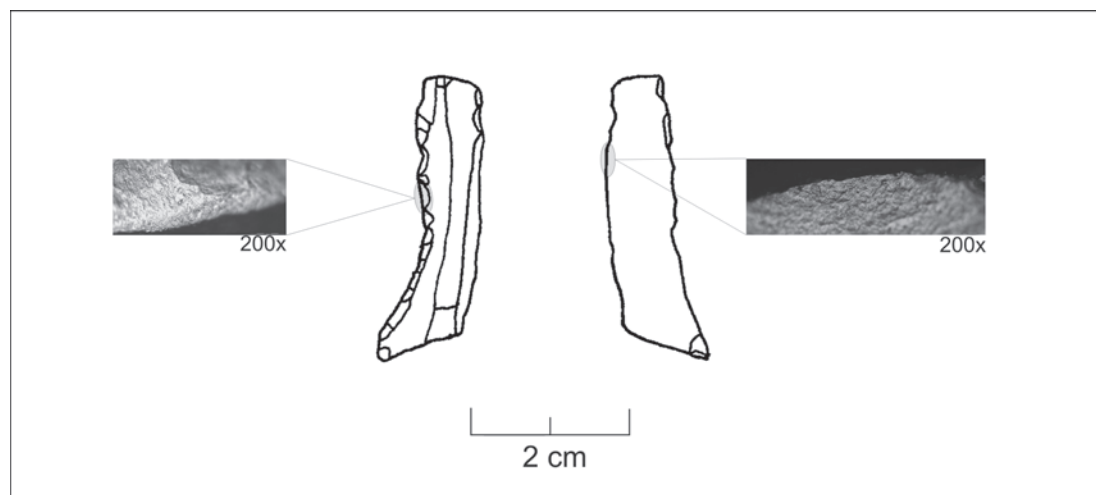




**Fig. 25**  
Monjukli Depe. Stone tool RN 5198.1 (C41, Stratum III). Polish from use (dorsal aspect, lower; ventral aspect, middle and lower) and hafting (dorsal aspect, upper; ventral aspect, upper; tool illustrations by Liz Niec)

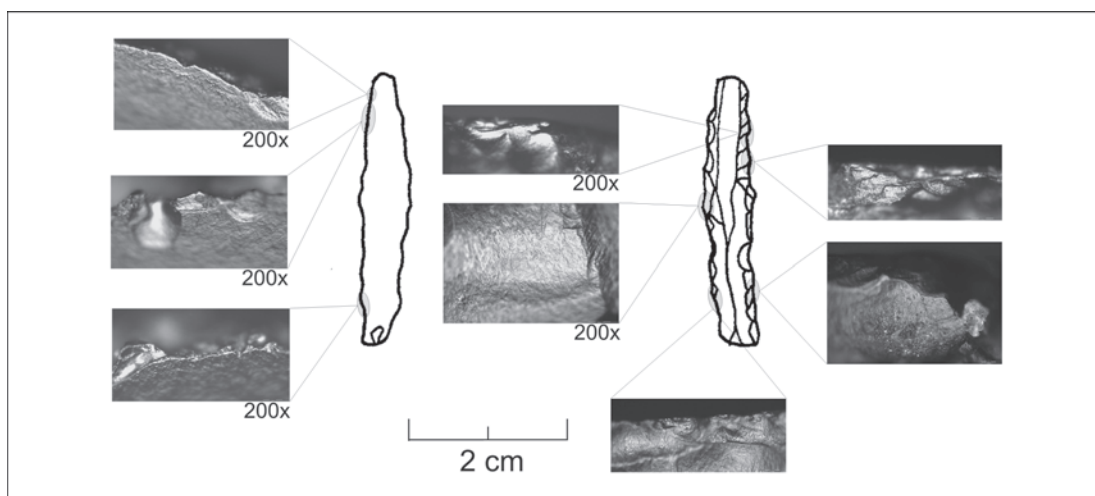


**Fig. 26**  
Monjukli Depe. Stone tool RN 5110.2 (C25, Stratum III). Polish from use (dorsal aspect, upper and middle) and hafting (dorsal aspect, lower; ventral aspect, upper; tool illustrations by Liz Niec)

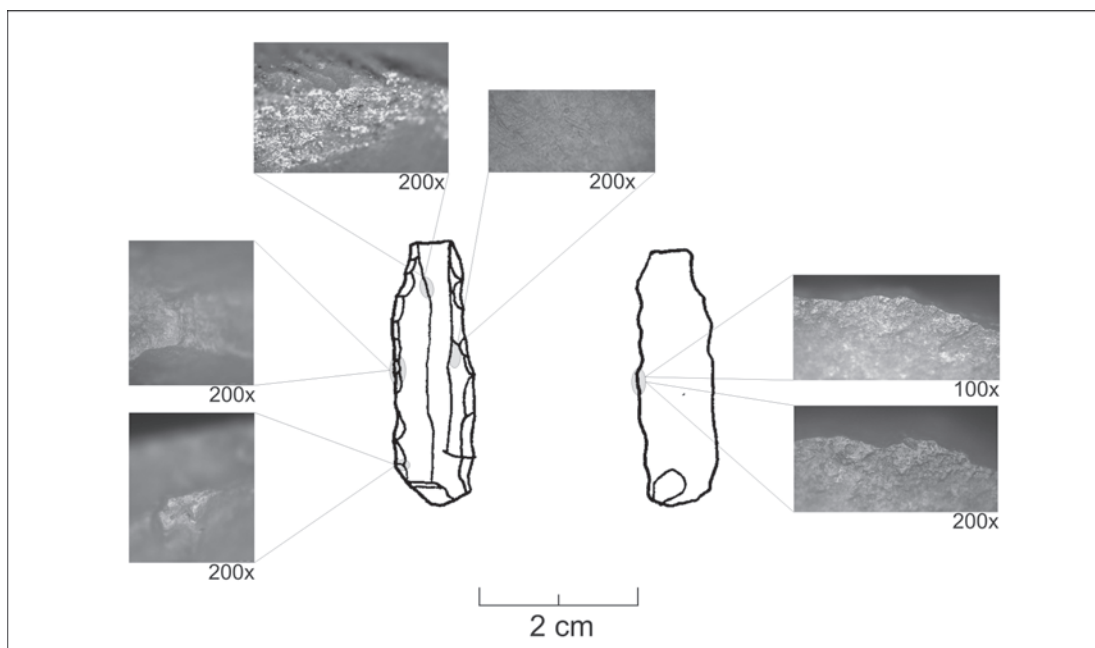


**Fig. 27**  
Monjukli Depe. Stone tool RN 3030.1 (B13, Stratum II), all images interpreted as use polish (tool illustrations by Liz Niec)

**Fig. 28**  
Monjukli Depe. Stone  
tool RN 3030.2 (B13,  
Stratum II), all images  
interpreted as use pol-  
ish (tool illustrations by  
Liz Niec)



**Fig. 29**  
Monjukli Depe. Stone  
tool RN 3262.1 (B71,  
Stratum III), haft polish  
(dorsal aspect, upper)  
and use polish (all  
other images; tool  
illustrations by Liz Niec)



somewhat fluted appearance (**Fig. 25, ventral aspect, lower image**) may indicate that the tool was used to cut plants like reeds and rushes rather than cereal grasses.

Tool RN 5110.2 (C25) (**Fig. 26**) exhibits a faint gloss along one edge, however the extensive re-touching along the edge and the natural gloss of the raw material make it difficult to distinguish this with the naked eye. A smooth bright polish is evidenced on the ventral aspect of the blade (middle image), also similar to polish from contact with a silica-accumulator plants like reeds or rushes. The polish on the dorsal aspect (middle image) is a

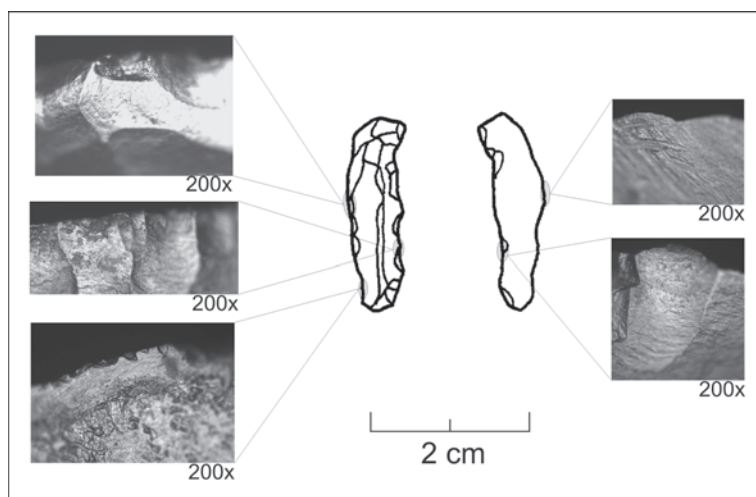
rough one similar to that which occurs from contact with dry hide. This asymmetrical aspect of the polish, in which the polish is dissimilar on the dorsal and ventral aspects, has been observed on micro-denticulates from Late Mesolithic and Early Neolithic sites in Denmark.<sup>96</sup> Its interpretation remains unresolved, although the distribution of the wear on the opposing edges on the pieces from Monjukli suggests a pattern created from a single action, rather than multiple, separate uses on both plant

<sup>96</sup> Jensen 1994, 59–61.

and hide. Possible explanations include processing plant and animal fibers, specifically dehairing hides in the case of animal fibers, or retting or maceration of plant fibers first treated with mineral substances such as ash to break down plant fibers needed to make fine textiles.<sup>97</sup>

Specimens RN 3030.1 and RN 3030.2 (B13) exhibit use polish traces comparable to those seen on Specimen RN 5110.2 and are similar in form and technology to tools from the Danish Mesolithic and Neolithic described as microdenticulates and curved knives (**Figs. 27; 28**). Unlike RN 5110.2 and the Danish microdenticulates reported by Jensen,<sup>98</sup> the dorsal and ventral polishes on these two pieces do not appear to be asymmetric. Rather, the polish is rough and pitted like dry hide, with isolated areas of polish similar to bone/antler on both ventral and dorsal aspects. One exception is an area of bright, smooth, flat polish on the ventral aspect of RN 3030.2 (**Fig. 28, upper image**) similar to experimental polishes from wood and reeds. The extent of edge retouch, particularly on RN 3030.2, and polish development on both pieces suggests that both tools were extensively used prior to discard. Jensen notes that polish on curved wood and plant working knives from Danish Neolithic sites are rarely as asymmetrical as observed on microdenticulates.<sup>99</sup> When compared with experimental wear, the features most closely resemble those produced by working materials like wood and reed. Jensen suggests that curved knives were used to whittle, shave, split and trim plant stems such as reed, rushes and wooden twigs.<sup>100</sup> If this interpretation is correct, these tools possibly reflect activities related to the production of mats, wickerwork, and baskets. The polish features on RN 3030.2 are more consistent with wood or reed, whereas the polish on RN 3030.1 is more similar to hide.

Three blades, RN 3262.1 (B71), RN 3262.2 (B71), and RN 202.1 (D42) (**Figs. 29–31**) exhibit a similar usewear pattern that closely resembles woody plant polish (reeds, rushes, cattails) in that it is bright, domed, dense and smooth with some striated areas. They are similar to experimental polishes from scraping cattail tubers (**Fig. 30, ventral aspect upper image**). The pitted nature of the surface polish also resembles polish caused by working hide. Narrow, linear streaks such as those illustrated in **Fig. 30 (ventral aspect, upper image)** were observed on my experiment that involved peeling dirty cattail tubers for two hours. Jensen<sup>101</sup>



**Fig. 30**  
Monjukli Depe. Stone tool RN 3262.2 (B71, Stratum III), all images interpreted as use polish. Note linear features on ventral aspect, upper image oriented obliquely to the edge (tool illustrations by Liz Niece)

and Sievert<sup>102</sup> have made similar observations on experimental tools used to process tubers. Jensen suggests that the linear streaks may be caused by abrasive soil particles adhering to the surface of tubers.<sup>103</sup> My experiments, as well as those of Sievert,<sup>104</sup> also found that root processing traces resemble those from cutting meat, except that they lack the typical greasy luster from soft tissue contact.

Two remaining specimens, RN 5110.4 and RN 5110.1 (C25), (**Figs. 32; 33**), included in the pilot study have less developed use polishes. Specimen RN 5110.4 (**Fig. 33**) exhibited a dense, dull and pitted polish that resembles hide, and polish streaks are present parallel to the long axis of the piece. The hide-like polish and linear polish streaks may suggest that this tool was used in a piercing or penetrating action indicating a possible use as a perforator or projectile tip. The flake tool, RN 5110.1, has a thin band of polish on a point formed by the convergence of two sides of the flake. The polish resembles wood in that it is domed and smooth. Polish similar to traces from hafting was observed on the edge opposite from the use edge, suggesting that the flake was hafted and possibly used as a knife.

## Summary

While the results of the study remain preliminary and should be regarded as first impressions, they nonetheless demonstrate that well preserved and interpretable wear traces are present at Monjukli Depe. We can suggest that the residents of the site

<sup>97</sup> Jensen 1994, 66–67.

<sup>98</sup> Jensen 1994, 50.

<sup>99</sup> Jensen 1994, 73.

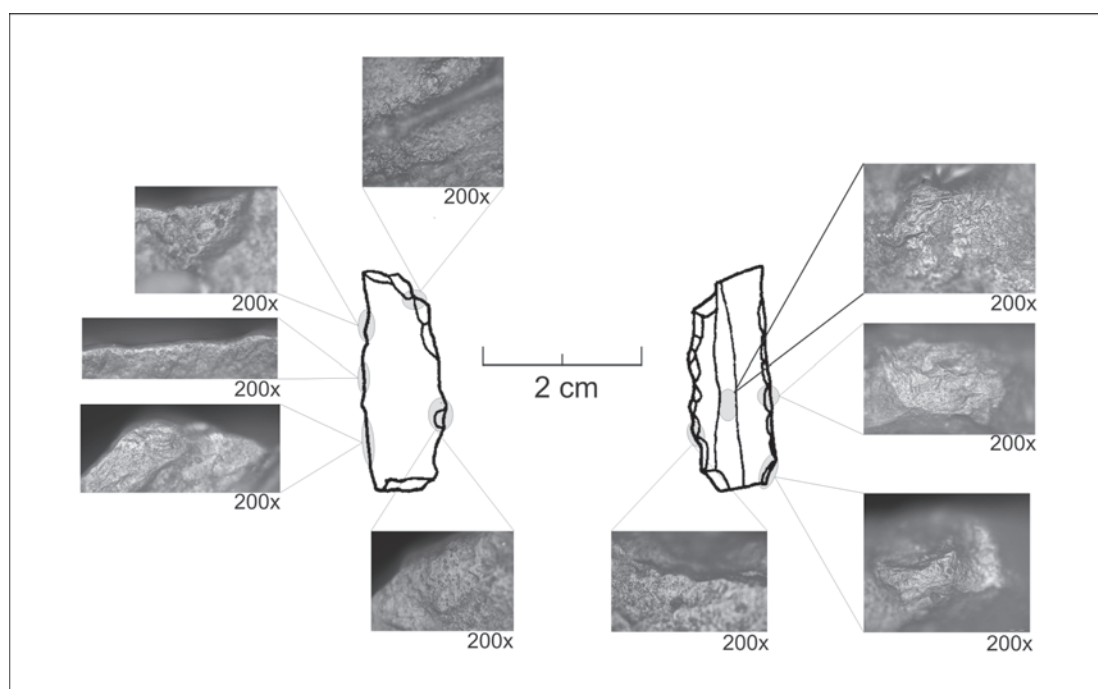
<sup>100</sup> Jensen 1994, 74.

<sup>101</sup> Jensen 1994, 37.

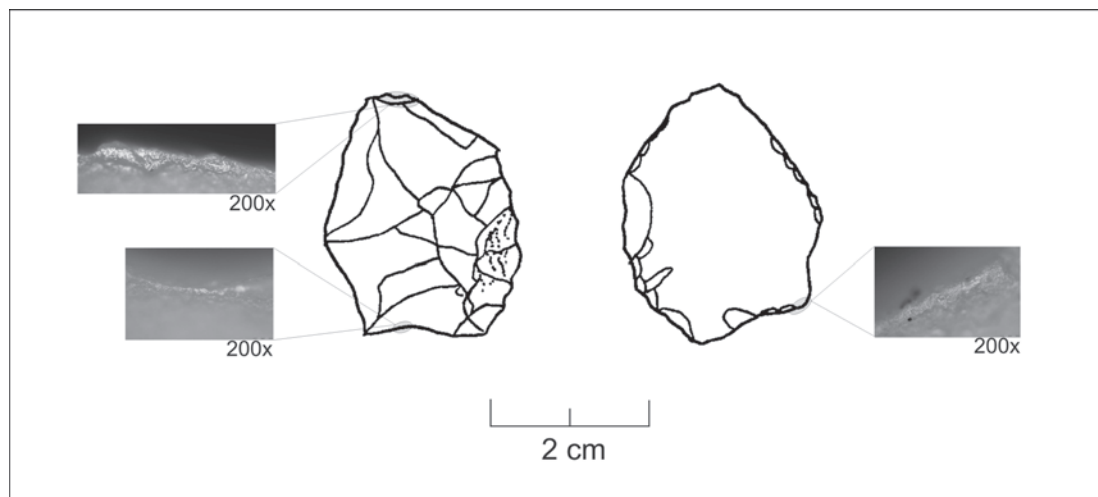
<sup>102</sup> Sievert 1992.

<sup>103</sup> Jensen 1994, 37.

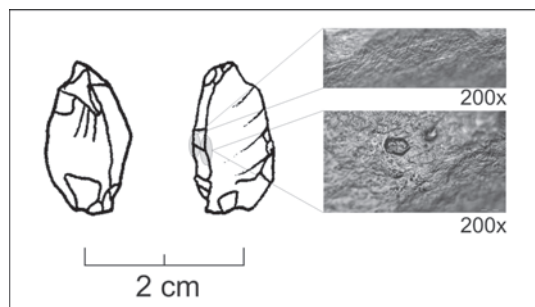
<sup>104</sup> Sievert 1992.



**Fig. 31**  
Monjukli Depe. Stone  
tool RN 202.1 (D42),  
use polish and haft pol-  
ish (dorsal aspect, up-  
per image; tool illustra-  
tions by Liz Niec)



**Fig. 32**  
Monjukli Depe. Stone  
tool RN 5110.1 (C25,  
Stratum III), use polish  
(dorsal aspect, upper)  
and possible haft pol-  
ish (dorsal aspect,  
lower image) and ven-  
tral aspect image (tool  
illustrations by Liz Niec)



**Fig. 33**  
Monjukli Depe. Stone  
tool RN 5110.4 (C25,  
Stratum III), possible  
use polish (tool illustra-  
tions by Liz Niec)

used blades and flake tools mainly for plant processing, including procuring plants, possibly reeds and rushes, and processing plant fibers. These could have been used by residents to make mats, baskets, and cordage. Blade tools such as RN 3030.1 closely resemble microdenticulates and curved knives documented at Danish Mesolithic and Neolithic sites. Jensen<sup>105</sup> has interpreted wear traces on

<sup>105</sup> Jensen 1994, 62–63.



RN	Unit-locus	Shape	Number of fragments	Base diameter: height	Height (cm)	Base diam/top diam/hole diam (cm)	Weight (g)	Color
41	SF10	bell-shaped	2	1.21	3.85-3.90	4.72/1.99-2.10/0.57-0.60	23.3	greenish buff
52	SF11	bell-shaped	1	1.10	4.08	4.5/-/0.66	19.9	reddish buff
1017	A4	conical	1	1.06	2.15	2.28/1.38-1.55/0.45-0.58	8.5	reddish to grayish
1026	A7	conical	1	1.24	2.73	3.4/-/0.4	30.8	reddish
1056	A16	conical	1	1.03	3.05	3.17/-/0.35-0.83	28.7	buff
1177	A1	bell-shaped	1	1.09	3.65	4/-/0.6	9.8	reddish buff
1191	A52	conical	1	1.09	2.48	2.71/-/0.31-0.59	7.7	reddish buff
1214	A56	conical	1		1.84	-/-/0.23	3.0	reddish gray
1230	A57	conical	1	1.15	2.17	2.5/-/0.39	3.9	reddish buff to brown
1239	A60	conical	1		1.84	-/-/0.34	1.5	reddish
3067	B23	conical	2	1.27	2.61	3.33/-/0.49	23.4	reddish buff
3192	B58	conical	1		>1.39	>2/-/0.48	1.5	reddish
3232	B68	bell-shaped	2	1.05	4.27	4.5/-/0.46	8.6	reddish to black
5167	C35	conical	1	1.23	1.81-1.85	2.29/-/0.5	6.3	gray
5253	C25	conical	1	0.88	1.69	1.5/-/0.35	2.0	reddish

**Tab. 8**  
Monjukli Depe. Spindle whorls

the Danish microdenticulates, not unlike the patterns evidenced in the Monjukli sample, to suggest that the tools may have been used as combs for hackling plant or animal fibers when a more refined fiber than that used for cordage was needed, perhaps for making textiles. Processing animal fibers and hides as well as hunting are also possible activities of which traces are present in the sample of tools examined. These use contexts should be further explored both experimentally and with a larger archaeological sample to refine interpretation of plant and animal processing activities. For example, polish from cutting cattails and meat (soft tissue) can look similar under optical microscopy. For this reason, meat polishes may be underrepresented in the pilot study. With a larger sample to draw on for comparative purposes it may be possible to better differentiate between tools used for butchering or meat processing and those that were used to process fibrous plants. Scanning electron and atomic force microscopy used in materials science fields to explore such surface features as roughness, grain size, and height may aid in identifying discriminate attributes that can potentially be used to differentiate between wear traces from rushes and reeds on the one hand and cereal grasses on the other. Both types of plants generate polishes that can be difficult to differentiate with optical microscopy alone, yet clearly have distinct archaeological implications.

### Other Aeneolithic artifacts

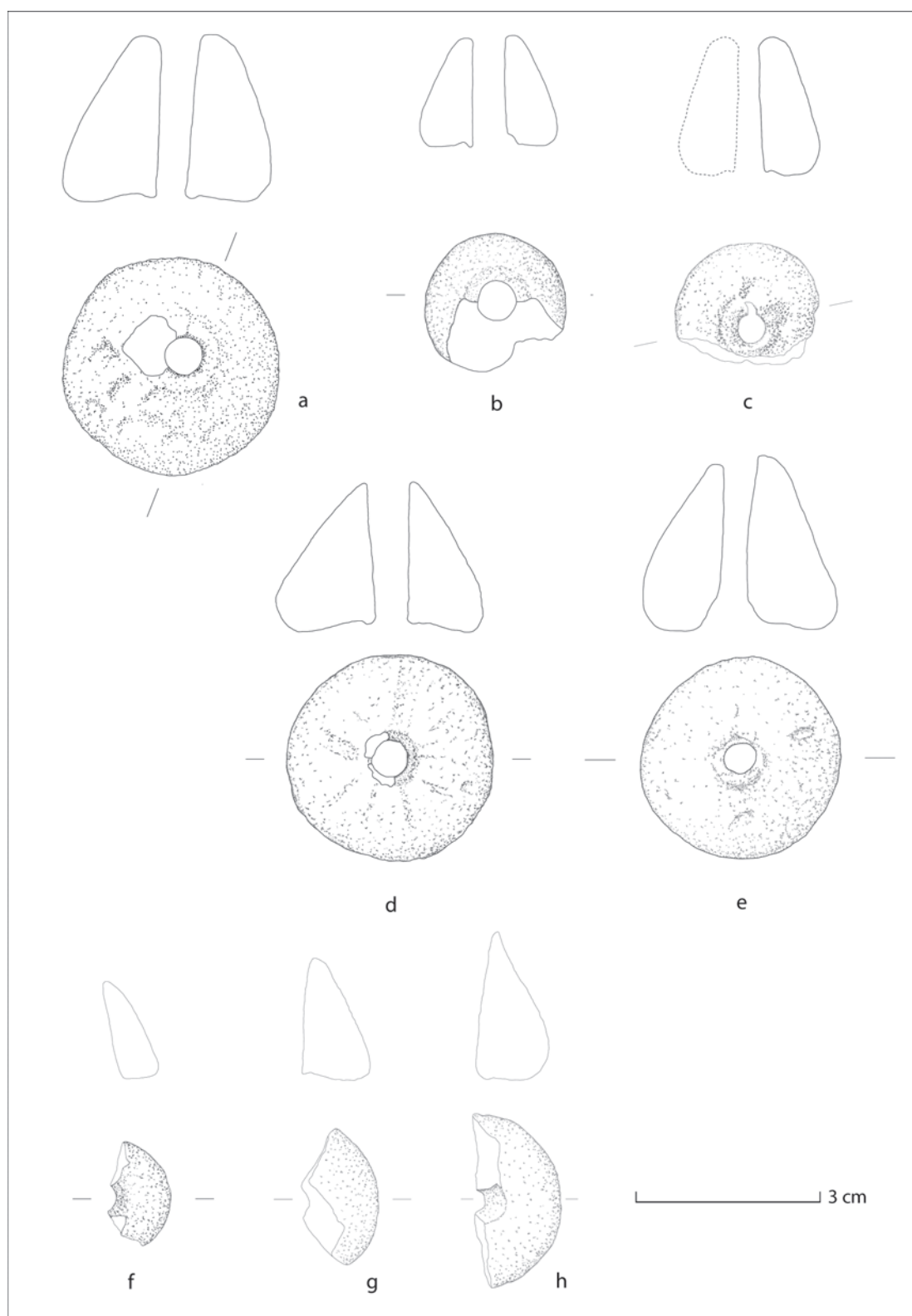
by Arnica Keßeler

Most of the small finds recovered from Monjukli Depe in 2010 were made out of locally available materials such as stone, clay and bone. However, a smaller number of objects made of non-local copper and lapis lazuli supplement the findings and point to the existence of contacts outside the immediate region. In this report the small finds are divided into categories that are based where possible on functional considerations.

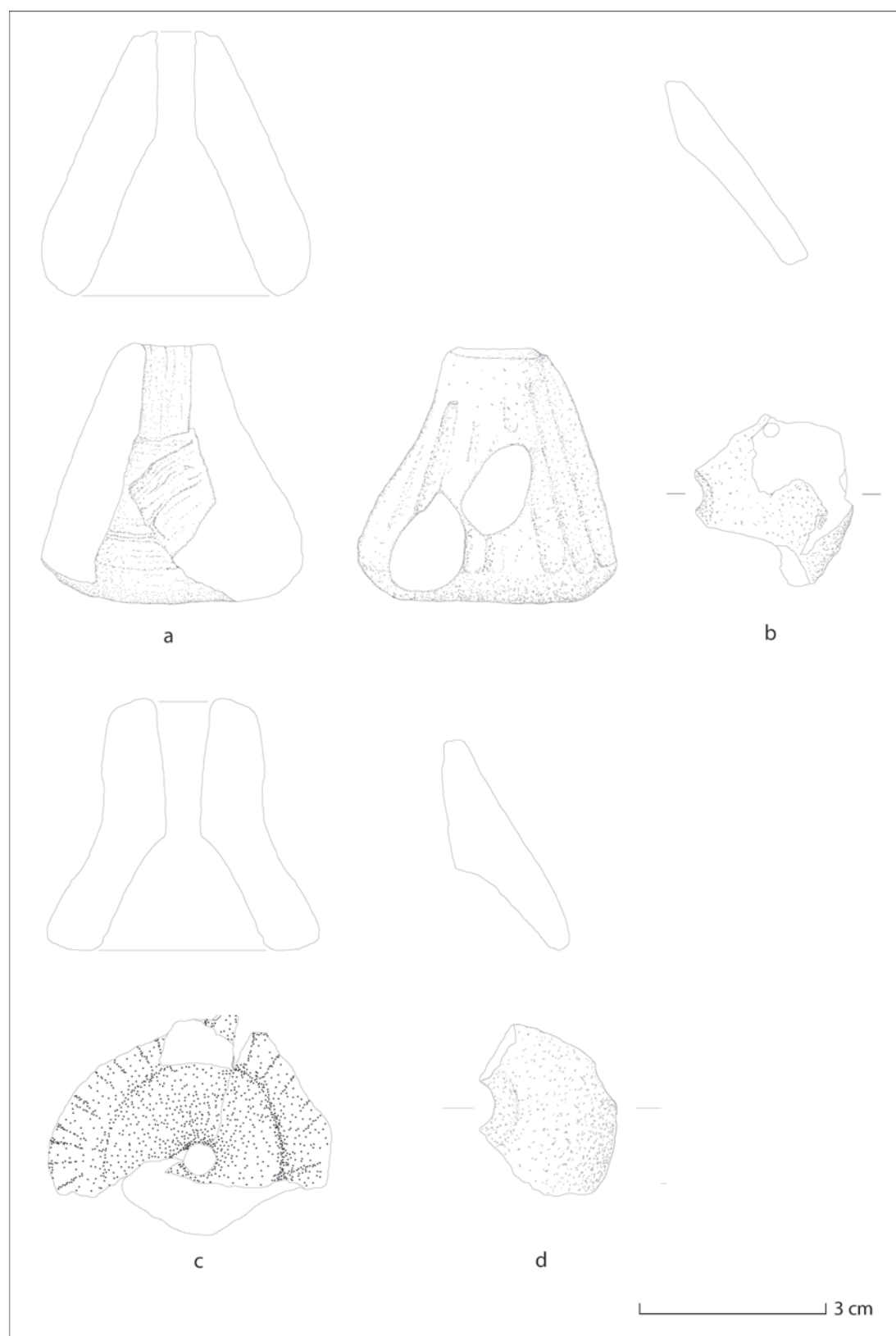
### Spindle whorls

A relatively large number of spindle whorls was found, indicating local spinning and presumably textile production (**Table 8**). All examples are made of clay. While nearly all whorls show signs of low firing, only one has a fully oxidized core indicating that it was highly fired. Determining the shape of the spindle whorls is only possible in some cases. Nearly all were found in a fragmentary state; only about half were preserved in a condition where the complete height and the diameter could be measured. Two main shapes occur, both of which could probably be subdivided into more forms if there were a larger number of well preserved examples.






The most common form is conical (**Fig. 34**). Some of these conical whorls have a concave base,



**Fig. 34**  
 Monjukli Depe. Conical  
 spindle whorls. — a  
 RN 1026 (A7);  
 b RN 3232 (B68, Stra-  
 tum II); c RN 1017 (A4);  
 d RN 3067 (B23, Stra-  
 tum II); e RN 1056  
 (A16); f RN 5253 (C25,  
 Stratum III); g RN 1230  
 (A57); h RN 1191 (A52,  
 Stratum I)



**Fig. 35**  
 Monjukli Depe. Spindle whorls with bell- or funnel-shaped base. – a RN 52 (SF11); b RN 5167 (C35, Stratum III); c RN 41 (SF10); d RN 1177 (A1)

RN	Shape	Color	Preservation	Weight (g)	Height/base diameter/top diameter
1055	peg-shaped	buff	fragmentary	7	2.04/–/–
1055		buff	complete	5.9	2.06/1.90/1.02-1.07
1055		buff	complete	9.4	2.51/2.19/1.34
1138		buff	complete	11	2.77/1.73-1.81/1.42-1.62
3275		brown	complete	0.8	0.93/0.85-1.01
5041		buff	fragmentary	0.5	1.16/1.5/–

**Tab. 9**  
Monjukli Depe. Shaped  
clay objects – tokens

while others rest on a more or less flat base. Their height varies from 1.84 cm to a maximum of 3.05 cm, while the base diameter varies from 1.5 to 3.4 cm. In most cases, the perforation was made after forming the whorl, either from the bottom or the top. However, some examples lack these kinds of perforation traces, indicating that they may have been formed around a stick. Only three whorls had evidence of decoration in the form of a colored wash.

The second type is also conical in shape, but it is characterized by a bell-shaped hollow base (**Fig. 35**). Examples of this type can be described as funnel-shaped when viewed from the bottom. They are larger than the plain conical whorls, varying from 3.65 to 4.27 cm in height and 4.00 to 4.72 cm in maximum diameter. On the inside of one whorl, rough production traces are visible that indicate that the bell-shaped hollow was carved out after the whorl was formed. Probably they were formed initially as larger versions of the plain conical whorls and afterwards carved or at least thinned into their funnel shape. Few show decorations, but at least one example of this type has incised lines on the edge of the base. Another piece exhibits parallel, shallow vertical impressions on the outside, which could, however, have come from scraping the exterior into shape.

Although there seems to be no single standard for producing the whorls of either type, they all follow a similar system in terms of proportions. Every one of the better preserved examples has a diameter that is greater than its height. The ratio of

base diameter to height varies from 1.03:1 to 1.27:1, with one piece as an exception.

Very similar spindle whorls can be found in many sites of this period in Turkmenistan, including Anau North,<sup>106</sup> Čakmakli Depe<sup>107</sup> and in the upper level of Monjukli Depe<sup>108</sup> excavated by Berdiev in 1961. In comparison to other Anau 1A sites, plain conical-shaped whorls were particularly frequently found at Monjukli Depe. This might indicate that the plain conical type is an earlier form, given the results of the radiocarbon dating,<sup>109</sup> however, this possibility can only be evaluated once further work has been conducted at the site.

## Tokens

Six small, shaped clay objects that might be tokens were recovered (**Table 9**). One is pyramidal, one a broken cylinder, and four are peg-shaped. Their surfaces are roughly smoothed. Except for one that was probably lightly baked, they all seem to be unfired. They may have functioned as tokens, that is, mnemonic devices.<sup>110</sup> However, a usage as labrets, in other words a form of body ornamentation, is also possible.

<sup>106</sup> Hiebert/Kurbansakhatov 2003, 83–84, 87–88.

<sup>107</sup> Бердыев 1968, 26.

<sup>108</sup> Бердыев 1972, 26.

<sup>109</sup> See “Dating”, this report.

<sup>110</sup> Schmandt-Besserat 1992.



### Shaped clay

Several objects were found that can be referred to simply as “shaped clay.” Under this rubric, a variety of shapes, including oblong, cylindrical and pinched, occurs. Most of the pieces are fragmentary. They are usually unbaked but some show signs of exposure to heat. At least one piece came directly out of an oven context, whereas in most other cases it cannot be said if the exposure to heat was intentional or not. Several show finger-prints or smoothing lines on their surface. In general, these objects vary too much to assign a single function to them. Some might be parts of figurines, but a larger body of material would be necessary in order to support this interpretation.

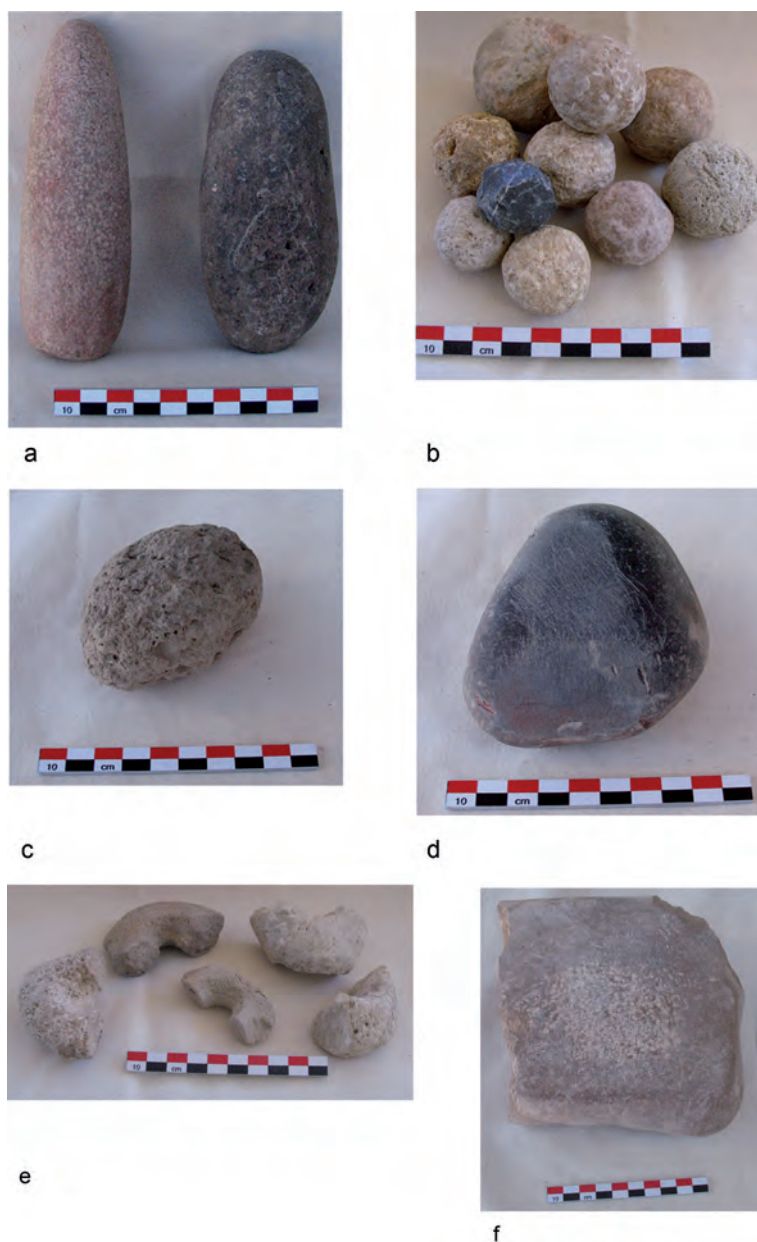
### Ground Stone

In contrast to the small quantities of pottery and chipped stone, ground stone tools from the site are numerous and varied. In addition to grinding slabs and handstones (Fig. 36), there are pestles and mortars for pounding, perforated stones perhaps used as weights (Fig. 37; for example, for looms), small stone balls that may have been used as sling pellets or as small grinders or pounders, and stone bowls of various sizes (Fig. 37). A hard limestone was generally the preferred material, whereas the frequently occurring sandstone, washed down in wadis from the Kopet Dag, was more rarely shaped into tools. Hard, black, fist-sized pebbles were used for polishing.

### Perforated stones

Seven perforated stones were found (Table 10). All are fragmentary, but comparisons with the small finds from the earlier Berdiev excavation indicate that they were likely ring-shaped with a perforation in the middle that was drilled from both sides. Apart from the drilled hole the stone usually seems to be unworked, indicating that naturally occurring stones with the right size were selected for perforating. The hole must have been drilled with a round tip, based on observations on the perforations, which have the form of a double truncated cone. The usage of these artifacts as weights is most likely.



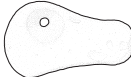




In addition to the perforated stone rings, one long pounder with a perforation was found (A16, RN 1053). The hole was made off center at the broader end of the stone. The narrower end shows heavy use wear. Apart from the perforation, no link can be drawn to the other perforated objects.



### Stone balls

A number of more or less spherical objects made of limestone were found (Fig. 36b). They vary in size from approximately 2.65 to 4.75 cm in diameter (Table 11). Nearly all of them are whitish in color, but some are made of more porous stone than others. No discrete weight categories can be discerned. Apart from a categorization of the stone balls as sling balls or similar weapons, which could be suggested because of their relatively uniform

**Fig. 36**  
Monjukli Depe. Ground stone tools. – a pestles (RN 3101, B37 and RN 3181.2, B54, both Stratum II); b stone balls; c handstone (RN 1244, A59, Stratum I); d handstone (RN 3222, B67, Stratum II); e perforated stones; f grinding slab (RN 1198, A54, Stratum I)

RN	Shape	Preservation	Color	Length/ width/ thickness (cm)	Diameter/ hole diameter (cm)	Weight (g)	Use-wear	Drilling
60		half	white	5.90/2.8/ 1.87	–/1.59	32.3		
1025		half	white	5.85/4.43/ 3.3	–1.19	88.6		hole drilled from both sides
1053		complete	white to tan	8.91/3.04- 5.21/2.86	–/0.49-0.56	147.1	narrow end battered from pounding	hole drilled from both sides
1190		half	white to tan	–/–/–	7/1.2	69.6		hole drilled from both sides
3000		half	white to tan	–/–/2.29- 2.94	7/1.09	100.8		hole drilled from both sides
3048		half	white	7.03/4.42/ 3.58	–/1.09	110.2		hole drilled from both sides
3110		broken crosswise as well as on two ends	white	7.75/6.05/ 2.1	–/–	73		

**Tab. 10**  
Monjukli Depe. Perforated stones (drawings not to scale)

RN	Unit-locus	Diameter (cm)	Weight (g)	Color
1054	A16	3.75-3.94	76.8	white
1076	A26	3.35-3.73	62.1	white
1157.1	A41	2.74-3.17	39.5	white
1157.2	A41	2.30-3.16	24.2	white
1232	A58	2.66-2.76	22.5	gray
1260	A63	3.36-3.79	52.8	white
3059	B20	3.06-3.46	47.8	white
3246	B72	2.42-2.88	25.3	white
230.1	fill Maruščenko trench	4.31-5.18	100	white
230.2	fill Maruščenko trench	3.0-3.69	35.2	white

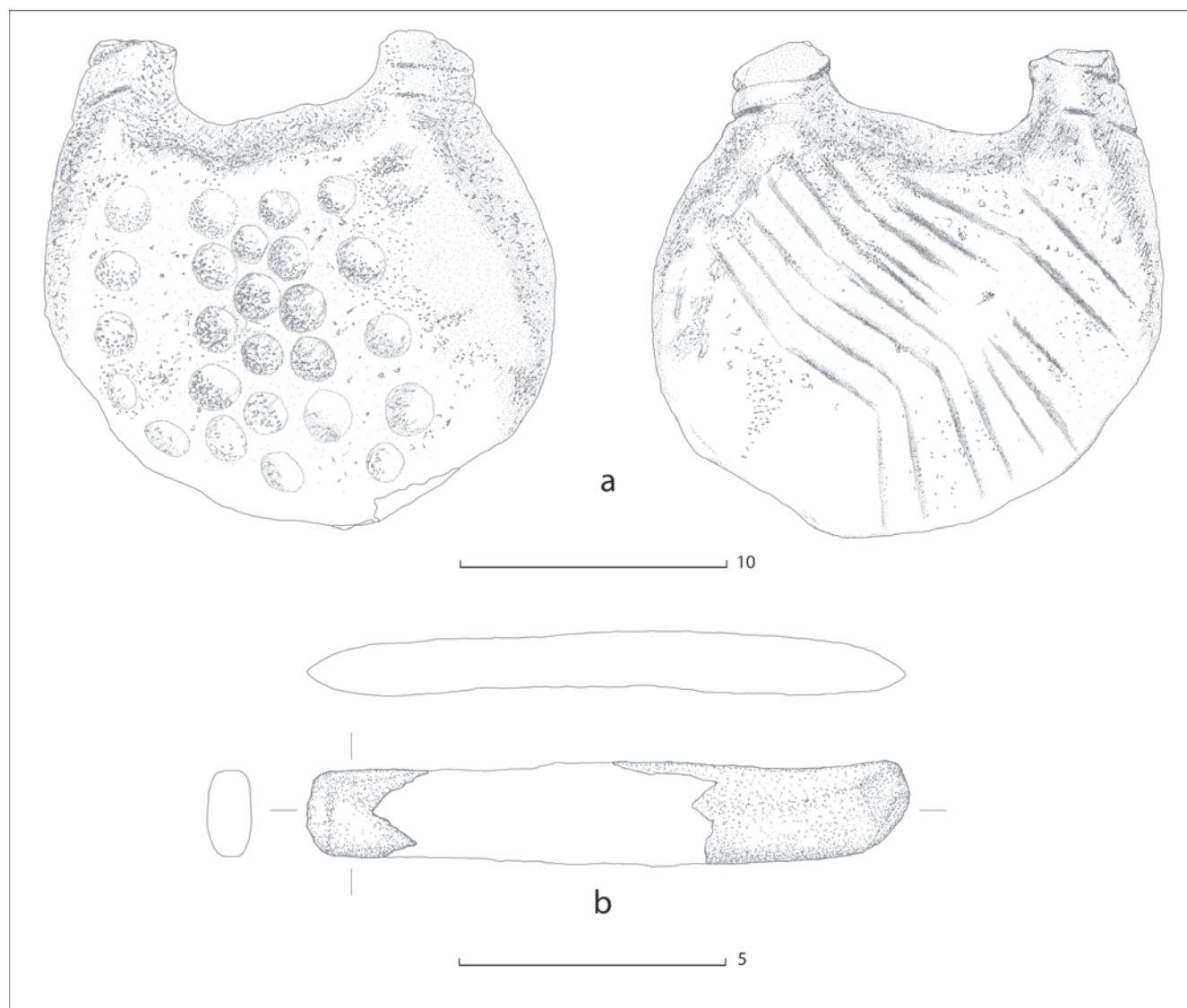
**Tab. 11**  
Monjukli Depe.  
Stone balls

size and shape, there is no indication of how they might have been used.

#### Other worked stone

A number of other stone objects that do not fit into any of the above-mentioned groups were also recovered. Among these are three stone vessel fragments. One was from a miniature stone bowl with a rounded base and thick round rim. The approximate diameter of 5 cm would have permitted the bowl to hold only small quantities. The second fragment is part of a large vessel with a thick ledge-like rim, with an approximate diameter of 21 cm. The third piece is a body sherd; the shape of the vessel is not identifiable.

A unique stone object, RN 1255 (A61), is more or less hemispherical in plan view, with a thick lenticular cross-section and two broken projections (**Fig. 37a**). One surface is covered with shallow round dimpled impressions of approxi-



mately 1.1 to 1.4 cm in diameter. The other surface is incised with a herringbone pattern, with lines of about five cm in length. Two incised lines occur around the circumference of each projection and join to form a 'V'. The object is approximately 18 to 20 cm in diameter and weighs approximately 3 kg. It was most likely a weight. Taken together, the shape, the impressions and especially the incisions may have been meant to depict an animal. Similar objects, but without incised decoration, were found in somewhat later contexts at Anau North,<sup>111</sup> Tappe Hesār,<sup>112</sup> and Kara Depe.<sup>113</sup>

Two stone hoes were recovered, both showing heavy traces of chipping (**Fig. 38**). While one is trapezoidal in shape, with a somewhat rounded and broad working edge, the other is a slightly expanded rectangle in form. In both cases, one surface is mostly unworked with just a few large flakes removed from the working end; the other surface is more or less completely flaked. Similar hoes were published by Berdiev from Čakmakli Depe.<sup>114</sup>

Finally, a chisel or wedge was identified. It has an elongated, narrow shape, approximately 11 cm in length (**Fig. 37b**). The ends are nearly symmetrical and smoothed.

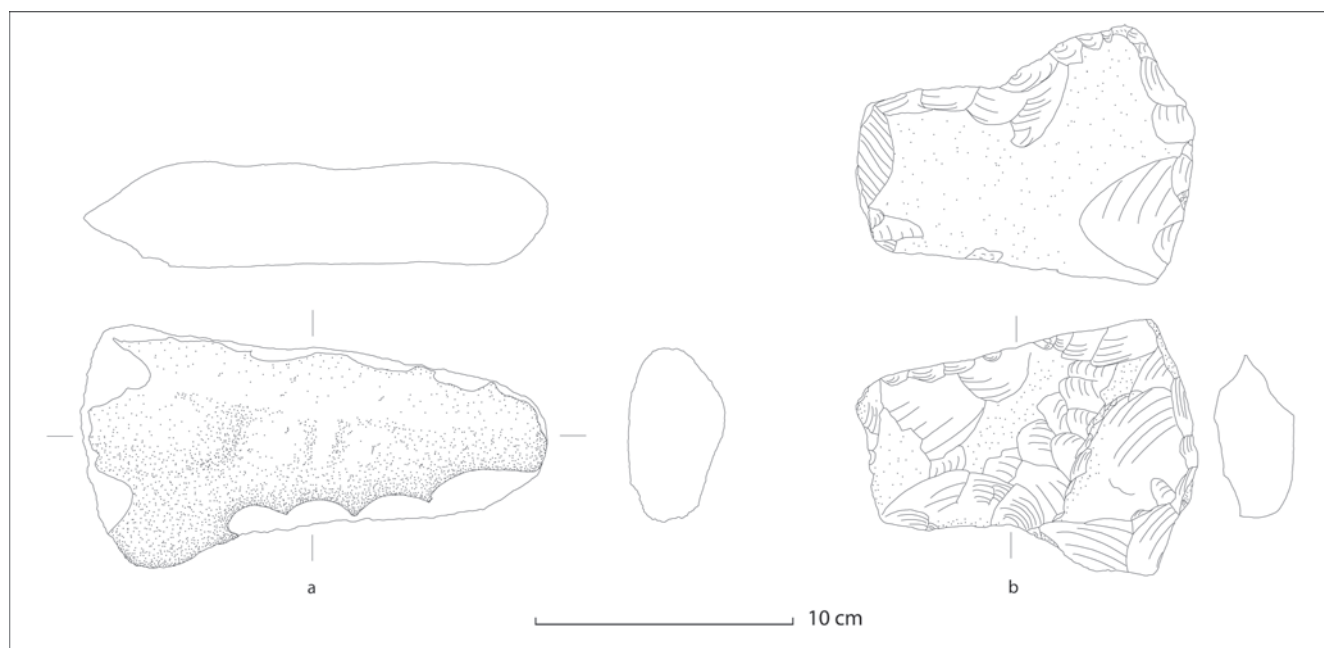
**Fig. 37**  
Monjukli Depe. Stone weight and a stone wedge or chisel. – a RN 1255 (A61, Stratum I); b RN 5126 (C33, Stratum III)

<sup>111</sup> Hiebert/Kurbansakhatov 2003, 95.

<sup>112</sup> Schmidt 1937, 81.

<sup>113</sup> Массон 1961, 451.

<sup>114</sup> Бердыев 1968, 34.



**Fig. 38**  
Monjukli Depe. Stone  
hoes. – a RN 1012  
(A3); b RN 5083 (C27,  
Stratum III)

#### Beads

A few beads made of various materials including stone, shell, bone, and clay were recovered (**Table 12**). One cylindrical bead cut from a bone has incisions

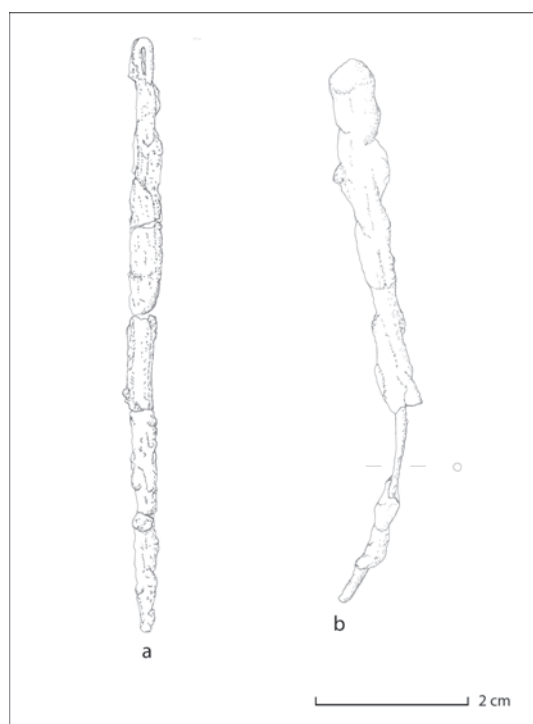
around the circumference; these incised lines do not meet at the beginning/end. A unique bead is made of lapis lazuli. It is a slightly angular tear-drop in shape, pierced through the narrow end, and polished. This bead is an indication of exchange activities on the part of the Monjukli inhabitants. A comparable bead was found at Anau North.<sup>115</sup>

#### Copper objects

The only metal objects recovered in the 2010 season were two copper needles or pins, one complete and the other broken into six fragments (**Fig. 39**). Both are heavily corroded, but a metal core is still visible in one. The broken one has a turned over end that produced an eyelet. It was likely a sewing tool; alternatively, these objects could have been pins used as part of the clothing. Similar copper pins were found at Anau North<sup>116</sup> and in Berdiev's excavations at Monjukli Depe.<sup>117</sup>

#### Bone objects

Two bone awls were recovered. One has an irregular crescent shape and is flat in section. The end is worked to a dull point. The other awl is elongated



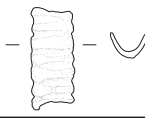
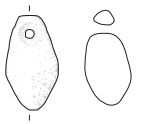
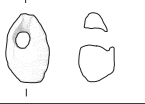


**Fig. 39**  
Monjukli Depe. Copper  
pins or needles. –  
a RN 3284 (B78,  
Stratum III); b RN 235  
(Unit D profile)

<sup>115</sup> Hiebert/Kurbansakhatov 2003, 86.

<sup>116</sup> Hiebert/Kurbansakhatov 2003, 89.

<sup>117</sup> Бердыев 1972, 26.



RN	Shape	Material	Color	Decoration	Length/width/ thickness (cm)	Diameter/ hole diameter (cm)	Weight (g)
163		bone	brown	incisions around circumference	1.46/–/–	0.56/–	0.2
3043	cylindrical	stone; very crumbly, perhaps burnt	white		0.75/–/–	0.5/0.28	0.5
3216		lapis lazuli	blue	finely ground/ polished	1.37/0.5-0.74/ 0.25-0.63	–/0.1	0.9
5237		shell	brown and white striped		0.99/0.64/0.51	–/0.24	0.3
5290		clay	buff	traces of red paint/wash		0.53–0.60/0.05	<0.1
5392		stone	gray		–/–/0.14-0.18	0.53/0.23	<0.1

**Tab. 12**  
Monjukli Depe. Beads  
(drawings not to scale)

and has a triangular shape in plan view with well smoothed edges (**Fig. 40b**). They were most likely used for perforating or working leather or similar materials.

Three other bone objects are round to oval in plan view and flat in cross-section (**Fig. 40a; 41**). They are made from the pelvis of large animals, probably cattle based on their size of approximately 10 cm in diameter. The objects were worked into shape. All of them have a perforation more or less in the middle that was an enlargement of a naturally occurring hole. The edges of the perforations show traces of burning. No specific use for these objects has been ascertained as of yet.

#### Burnt stone

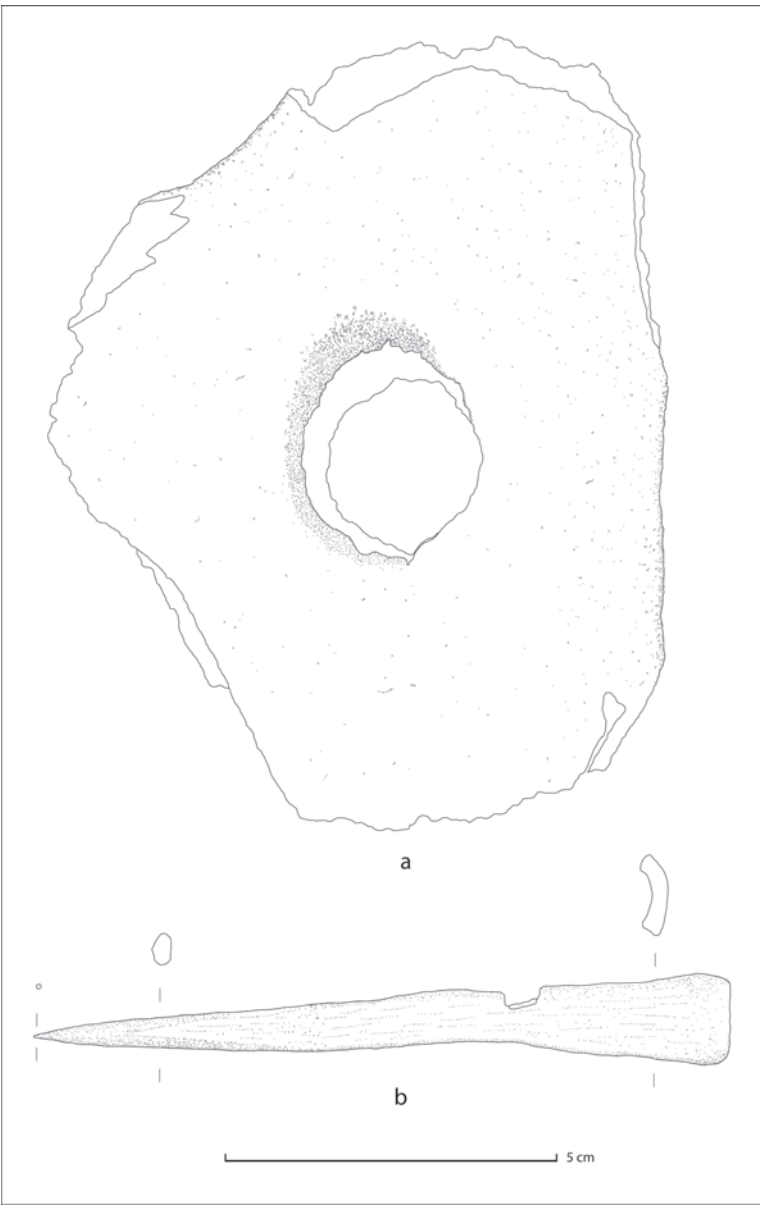
Among the common finds at Monjukli Depe are burnt stones. They occur in a variety of sizes but tend to be slightly larger than a fist. Almost all Aeneolithic contexts at Monjukli Depe contain substantial quantities of such stones, and we conclude that they were used in indirect forms of cooking<sup>118</sup> and perhaps also to heat indoor spaces. The absence of sooting traces on Anau IA pottery is a

further indication that cooking did not usually involve placing pots directly over a fire. The density of burnt stone is much lower in Džejtun levels,

Animal group Species	Neolithic		Aeneolithic	
	Count	Weight (g)	Count	Weight (g)
Domestic animals				
sheep/goat	188	360	1784	6280
(out of the above, sheep)	(1)	(1)	(14)	(116)
(out of the above, goat)	(2)	(2)	(8)	(80)
cattle	2	15	30	891
dog	1	1	4	4
Domestic/wild animals				
sheep ( <i>Ovis</i> sp.)	–	–	9	148
pig ( <i>Sus</i> sp.)	–	–	2	8
Wild animals				
half-ass ( <i>Equus hemionus</i> )	3	49	26	1161
gazelle ( <i>Gazella subgutturosa</i> )	1	1	14	52
fox ( <i>Vulpes</i> sp.)	1	1	2	2
hare ( <i>Lepus tolai</i> )	–	–	1	1
lion/leopard ( <i>Panthera</i> sp.)	–	–	1	25
crane ( <i>Grus</i> sp.)/stork ( <i>Ciconia</i> sp.)	–	–	1	5
carp (Cyprinidae indet.)	–	–	1	1
turtle ( <i>Testudo</i> sp.)	–	–	6	6
unidentified fragments	1010	985	3619	3661

**Tab. 13**  
Monjukli Depe. List of the identified taxa with count and weight (in grams) by time period

<sup>118</sup> Dittmann 1990.



**Fig. 40**  
Monjukli Depe. Bone  
objects, including an  
awl and a piece made  
out of a pelvis. –  
a RN 3142 (B47,  
Stratum II); –  
b RN 1160  
(A49, Stratum I)

although it remains to be established whether this is due to the particular contexts so far excavated or to a different way of cooking food in Neolithic times.

**Archaeozoological investigations**

by Norbert Benecke

The 2010 excavations at Monjukli Depe recovered not only artifacts such as ceramics and chipped stone but also animal bones and teeth. The animal remains were collected with great care by means of sieving as

well as by hand in the course of excavation. For this report the collections from undisturbed, stratified contexts dating to the Neolithic and Aeneolithic periods have been studied. In total, this selected sample consists of 6706 pieces, of which 1206 derive from Neolithic and 5500 from Aeneolithic contexts.

Overall the faunal material from Monjukli Depe can be characterized as butchery and food remains discarded by the former inhabitants of the settlement. In particular, the high degree of fragmentation of the bones as well as the occurrence of hacking and cut-marks point to this conclusion. The bones are for the most part well preserved. They are yellowish-brown in color and mostly have a firm consistency. A small proportion of the faunal remains (6%) shows traces of burning.

The material is comprised of remains of mammals, birds, fish and reptiles. Out of the total of 6706 pieces, 2077 or 31% could be taxonomically identified. The majority of the identifiable bones belongs to the family of mammals (**Table 13**). Within this group the small ruminants, sheep and goat, dominate, with over 90% of the total; this is the case both in collections from Neolithic and Aeneolithic levels. In both periods the inhabitants apparently relied predominantly on these two species for their animal-based subsistence. Based on the identifiable bones, sheep were somewhat more common in the herds than goats. The distribution of skeletal elements indicates that all parts of the skeleton are present in the material, but not in proportion to the normal distribution within the animal skeleton (**Fig. 42**). The vertebrae, ribs and pelvis are strongly underrepresented. Because of their low density, these are the elements that generally are more quickly subject to destruction through factors such as trampling or redeposition due to construction activities. Their low frequency in the material

Criterion	Age	Count
Premolars in wear	1–2 months	2
M1 erupting	3–4 months	1
M1 in wear	5–8 months	13
M2 erupting	9–11 months	1
M2 in wear	12–17 months	4
M3 erupting	18–24 months	3
permanent dentition, M3-abrasion:		
weak-moderate	over 2 years	20
moderately strong	over 2 years	3

**Tab. 14**  
Monjukli Depe. Age of slaughter of sheep/goat, based on mandibles from the Aeneolithic levels

studied is thus attributable primarily to taphonomic factors.

The age at slaughter of 47 sheep/goat mandibles from Aeneolithic contexts could be determined (Table 14). Of these 17 derive from juveniles (up to 11 months old), seven from subadults (12–24 months), and 23 from adult animals (over two years old). At present, sex determinations are lacking, making conclusions regarding secondary usage (for example, for milk) impossible. Especially noteworthy is the high proportion of animals aged five to eight months. This may be an indication of fall and winter butchery. Such a practice was necessary in order to regulate herd size and/or deal with the limited availability of animal fodder in winter.

In addition to sheep and goat, cattle is also represented in the assemblage of domestic animals from Monjukli Depe. Only a few bones and teeth of cattle are present. This speaks for a limited significance of cattle in the meat intake of residents at the site. Two bones can be attributed to pig. It is not possible to determine whether these are from domestic or wild pig. The faunal material from future seasons will show whether pig was among the animals raised locally or if the inhabitants hunted wild boar. A few bones of dog complete the assemblage of domestic animals.

In total, 49 bones of wild animals could be identified. The most common species is the half-ass, followed by goitered gazelle, fox, hare, and a large cat. In addition, some of the large sheep bones may derive from wild sheep. The question of whether wild sheep was actually part of the game regularly hunted by Monjukli residents can only be answered when there is a larger sample. Birds are represented by a single bone of a crane or stork. Another unique find is a fish belonging to the group of carp. In addition, there are a few pieces of land turtles. The small quantity of bones from wild animals in comparison to domestic species points to a limited use of such natural resources for subsistence purposes. Apparently the cultivation of crops and raising of animals contributed a sufficient and stable subsistence basis for the settlement's inhabitants.

The wild animals attested in the bone assemblage, especially the half-ass and goitered gazelle, point to a steppic and semi-arid landscape in the surroundings of Monjukli Depe. The presence of crane or stork could be an indication that moist areas were present at least periodically.

### The faunal assemblage: depositional and postdepositional processes

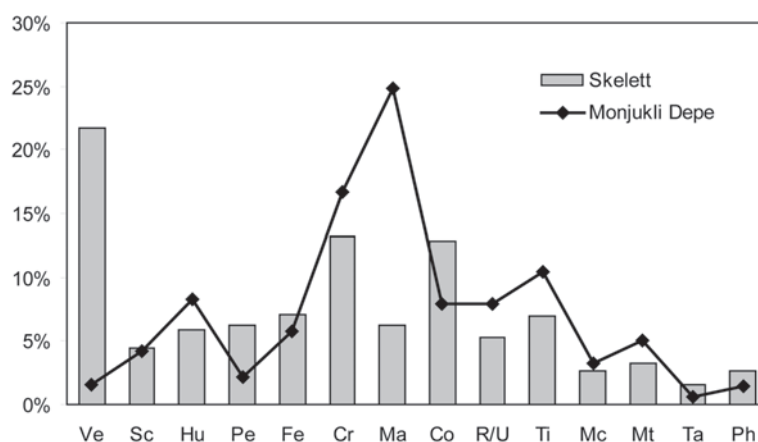
by Jana Eger

The following analysis examines the contexts in which animal bone occurs at Monjukli Depe, with

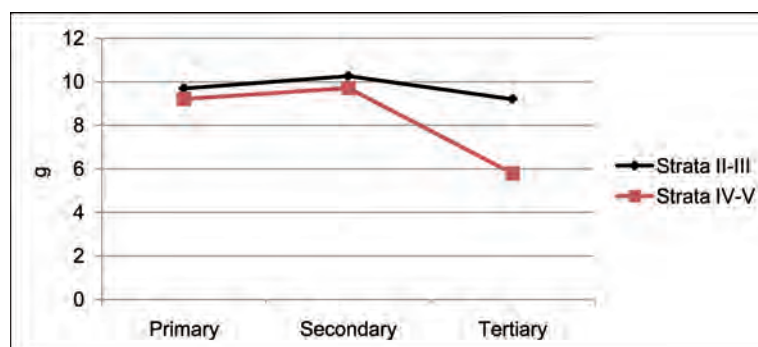


**Fig. 41**  
Monjukli Depe. Bone objects made out of animal pelvises (RN 3142 and 3289, B47, Stratum II)

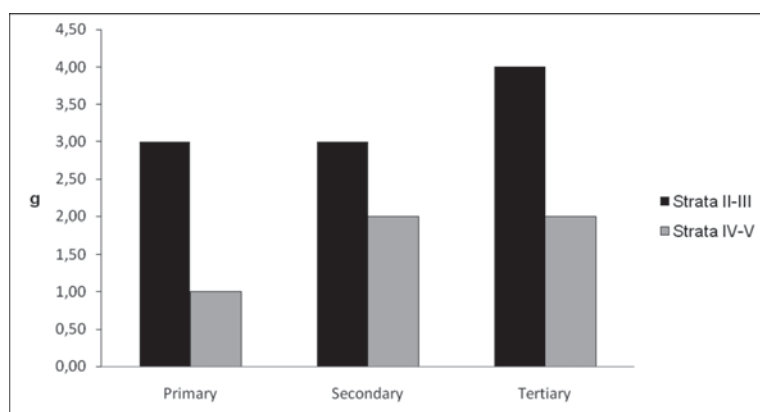
the goal of an assessment of stratum-specific taphonomic conditions. The average bone weight of identified animal bones per context at Monjukli Depe provides some information on the deposi-



**Fig. 42**  
Monjukli Depe. Proportion by weight of the various bones of a modern sheep skeleton with the superimposed proportion of sheep/goat bones by weight at Monjukli Depe (Ve – Vertebrae, Sc – Scapula, Hu – Humerus, Pe – Pelvis, Fe – Femur, Cr – Cranium, Ma – Mandibula, Co – Costae, R/U – Radius/Ulna, Ti – Tibia, Mc – Metacarpus, Mt – Metatarsus, Ta – Tarsalia, Ph – Phalanges)



**Fig. 43**  
Monjukli Depe. Mean bone weight (g) per context type



**Fig. 44**  
Monjukli Depe. Median  
bone weight (g) per  
context type

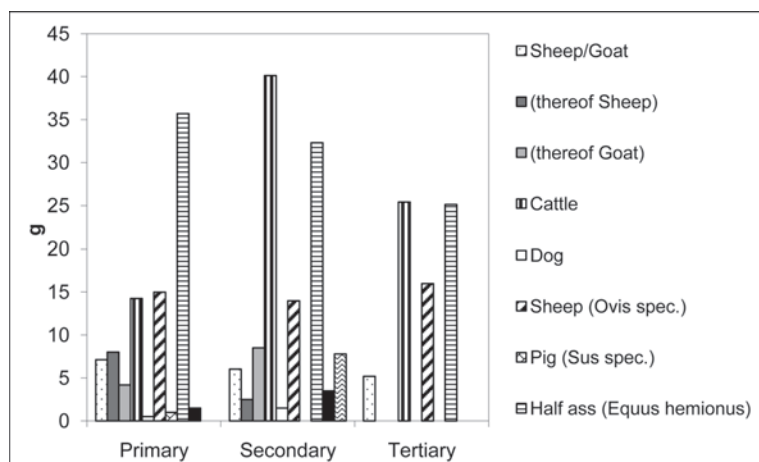
tional environment. Because of the scarcity of most other categories of finds, a close analysis of animal bones is one of the few means to assess taphonomic conditions in general.

The average bone weight (Fig. 43) is divided into the Aeneolithic period (Meana horizon: Strata II and III), and the Neolithic period (Džejtun horizon: Strata IV and V), with the overall values for primary, secondary and tertiary contexts plotted.<sup>119</sup> In both periods the highest mean bone weight is in secondary contexts (10.3 g/bone for Strata II–III and 9.7 g for Strata IV–V, respectively), followed closely by primary contexts. Thus, deposits such as surfaces, floors and fills of bins display quite similar depositional conditions in the two phases. Only tertiary contexts display a marked difference, with approximately 9.2 g/bone for Strata II–III and approximately 5.8 g for Strata IV–V. These values indicate much

greater post-depositional fragmentation in the Neolithic than in the Aeneolithic Meana horizon.

Average weight values for bone assemblages are prone to outlier effects. Therefore, we also calculated median values of bone weight (Fig. 44). Interestingly, they result in a relatively consistent set of data. In the Meana phase primary and secondary contexts have the same median value, whereas tertiary contexts display a somewhat higher value. In the Neolithic context secondary and tertiary contexts have the same median, which is somewhat greater than for primary contexts. Normally, one would expect that tertiary and primary contexts tend to display lower weight values than secondary contexts, as the latter are those where untreated refuse is deposited. In particular, large bones would likely have been removed from primary living contexts such as floors and installations. The relative consistency between primary and secondary context values in the Monjukli Depe median bone weights can be due to one of two processes: either primary contexts were just as quickly covered as secondary ones, so that depositional events must have happened fairly quickly, or secondary contexts contain faunal assemblages that are as heavily reworked as those from primary contexts. The latter are typically trampled and crushed into small pieces, at least when they derive from surfaces. For tertiary contexts, weight values are less easily predictable.

The lower median bone size in the Džejtun Strata IV–V is probably due to the nature of the excavated contexts. Well-preserved architecture, installations and floors were discovered in the Aeneolithic strata, while only faint surfaces with limited clusters of artifacts, including bones, were documented for the Neolithic levels.



**Fig. 45**  
Monjukli Depe. Mean  
species weight per con-  
text type in Strata II–III

<sup>119</sup> The analyses include only well-defined archaeological contexts. Animal bones from contexts that are marked as unclear, mixed, or have potential intrusive material are not considered here. See discussion of types of contexts in the section “Excavation methods”.

#### Species richness per context

Domestic animals such as sheep, goat, cattle and dog, animals that may be domestic or wild species such as *Ovis* and *Sus*, together with wild animals such as half-ass, goitered gazelle and lion/leopard have been identified among the faunal remains at the site.<sup>120</sup> It is remarkable that a large variety of species is identifiable in the primary and secondary contexts of Strata II–III, while the tertiary contexts from these strata contain merely four species (Fig. 45). One reason for this might be sample size: the sample of identifiable species in primary contexts is 527, for secondary contexts it is 610, but for tertiary contexts merely 114 bones.

<sup>120</sup> Fox (*Vulpes* sp.), tortoise (*Testudo* sp.) and rodent were not considered due to their mean bone weight of less than 0.5 g.



It is of interest that mean bone weight of most species is similar for primary and secondary contexts, which reconfirms the evaluation of the combined contexts based on median bone weight. There is one exception to this pattern of similarity between primary and secondary contexts: the mean weight of cattle bone in secondary contexts is more than double the value in primary ones. It will be useful to investigate a larger sample to see whether carcasses of cattle were treated differently from other animals in the Meana horizon at Monjukli Depe.

In Strata IV–V the richness of animal species increases as one moves from primary to tertiary contexts (Fig. 46) and thus the relationship between context type and species richness in the Neolithic Džejtun horizon is the opposite of that in Meana horizon levels. In tertiary contexts, domestic animals (sheep/goat, cattle and dog) are present as well as wild animals such as half-ass, goitered gazelle and fox. This is again, however, due to sample size. Whereas tertiary contexts contain 103 bones, in primary contexts there are only 14 bones. More material is clearly needed in order to reach firmer conclusions.

As noted in the discussion of the faunal remains, a considerable number of sheep/goat mandibles could be assigned to age categories. The spatial distribution of mandibles of juvenile, subadult and adult animals shows little variation when examined by excavation unit. This suggests that, at present, there is no indication of differential use of animals of different ages in the excavated parts of the site.

## Preliminary archaeobotanical results

by Naomi F. Miller

Eleven flotation samples were analyzed for this report.<sup>121</sup> The samples chosen for this first round of analysis represent all the excavated strata: one sample from the earliest level reached in Unit D, two from Stratum V, four from Strata II–III, and two from Stratum I. Two mixed samples were inadvertently selected for analysis as well. Table 15 contains the data from the 11 samples analyzed, while Table 16 displays sample-by-sample calculations of data grouped by general category.

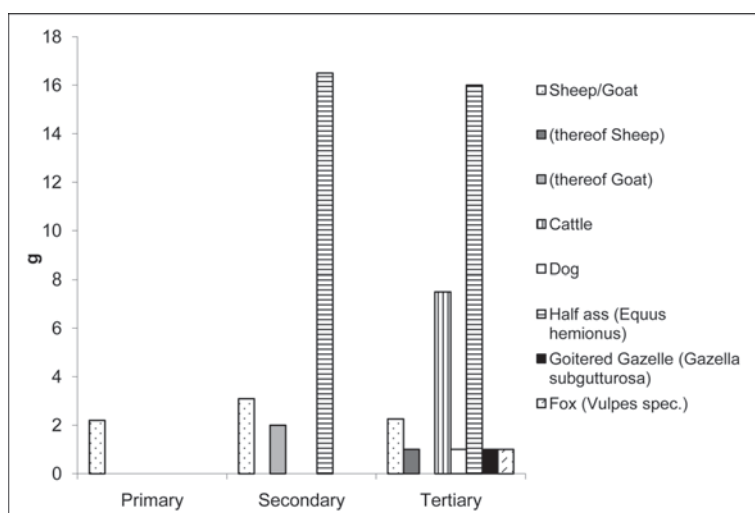


Fig. 46  
Monjukli Depe. Mean species weight per context type in Strata IV–V

Flotation was carried out in the field by the excavation team. Average sample size for the 50 samples was approximately 4.5 liters.<sup>122</sup> No burnt buildings were encountered, but there were several burnt deposits. The charred plant remains most likely represent the incomplete combustion of fuel or other occupation debris.

## The plants<sup>123</sup>

### Food plants

*Hordeum vulgare* subsp. *hexastichum*: Six-row barley occurs throughout the sequence. The grains tend to be plump, similar to those found at Anau North,<sup>124</sup> but many are distorted and puffed from burning. Average weight of the whole grains is equivalent to 0.5 g/100 grains. In two-row barley, each internode has one fertile (i.e., seed-bearing) floret and two sterile ones. Six-row barley has three fertile florets per internode. The central grains of both types are straight. In the six-row type, the lateral grains are twisted, but this characteristic is not always clear in charred material. At Monjukli Depe, some barley grains are twisted, but the identification as six-row barley rests primarily on the fact that the well-preserved identifiable internodes have three robust pedicels, characteristic of the six-row type. There were also a number of compact barley rachis fragments, which suggests that a second

<sup>122</sup> The average would be 3.9 liters if the one 34-liter sample were excluded.

<sup>123</sup> Preliminary sorting and identification took place in the archaeobotanical laboratory facilities of the (DAI) Deutsches Archäologisches Institut. The sorting protocol followed Miller 2010, Appendix A.

<sup>124</sup> Miller 2003, 130.

<sup>121</sup> Funding for the work was provided in the context of a TOPOI Senior Fellowship through the invitation of Dr. Susan Pollock. During my stay in Berlin in May 2011, Dr. Reinder Neef generously provided laboratory space and occasional consultation on identifications at the Deutsches Archäologisches Institut.

Stratum	indet	V	V	II–III	II–III	II–III	II–III	I	I	mixed	mixed
RN	165	5335	5325	3087	5221	5145	5157	1097	1217	3151	3272
Soil volume (ltr)	1.2	3.8	4.5	4.8	4	6.75	4.9	5.8	5.3	3	4.9
Sample volume, cc	1	25	10	25	50	120	70	20	25	75	120
Charcoal, g, >2 mm	0	2.69	3.15	6.48	0.4	18.11	11.72	3.74	1.71	5.01	11.95
Seed, g, >2 mm	0	0.07	0.05	+	1.12	0.01	0.02	0.01	0.13	0.71	0.93
Misc, g, >2 mm	0	+	+	0	0.18	0	0.01	+	0	0.57	0.69
Number wild	12	35	18	2	32	2	89	44	85	403	867
<i>Hordeum vulgare</i> , g		0.03	0.04		0.04		0.01	0.02	0.21	0.18	0.19
<i>Triticum aestivum</i> , g					0.31	0.01			0.03	0.44	0.34
<i>T. monococcum</i> , g	0.01	0.03	0.03					0.02			0.02
<i>Triticum</i> sp., g		0.03	0.02	+	0.33		0.01	0.01	0.01		0.19
Cereal indet., g		0.01	0.05		0.56	0.02	+	0.04	0.12	0.10	0.20
<i>Elaeagnus</i> , g											0.02
<i>Linum</i>											2
<i>Vitis</i>									2		
Nutshell, g								+			
cf. Asteraceae					1					1	
<i>Asperugo</i>										1	
<i>Heliotropium</i>		1							2	3	5
<i>Euclidium syriacum</i>				1	12		4	1	1	117	259
Brassicaceae	2	2						11	1	6	28
<i>Salsola</i> kali-type		2									
<i>Suaeda</i>		2	3				1				
Chenopodiaceae?						1	55	3	16	40	42
Convolvulaceae										1	
<i>Scirpus</i>					1						
Cyperaceae							1			15	9
<i>Alhagi</i> cf						1	10				
<i>Astragalus</i>		3								8	20
<i>Astragalus</i> /Trigonella					1						
<i>Trigonella</i>		1	1					8	4	9	17
Fabaceae (small)			2	1			14		8	7	77
Lamiaceae											2
<i>Aegilops</i>	3	2						2		8	1
<i>Eremopyrum</i>		3	3								
<i>Hordeum spontaneum</i> -type									1		

Tab. 15

Stratum	indet	V	V	II–III	II–III	II–III	II–III	I	I	mixed	mixed
RN	165	5335	5325	3087	5221	5145	5157	1097	1217	3151	3272
<i>Poa bulbosa</i> , bulblet											7
Triticoid							1			1	6
Poaceae, indet.	7	16	6		16			1	8	31	51
<i>Ceratocephalus</i>								1		3	5
<i>Consolida</i> (MD unk 1)											1
<i>Galium</i>							1			1	2
<i>Veronica</i>					1			11	1	79	261
cf. <i>Hyoscyamus</i>										1	
Unknown		3	3				2	6	43	71	74
Plant parts											
Siliqua (linear)											2
<i>Alhagi</i> pod segment?				1			3				
<i>Aegilops</i> glume base					1				1	10	5
<i>Hordeum</i> (6-row) internode	3	3	7		4				9	352	370
<i>Hordeum</i> misc. internode	2	11			15			1	31	27	59
<i>Hordeum</i> , spike base					2					7	1
<i>Hordeum</i> , compact internode		3	4					2	7	56	82
<i>Hordeum</i> , wild		17							1		
<i>Triticum aestivum</i> internode	1			2	727		1	2	4	898	1324
<i>T. aestivum</i> internode tips					318						302
<i>T. aestivum</i> , spike base					27					60	77
<i>T. monococcum</i> spikelet fork		47	13								3?
<i>T. monococcum</i> / <i>dicoccum</i> spikelet fork	17	73	33		2		1				
straw nodes								3		26	
straw, g										0.08	
glumes, g		0.04			+					0.03	0.02
MD Poaceae plant part 1			1		5					8	6
MD Poaceae plant part 2					1						
<i>Tamarix</i> twiglet											1
Other items											
<i>Asperugo</i> (uncharred)										1	
dung pellet (#)										8	5
dung pellet (wt, g)										0.81	0.26
dung frag (wt, g)										0.83	1.59
insect, charred										1	2
larva, charred										2	

**Tab. 15**  
Monjukli Depe. Contents of the macrobotanical samples analyzed

Stratum	indet	V	V	II–III	II–III	II–III	II–III	I	I	mixed	mixed
RN	165	5335	5325	3087	5221	5145	5157	1097	1217	3151	3272
Unit-locus	D42	C80	C78	B37	C47	C36	C39	A36	A56	B50	B77
Context	surface	surface	fill	over surface	storage location	oven fill	surface, interior	burnt bin	burnt layer	burnt deposit	burnt deposit
		C3b	C3b	B1A	C2d	C2c	C2c	A1A	A1B		
Soil volume (liters)	1.2	3.8	4.5	4.8	4	6.75	4.9	5.8	5.3	3	4.9
Sample volume, cc	1	25	10	25	50	120	70	20	25	75	120
Charcoal, g, >2 mm	0	2.69	3.15	6.48	0.4	18.11	11.72	3.74	1.71	5.01	11.95
Seed, g, >2 mm	0	0.07	0.05	+	1.12	0.01	0.02	0.01	0.13	0.71	0.93
Misc, g, >2 mm	0	+	+	0	0.18	0	0.01	+	0	0.57	0.69
Number wild (includes <i>Euclidium</i> )	12	35	18	2	32	2	89	44	85	403	867
Density charred (g/liter)	0.00	0.73	0.71	1.35	0.43	2.68	2.40	0.65	0.35	2.10	2.77
seed:charcoal (g/g)	n/c	0.03	0.02	+	2.80	0	0	0	0.08	0.14	0.08
wild:cereal (#/g)	1200	350	129	n/c	26	67	4450	489	230	560	922
<i>T. aestivum</i> , est. grain/internode (#/#)					0.06	n/c			1.50	0.10	0.04
<i>T. monococcum</i> , est. grain/sf	0.08	0.04	0.09					n/c			0.95
<i>Hordeum</i> , est grain/int.		1.20	0.47		0.38		n/c	4.00	1.05	0.08	0.07

**Tab. 16**  
Monjukli Depe. Macro-  
botanical data: ratios  
calculated on a sample-  
by-sample basis.

variety of barley was also grown. Some internodes and internode fragments were too poorly preserved to be sure that they are the six-row type and are therefore referred to as *Hordeum* misc. There were a few basal spikes of barley (see discussion below).

*Triticum aestivum*: *T. aestivum* (bread wheat) is a free-threshing type. With the exception of a single internode in the earliest sample, bread wheat first appears in Strata II–III. The grains are compact; one sample had a grain that was sphaeoro-coccoid. Average weight of the whole grains is equivalent to 0.5 g/100 grains. The identifiable rachis internodes of wheat are bread wheat (deciduous glume base, some with shield-shape), so it is assumed that the grain is also hexaploid bread wheat, not tetraploid durum. There were many basal spikes of bread wheat (see discussion below).

*Triticum monococcum*: *T. monococcum* is a glume wheat (the grains are tightly enclosed in the hulls). Although einkorn occurs throughout the sequence, it is much more prominent in Stratum V (both as grain and rachis fragments–spikelet forks) than in later deposits. Most of the complete spikelet forks of hulled wheat look as though they are from einkorn with parallel sides. There are no obvious emmer grains or spikelet forks, though strictly speaking the broken rachis fragments are not proven to be einkorn. The glume wheat will be treated as einkorn for purposes of this analysis.

Cereals: The bread wheat and barley rachis fragments are remarkably numerous and well-pre-

served (many still have hairs visible). In contrast, many of the bread wheat and barley grains in RN 3151 (B50), 3272 (B77), and 5221 (C47) are puffed and poorly preserved.<sup>125</sup> Experimental charring shows that six-row barley and bread wheat grains are more likely to be preserved than their associated rachis fragments.<sup>126</sup> This suggests that the grain and rachis fragments come from different sources. Further support for this idea is based on the number of preserved items. Very approximate calculations of expected numbers of seeds per ear and per internode can be made based on modern material. For six-row barley, 33–60 grains per spike (equivalent to 11–22 internodes) is not unreasonable.<sup>127</sup> For wheat, 30 grains/spike<sup>128</sup> and 8–12 internodes per spike<sup>129</sup> are plausible. **Table 17** shows that the amount of rachis material far exceeds the amount of grain one might expect if entire ears of grain were stored.

*Elaeagnus*: Part of a Russian olive pit was found in Stratum II B77 sample RN 3272. Botanically unrelated to olive (*Olea europaea*), the dried fruit of Russian olive looks a little bit like a small, red date with a very dry flesh. It is eaten locally to-

<sup>125</sup> The first two samples are from mixed contexts that may contain some modern material.

<sup>126</sup> Boardman/Jones 1990, 6.

<sup>127</sup> Eshgi et al. 2010, 522–524.

<sup>128</sup> Nerson 1980, 230–231.

<sup>129</sup> Edwards 2010, 1.



	Six-row barley (3 seeds/internode)	Bread wheat (2 seeds/internode)
Number spike bases	2	27
Internodes/spike, expected number internodes	22–44*	216–324**
Actual number internodes	19	1045
Expected number seeds	66–132 <sup>#</sup>	432–648 <sup>##</sup>
Expected number seeds (actual number internodes)	57	2090
Actual number seed equivalents	8	62

\* 11–22 internodes/spike, \*\* 8–12 internodes/spike, <sup>#</sup> spike base, <sup>##</sup> @30/spike

**Tab. 17**  
Monjukli Depe. Estimates expected and actual numbers of grains based on number of spike bases and internodes in C47 (RN 5221)

day, and I have seen it sold in markets in Iran and Turkey, but am unaware of it being found on other ancient sites. Helmut Kroll's<sup>130</sup> database contains a reference to finds of this fruit from medieval Dzhetysay, Kazakhstan, and it is part of the natural vegetation of Turkmenistan.<sup>131</sup>

*Vitis*: Two remarkably tiny grape seeds were found in Stratum I (RN 1217, A56). Ordinarily, the presence of underdeveloped grape seeds in an assemblage is indicative of domesticated grapes.<sup>132</sup> Wild grape occurs in Turkmenistan but is not common.<sup>133</sup> It seems unlikely that there would be domesticated grape at this early date (first half of the fifth millennium). By 4500 BC, grape cultivation had already spread down the Zagros beyond the natural habitat zone, but the earliest undeveloped grape seeds I am aware of date to the fourth millennium deposits at Kurban Höyük.<sup>134</sup>

*Linum*: Two poorly preserved flax seeds were found in Stratum II–III (RN 3272, B77). There are three species of wild flax in Turkmenistan,<sup>135</sup> so one should not assume flax was cultivated at Monjukli Depe.

#### Wild and weedy plants

With the possible exception of indeterminate Chenopodiaceae and *Tamarix*, the families and genera identified in the samples<sup>136</sup> are most likely from plants of open ground: some herbs and some small woody plants, some plants of disturbed ground or field weeds and some from steppe pasture.

cf. Asteraceae (*Compositae*—daisy family): Most of the members of this family are plants of open ground.

Boraginaceae (borage family): *Asperugo procumbens* is a plant of disturbed ground; only one species grows in Turkmenistan. There are many species of *Heliotropium* (heliotrope) in Turkmenistan.

Brassicaceae (*Cruciferae* – mustard family): There were at least two different unidentified types of Brassicaceae. Most of the members of this family are plants of open ground. *Euclidium syriacum* is a plant of disturbed ground; only one species grows in Turkmenistan. The silique of *E. syriacum* is indehiscent (i.e., it does not release its seeds upon ripening). Some of the siliques are intact (and would have two seeds), some are not. For purposes of this analysis, I have counted each silique as one seed.

Chenopodiaceae (goosefoot family): In Turkmenistan, the Chenopodiaceae family includes field weeds, herbaceous and woody wild plants, and trees (saxaul – *Haloxylon* spp., et al.). Two identified types, *Salsola* cf. *kali* and *Suaeda* grow near fields and in disturbed areas. A seed type with a coiled embryo is numerous but only tentatively assigned to the family.

Convolvulaceae (bindweed family): One seed reminiscent of *Convolvulus* (but very small) was encountered. The genus is very varied (from field weed to small woody steppe plant).

Cyperaceae (sedge family): The sedges tend to be plants of moist ground and stream and canal banks. One sedge seed is categorized as *Scirpus*.

Fabaceae (Leguminosae – pea/clover family): In Turkmenistan, the pea family includes field weeds, wild plants, and shrubby plants. *Alhagi* (camelthorn) seeds and pod segments are tentatively identified. *Astragalus* is a diverse genus. *Trigonella* is a clover-like plant that, at least in Anatolia, is an indicator of healthy steppe. Miscellaneous unidentified small legume seeds are numerous.

Lamiaceae (Labiatae – mint family): This diverse family is characterized by plants that have 'essential' oils.

<sup>130</sup> Kroll n. d.

<sup>131</sup> Никитин/Гельдиханов 1988, 418–419.

<sup>132</sup> Kroll 1999.

<sup>133</sup> Никитин/Гельдиханов 1988, 400.

<sup>134</sup> Miller 2008, 429.

<sup>135</sup> Никитин/Гельдиханов 1988, 378.

<sup>136</sup> Никитин/Гельдиханов 1988.

Stratum	RN	Unit-locus	Brief characterization
earliest	165	D42	small sample, but has einkorn, 6-row barley, 1 bread wheat internode [surface]
V	5335	C80	grain and rachis of 6-row barley and einkorn [surface]
V	5325	C78	grain and rachis of 6-row barley and einkorn [fill]
II–III	3087	B37	nearly all charcoal [deposit directly over surface]
II–III	3151	B50	lots of charcoal; grain and rachis of 6-row barley and bread wheat [w > b]; wild seeds; dung pellets; charred insect [burnt deposit in room]
II–III	3272	B77	lots of charcoal; grain and rachis of 6-row barley and bread wheat [w > b]; wild seeds; dung pellets; charred insect [burnt deposit in room]
II–III	5221	C47	grain and rachis of 6-row barley and bread wheat [w>b] [storage installation]
II–III	5145	C36	nearly all charcoal [oven fill]
II–III	5157	C39	nearly all charcoal [interior surface]; apparent high wild:cereal due to presence of few seeds [interior surface]
I	1097	A36	moderate charcoal density, not much seed material [burnt bin]
I	1217	A56	moderate charcoal density, relatively high seed:charcoal, but not much material [burnt layer]

**Tab. 18**  
Monjukli Depe. Summary characteristics of the macrobotanical samples

Poaceae (Gramineae – grass family): The grasses are most likely to be plants of open ground. The seeds are easy to identify to family, but only a few genera have been designated. Turkmenistan has seven species of *Aegilops* (goat-face grass), which occurs in these samples as both seed and rachis fragments. *Eremopyrum* has been seen, as has a wild barley with fairly large seed (*Hordeum spontaneum*-type). Some of the barley rachis fragments appear to have cleanly disarticulated, and so may be from wild plants. Although *Poa bulbosa* bulblets are not seeds, they are propagules for that plant, I count them in the seed category. Miscellaneous unidentified small grass seeds are numerous.

Ranunculaceae (buttercup family): Both members of the buttercup family found in these samples are plants of open ground. *Ceratocephalus* is a very short plant. Though not listed by Nikitin and Gel'dikhov,<sup>137</sup> it is endemic in Eurasia, and I have seen it growing on disturbed ground near Anau and in the Anau seed assemblage. There are seven species of *Consolida* in Turkmenistan.

Rubiaceae (bedstraw family): *Galium* is a varied genus (13 species in Turkmenistan) with sticky seeds.

Scrophulariaceae (figwort family): *Veronica* is a small herbaceous plant. Its seeds are numerous in these samples; there are 21 species in Turkmenistan. This type was mistakenly called AN Caryophyllaceae-1 at Anau North.<sup>138</sup>

Solanaceae (nightshade family): A single *Hyoscyamus* (henbane) seed has been tentatively identified.

Tamaricaceae: A single twiglet of *Tamarix* (tamarisk) was seen, with its distinctive triangular phyllodes (small leaves). Although I did not try to identify the charcoal in the flotation samples, I did notice some tamarisk (*Tamarix*) and poplar/willow (*Populus/Salix*). Dr. Reinder Neef identified charcoal in samples destined for C-14 dating; it was primarily *Tamarix*, as at Anau<sup>139</sup> and Džejtun.<sup>140</sup> This suggests that people did not have to travel far for wood, but rather exploited nearby tugai vegetation.

### The samples

The eleven samples analyzed have over 30 taxa (types), including at least five food plants, 20 wild genera, and other members of several plant families. **Table 18** provides a summary characterization for each sample. Overall, preservation is good.

The earliest sample, RN 165 from the profile of Unit D: Low density precludes any major conclusions from this one sample that dates to the Džejtun period. The bread wheat internode is unexpected (i.e. there were no grains and a few internodes of free-threshing wheat in the Džejtun samples).<sup>141</sup>

Stratum V: The two samples (RN 5325 and 5335), mostly charcoal, look like redeposited ordinary occupation debris from a settlement that was located near a source of wood (riparian or forest). There are more glume wheat spikelet forks than grains to fill them, and a moderate wild : cereal ra-

<sup>137</sup> Никитин/Гельдиханов 1988.

<sup>138</sup> Miller 2003, 132–133, Fig. 10.6F.

<sup>139</sup> See Miller 2003, 135.

<sup>140</sup> Asouti 2010, 168.

<sup>141</sup> Charles/Bogaard 2010, 256–259.

tio, further supporting the view that the material is not from burnt seed stores.

Strata II–III: Similarly to Stratum V, all samples other than RN 5221 have low seed : charcoal ratios typical of ordinary occupation debris. The contents of RN 5221, listed as a possible storage installation, is reminiscent of coarse-sieve wheat-processing debris (there are many more rachis fragments than grain to fill them (**Table 17**), most of the identified grain is wheat, not barley, the wild : cereal ratio is low).<sup>142</sup> If the feature once stored crops, one could imagine that the non-crop remains drifted to the floor as the clean wheat grains were removed for consumption. Its designation as a “possible storage installation” is consistent with the charred macroremains as well as the phytolith assemblage,<sup>143</sup> but rather than grain storage, it could represent storage of threshing byproduct. Sample RN 5145, which has the highest proportion of wood charcoal relative to seed, appears to be an *in situ* oven deposit. Sample RN 5157 is also nearly all charcoal.

Stratum I: Both samples, one from a burnt bin and one a burnt layer, had relatively low densities of material and low seed : charcoal ratios.

The two mixed samples (RN 3151 and RN 3272), which have unusually numerous grain and rachis fragments, have more typical low seed : charcoal ratios. The non-wood remains include many more bread wheat rachis internodes than bread wheat grain to fill them.

### Monjukli Depe in Context

The plant remains from Monjukli Depe are particularly interesting because they reduce the temporal gap between Neolithic Džejtun<sup>144</sup> and Chalcolithic Anau.<sup>145</sup> Although Monjukli Depe is located south-east of those sites, it is intermediary in one key spatial aspect as well: distance from the Kopet Dag (**Table 19**). Because water from precipitation as well as streams is correlated with distance from the mountains, I think it is possible that the availability of moisture for the Monjukli Depe agricultural system was greater than at Džejtun and less than or about the same as at Anau, barring major climate or other environmental shifts. Insofar as the Monjukli Depe assemblage appears intermediary, it will not always be easy to give a temporal, spatial, or temporal-spatial explanation.

	Džejtun	Monjukli Depe	Anau North
Location		lat 36.8486° long 60.4194°	lat 37.9047° long 58.5656°
Elevation	ca. 120 m	ca. 290 m	ca. 225 m
Distance from Kopet Dag	ca. 30 km	ca. 6–7 km	ca. 5 km
Precipitation	ca. 200 mm	estimate: ≤Anau	ca. 230 mm

**Table 20** provides comparative summary data for the three sites. Monjukli Depe Stratum V is roughly contemporary with Džejtun; Strata I–III pre-date the available radiocarbon determinations from Anau North. The Džejtun report provides grain counts, not weights. I have converted the weight of seeds and fragments from Monjukli Depe based on whole grains from these samples. Free-threshing wheat (*T. aestivum*) and barley (*H. vulgare*) equivalents are estimated to be 100 grain  $\approx$  0.5 g; glume wheat (*T. monococcum*) 100 grains  $\approx$  0.7 g. I have calculated the proportions of wheat and barley (grain and rachis) by adding the total numbers by phase. Effectively, this gives more statistical weight to the larger samples.<sup>146</sup> For the other ratios I use the median rather than the mean, because there is no underlying normal distribution.<sup>147</sup> The wild : cereal ratio for Džejtun is an estimate because the report does not include total seed count or weight of the cereal.

One aspect of wheat cultivation does appear to change over time: crop choice. Džejtun has glume wheats (einkorn, cf. emmer), but virtually no free-threshing wheat (bread wheat); Anau North has bread wheat, but no glume wheat. Monjukli has both, with glume wheat occurring early in the sequence and free-threshing wheat appearing later<sup>148</sup> (**Table 20**). The minor food components, Russian olive, flax, and grape, are unknown at both Džejtun and Anau North.

Barley is more drought-tolerant and more salt-tolerant than wheat. It is also more important as a fodder (both grain and leaves/straw), while wheat is more important as food (the straw is not as good for fodder as barley straw). On archaeological sites in the rainfall agriculture zone along the Euphrates, wheat declines in importance relative to barley as

**Tab. 19**  
Locations of Monjukli Depe, Džejtun and Anau North (Source for Džejtun: Harris/Limbrey 2010, 27)

<sup>142</sup> See, for example, Hillmann 1984, 410.

<sup>143</sup> See Ryan, this report.

<sup>144</sup> Charles/Bogaard 2010.

<sup>145</sup> Miller 2003.

<sup>146</sup> Miller 1988, 80–82.

<sup>147</sup> Miller 2010, 38.

<sup>148</sup> One of the unexpected discoveries at Džejtun was einkorn. Although einkorn was one of the first domesticates, it is a plant that prefers a cool climate and is more likely to be grown in the rainfall agriculture zone (see Zohary/Hopf 1994). On phytogeographical and genetic grounds, it appears that bread wheat was probably domesticated southwest of the Caspian Sea around 6000 BC (Zohary/Hopf 1994, 52), i.e., at the time of Džejtun. Bread wheat is commonly irrigated in regions too arid for dry-farming.

**Tab. 20**  
Summary of macrobotanical data comparing Monjukli Depe, Anau North and Džejtun. Numbers in parentheses are weights used to calculate number of grains (Sources: Džejtun: Charles/Bogaard 2010; Anau: Miller 2003)

	Džejtun	MD V	MD I–III	Anau IA, L. 19, 20	Anau IB, L. 5–18
Number flotation samples	39	2	6	10	27
Glume wheat # (wt.)	595	8 (0.06)	4 (0.02)	0	0
Free-threshing wheat # (wt.)	0	0	64 (0.45)	16 (0.08)	46 (0.23)
Wheat indet. # (wt.)	0	16 (0.11)	52 (0.36)	0	6 (0.03)
Barley # (wt.)	103	14 (0.07)	56 (0.28)	96 (0.48)	596 (2.48) outlier: 2.14
% wheat identified to type (relative to barley)	85	57	55	46	27*
% wheat including <i>Triticum</i> sp. (relative to barley)	85	61	68	46	32*
Median seed:charcoal (g/g)	no data	0.03	0.00	0.0041 (+)	0.0045 (+)
Median wild:cereal (#/g)	300 [est.]	240	230** [n = 5]	713	400
% glume wheat grain vs. all identified wheat grain	100	100	6	0	0
% glume wheat internode vs. all identified wheat internodes	99.9	100	+	0	0
Glume wheat grain: spikelet fork	0.07	0.05	1.33	none	none
Free-threshing wheat grain: internode	n/c	n/c	0.09	0.42	+
Barley grain: barley internode	2.86	0.50	0.93	0.56	0.27*

\* If outlier sample is included, % wheat is reduced to 8 or 9%; *Hordeum* grain/internode to 2.34

\*\* Excludes RN 3087, which has virtually no measurable cereal remains

one goes from the moister north to the more arid south. Shifts in the proportions of wheat and barley are also associated with the pastoral economy, as reflected in proportions of sheep and goat relative to cattle and pig, as well as the wild: cereal ratio (pasture vs. foddering).<sup>149</sup> In the Turkmenistan samples wheat is most important in the oldest and (climatically) driest site and declines over time and perhaps with increasing moisture. My thought is that wheat proportions reflect dependence on irrigation (i.e., as long as you are irrigating, you might just as well grow food rather than fodder; the moister regions can risk using less irrigation, so barley becomes a more secure crop than wheat). There are too many variables and too few samples to make any definitive statement, however.

**Table 21** lists the most common wild and weedy types at the three sites. Ubiquity is not useful for Monjukli Depe Stratum V, as only two samples were examined. Some wild types occur only at Džejtun or only at Anau. Four types present at Monjukli Depe (*Alhagi*, *Veronica*, *Euclidium*, and *Ceratocephalus*) are not listed among the Džejtun common types ( $\geq 16\%$  ubiquity for Monjukli,  $\geq 10\%$  for

Džejtun). Except for a few *Eremopyrum*, all genera found at Monjukli Depe also occur at Anau. I have spent little time trying to identify grasses, which might account for relatively few grasses identified to the genus level for Anau and Monjukli Depe compared to Džejtun. Overall one can say that the weed seed assemblages of the three sites are similar, which may simply reflect the fact that the taxa represent plants of disturbed ground and irrigated fields, rather than “natural” steppe vegetation.

#### Summary of most important conclusions

- Wheat (einkorn [*Triticum monococcum*] in Stratum V and bread wheat [*T. aestivum*] in Strata II–III and I) is the most important cultigen.
- These macroremain results are consistent with the phytolith results (i.e., more wheat than barley; irrigation was practiced).
- Six-row barley (*Hordeum vulgare* var. *vulgare*) occurs throughout the sequence.
- Monjukli Depe is chronologically intermediary between Džejtun and Anau, and also may be agriculturally intermediary (in terms of moisture availability). Its assemblage is intermediary between Džejtun and Anau in two respects: it shows a

<sup>149</sup> Miller 1997; Miller 2010, 70.



	Džejtun	MD V	MD I–III	Anau 1A L. 19, 20	Anau IB L. 5–18
Number of samples	39	2	6	10	27
<i>Asparagus</i>	23	.	.	.	.
<i>Centaurea</i>	15	.	.	.	.
cf. <i>Artemisia</i>	.	.	.	20	4
<i>Heliotropium</i>	26	✓	16	90	37
<i>Alyssum</i>	44	.	.	.	11
<i>Euclidium</i>	.	.	83	70	33
<i>Capparis</i>	82	.	.	30	11
<i>Atriplex</i> fruit	.	.	.	10	.
<i>Chenopodium</i>	18	.	.	.	.
<i>Salsola</i>	.	.	.	40	37
<i>Suaeda</i>	13	✓	16	.	11
<i>Scirpus</i>	72	.	16	.	7
<i>Alhagi</i> & pod	.	.	50	10	4
<i>Astragalus</i>	.	✓	50	20	15
<i>Astragalus/Trigonella</i>	85	.	.	.	.
<i>Trigonella</i>	.	✓	33	80	48
<i>Melilotus/Trifolium</i>	36		.	10	11
<i>Erodium</i>	15	.	.	.	.
<i>Aegilops</i>	87	✓	16	70	15
<i>Aegilops</i> glume base	82	.	33	70	33
<i>Aeluropus</i>	87	.	.	.	.
<i>Bromus</i>	72	.	.	.	.
<i>Eremopyrum</i>	56	✓	.	.	.
<i>Hordeum murinum</i>	.	.	.	40	7
<i>Phleum/Eragrostis</i>	.	.	.	10	11
<i>Phragmites</i> culm	13	.	.	.	4
<i>Stipagrostis</i>	36	.	.	.	.
<i>Polygonum</i>	23	.	.	.	.
<i>Ceratocephalus</i>	.	.	16	10	7
<i>Adonis</i>	.	.	.	60	11
<i>Galium</i>	38	.	16	30	22
<i>Veronica</i>	.	.	50	40	4

**Tab. 21**  
Monjukli Depe. Percent ubiquity of wild plants identified at least to genus that occur in at least 10% of samples (16% for MD I–III)

transition from mostly einkorn to mostly bread wheat, and the wheat to barley ratio is lower than at Anau and higher than at Džejtun.

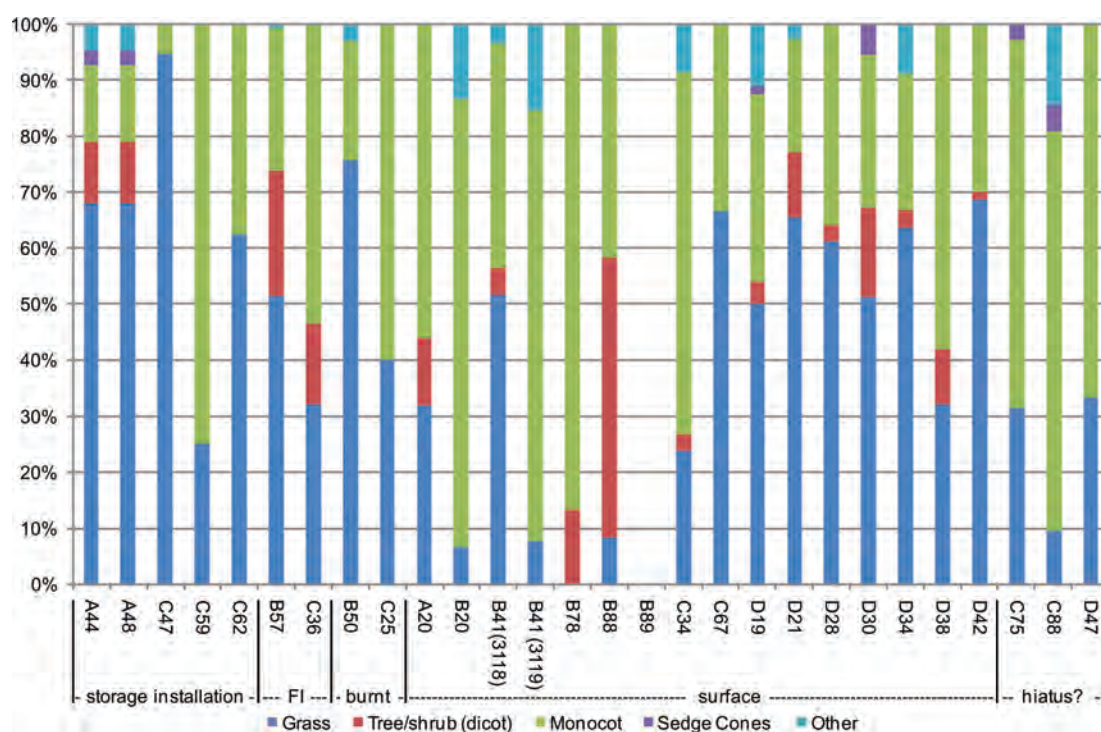
- Despite some changes and differences across time and space, the tugai–irrigation based agricultural niche characterized the subsistence economy of Turkmenistan from the Džejtun to the Anau IA periods.

## Phytolith analysis

by Philippa Ryan

Sediment samples were processed for phytolith content (microbotanical remains) from different types of archaeological contexts, including storage pits, hearths and floors. The plant evidence from

**Fig. 47**  
Monjukli Depe. Relative  
abundance of grass single-cell  
phytoliths,  
grouped by context  
category



these types of archaeological features can help to investigate the kinds of plants used for food and fuel as well as to provide a general picture of the types of plants that were present in the surrounding environment. In addition, the distribution of phytoliths can potentially help to consider the locations of plant-based activities, such as cereal processing, as well as to provide information about crop-processing practices, such as whether cereals were stored in their husks, whether crops were cleaned of weedy grasses prior to storage, and evidence of irrigation.

Phytoliths are plant-cell microfossils, formed when soluble silica  $\text{Si}(\text{OH})_4$  is taken up by plants in groundwater and deposited in certain intracellular or extra-cellular locations.<sup>150</sup> Rates of phytolith production, as well as the degree of taxonomic information they can provide, vary between plant taxa. The largest quantities of phytoliths are produced by grasses and sedges, and in contrast much lower numbers are produced by trees and shrubs.<sup>151</sup> Phytoliths are released into sediments when plants are burnt or decay and so, although providing less taxonomic information than charred macrobotanical remains, survive in both charred and non-charred locations. As a result, studies of phytoliths can more frequently investigate locations

of plant-based activities. In certain environmental conditions, such as aridity and greater water availability, areas of epidermal tissue can become silicified, creating multicellular 'silica-skeletons'.<sup>152</sup> The impact of growing conditions on silica-skeleton formation allows the size of cereal silica skeletons to potentially act as an indicator of irrigation.<sup>153</sup>

## Methods

Phytoliths were extracted in a series of laboratory processes to remove carbonates, clays and organic material following methods outlined by Rosen.<sup>154</sup> Phytoliths were mounted onto slides and analyzed at  $400\times$  magnification. Approximately 300 single cell and 100 multicell phytoliths per slide were counted. The numbers per gram of sediment and percentage values of individual morphologies were calculated. It can be useful to compare relative abundances (%) of phytolith types, rather than absolute counts, when a wide range of archaeological contexts or sediments are studied because of variable phytolith densities. When comparing percentage values the single and multicell record is considered separately.

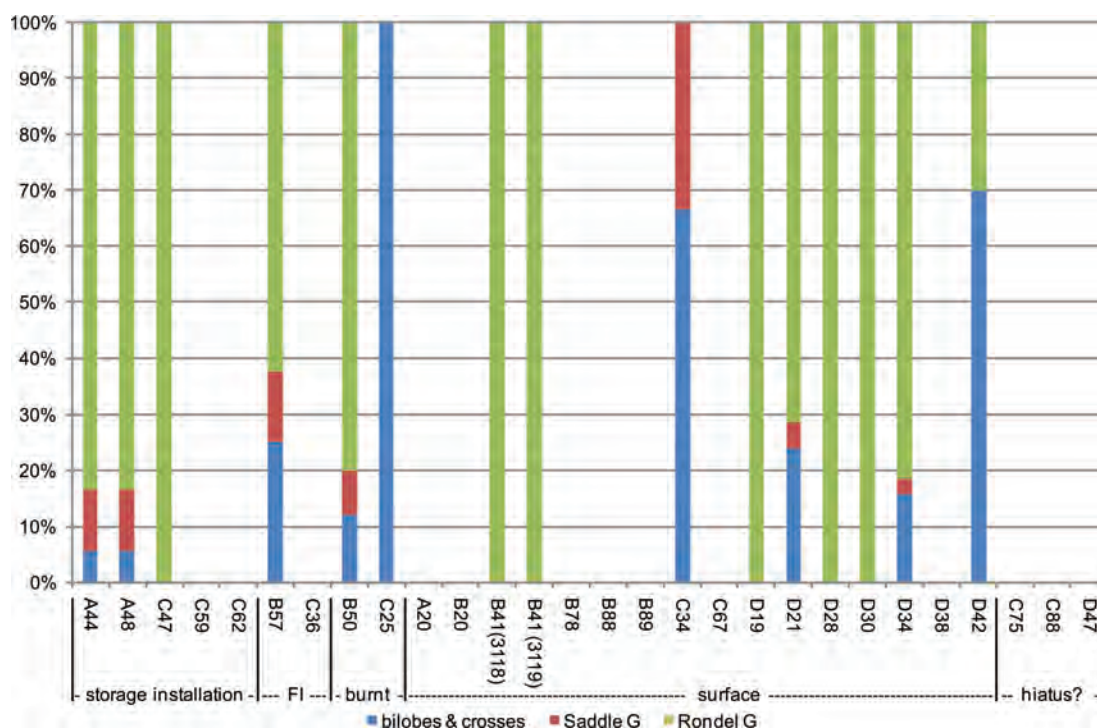
<sup>150</sup> Piperno 2006, 5.

<sup>151</sup> Albert/Weiner 2001, 265.

<sup>152</sup> Rosen 1992, 129.

<sup>153</sup> Rosen/Weiner 1994.

<sup>154</sup> Rosen 2005, 204.



**Fig. 48**  
Monjukli Depe. Relative abundance of grass short cells, grouped by context category

### Phytoliths present

Data on phytoliths present within samples analyzed, and phytolith densities within sediments are available on the Monjukli Depe website.<sup>155</sup> There is variation in quantities of phytoliths present within sediments, with many samples having <1% phytolith content, while other contexts – in particular storage context C47 – have higher densities.

### Phytolith single-cells

The relative abundances of different categories of grass single cells are compared in **Fig. 47**. Phytoliths present are predominantly from grasses, with moderate amounts from trees/shrubs and small quantities from sedges (Cyperaceae). The morphologies recorded as monocot are found in both grasses and sedges, and since only a small quantity of sedge cone phytoliths are present, it is likely that many of the monocot long-cells are from grasses. Proportions of phytoliths from trees and shrubs vary between being absent in some samples, present in moderate proportions in many of

the samples, and present to the greatest extent in B88. Several samples have a low diversity of phytolith morphologies present, and these are generally those with negligible phytolith content.

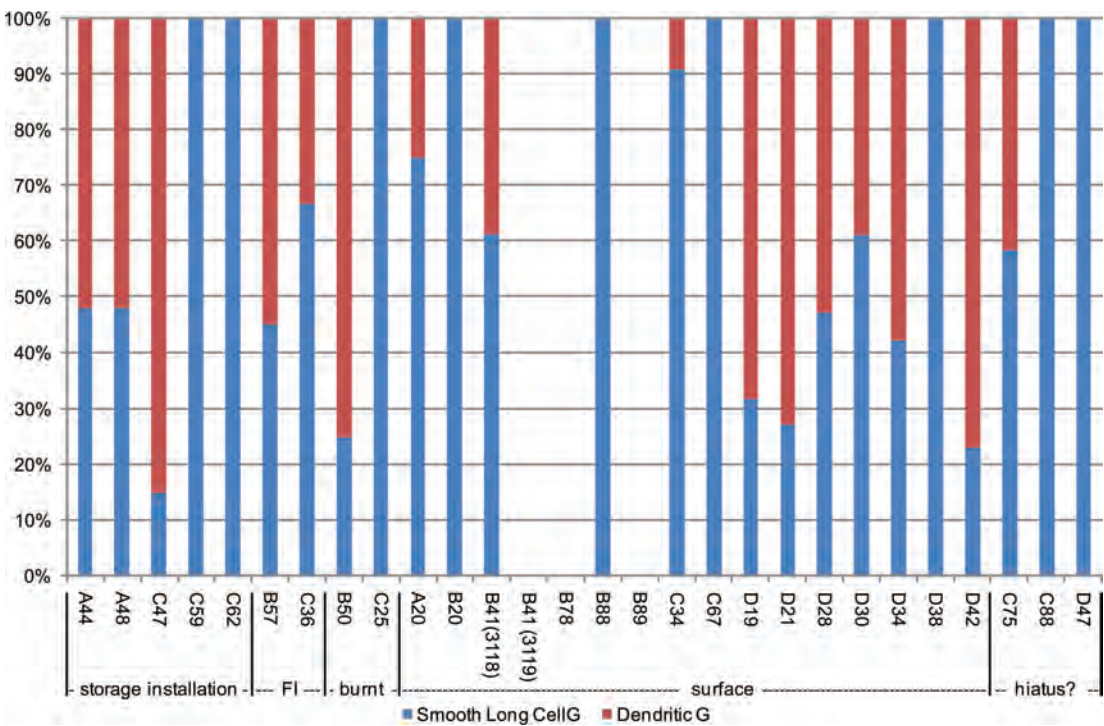
The proportions of different grass short cells, which can provide information about the categories of grass sub-families present, are compared in **Fig. 48**. It is clear that rondels, from Pooid  $C_3$  grasses (which include wheat and barley) are generally present in the greatest proportions. There are smaller amounts of bilobes from Panicoid  $C_3/C_4$  grasses and saddle forms (found mainly in Chloridoid  $C_4$  grasses, but also within *Phragmites* reeds  $C_3$ ). Two samples (C25, C34) contain only bilobes, crosses and saddles. In general, Pooid grasses are associated with temperate environments or high altitudes, the  $C_4$  grasses with hotter dryer climates, with Chloridoid grasses more adapted to semi-arid conditions, and Panicoid grasses to areas with water availability, although there is also variability between individual genera.<sup>156</sup>

The relative proportions of dendritic long-cells from grass husks to smooth long-cells, mainly found within grass stems, are compared in **Fig. 49**. In several contexts dendritics are present in higher

<sup>155</sup> <http://www.monjukli.net>

<sup>156</sup> Twiss 1992, 113.

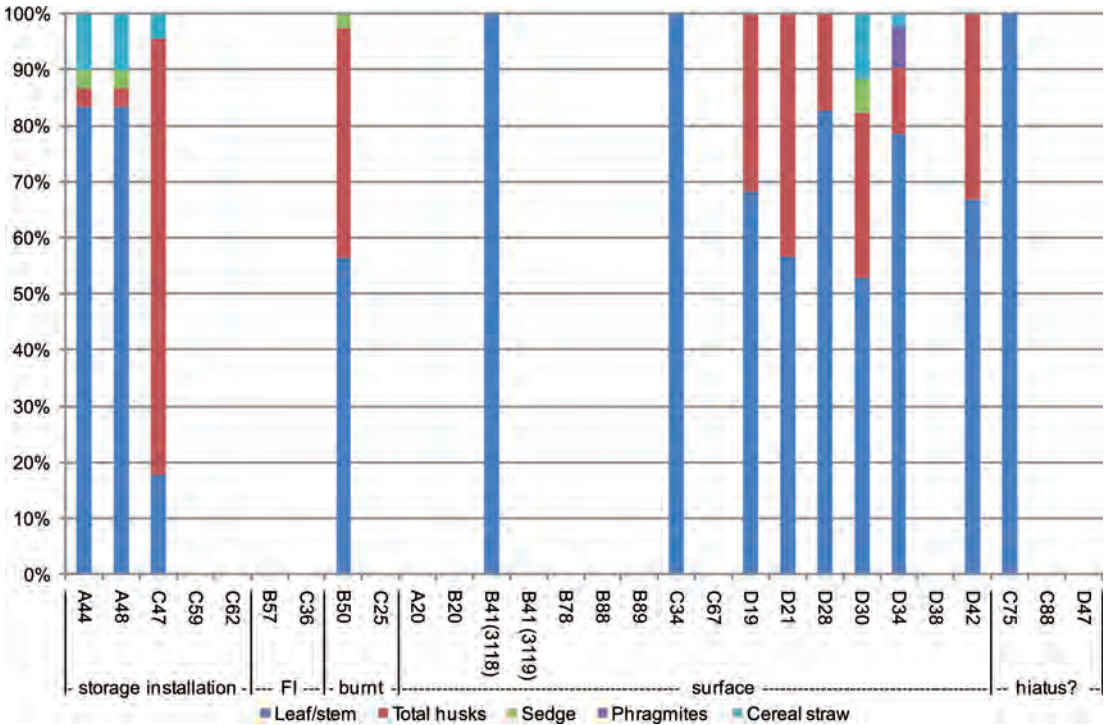
**Fig. 49**  
Monjukli Depe. Relative abundance of smooth and dendritic long cells from grasses, grouped by context category



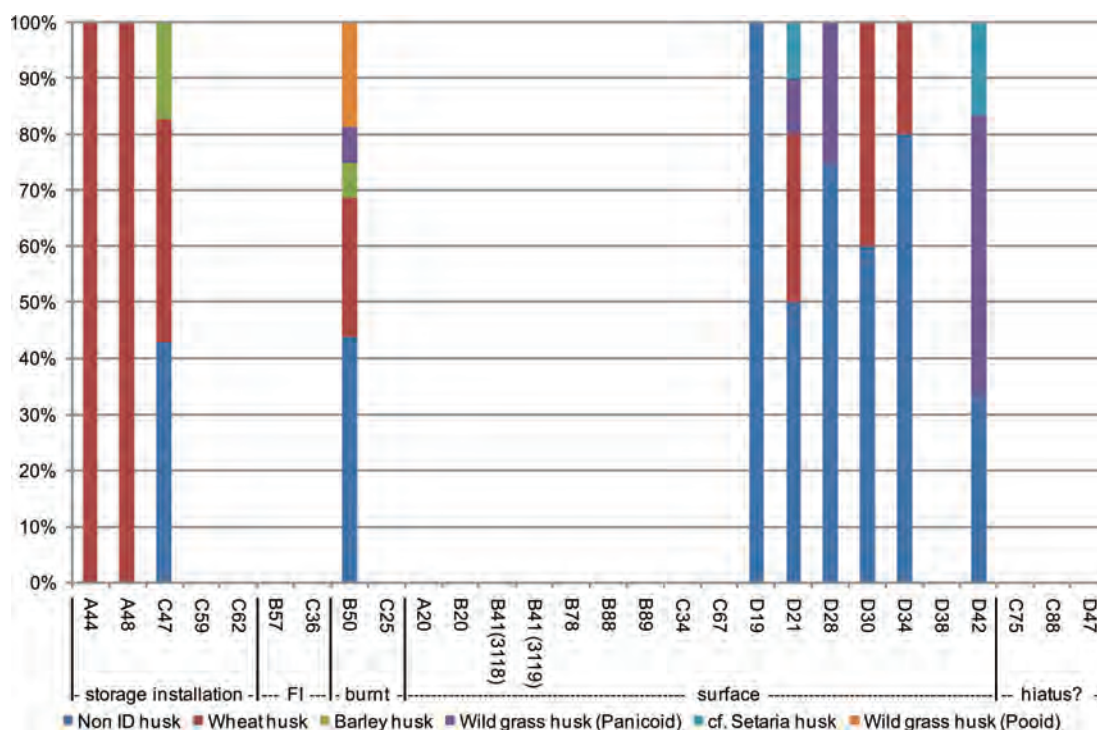
proportions than smooth long-cells. There are high proportions of dendritics in storage contexts, particularly C47. There is also a contrast between sur-

faces with and without high proportions of dendritics, suggesting some possible locations of grass-seed processing.

**Fig. 50**  
Monjukli Depe. Relative abundance of multi-cell phytoliths present, grouped by context category







**Fig. 51**  
Monjukli Depe. Relative abundance of grass husk phytoliths, grouped by context category

### Phytolith multicells

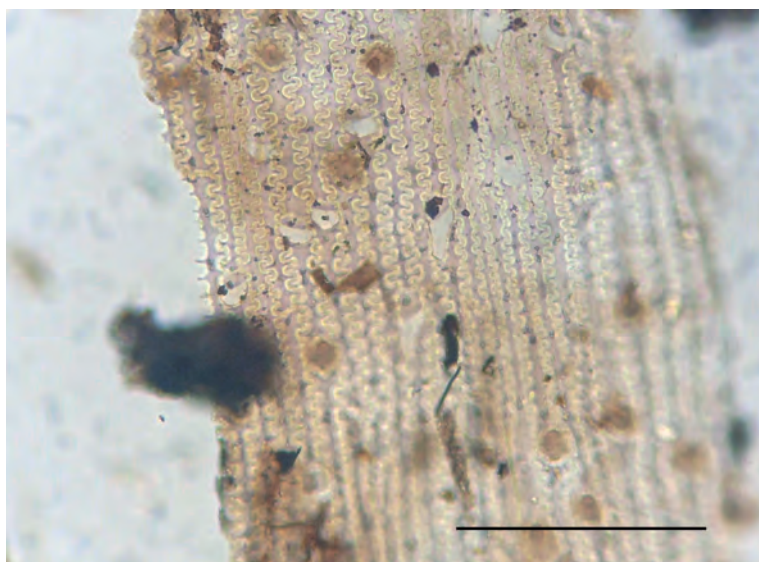
**Fig. 50** compares the relative abundances of different categories of phytolith multi-cells. Several samples have no multicellular phytoliths; these are generally samples with very low phytolith content. In samples where multicells are present, leaf and stem phytoliths are generally present in the highest relative abundances, apart from C47 where husk phytoliths are present in greater proportions. The leaf/stem category includes grasses and non-taxonomically identifiable phytoliths from monocots (mainly grasses and sedges). There are also small quantities of multicellular phytoliths identified from cereal straw, *Phragmites* and sedges. As well as in C47, husk multicell phytoliths are present in high proportions in D21 and in slightly lower proportions in D19, D28, D42 and in low proportions in D34, A44 and A48. **Fig. 51** shows the relative proportions of grass husk phytoliths in greater detail. There are silica-skeletons present from wheat (*Triticum* sp.), barley (*Hordeum* sp.), and wild Pooideae and Panicoid grasses, including cf. *Setaria* sp. and *Aegilops* sp. Husk silica skeletons from wheat are present in larger proportions than from other grasses and also in a greater number of samples.

### Discussion

The very low percentage of phytoliths in some samples suggests that these contexts were well cleaned in antiquity. Nevertheless, even when the quantities of phytoliths are small, analyzing the relative proportions of morphologies present can still provide some information about the types of plant-based activities that may have occurred within certain locations, such as is suggested below in relation to cereal processing.

Overall cereal agriculture was emphasized, based primarily on wheat (*Triticum* sp.). Storage context C47 is interesting for having the highest proportion of grass husk silica skeletons, with wheat as well as barley present. It is interesting that the grass husks present in other storage contexts (A44, A48) are only from wheat, overall emphasizing glume wheat storage. The lack of cereal multicells or dendritic single cells (from grass husks) from C59 and C62 suggests that these storage pits were well cleaned in antiquity – or used for some other form of storage. However, the presence of free-threshing cereals, including *Triticum aestivum* or *Hordeum vulgare* var. *nudum*, will be underrepresented in the phytolith record from household contexts, since such cereals would most likely have been stored naked. It is possible that the barley phytoliths in storage context C47 were





**Fig. 52**  
Monjukli Depe. Photograph of a large wheat  
husk silica skeleton

either from stored domestic barley or from a weedy form of barley, since cereals are generally identifiable to genera rather than species. The presence of wheat husk phytoliths in domestic contexts, particularly in storage context C47, most likely reflects glume wheat cereals (emmer or einkorn) stored in their husks. These glume wheats would need to be de-husked prior to consumption, and the floor surfaces (D21, D30, D34) with cereal husk silica skeletons present may reflect locations of cereal processing or dirty floor areas near rake-outs.

Silica skeletons can be mechanically broken down,<sup>157</sup> for example through trampling, and this may provide variable preservation for multicells between context categories. The figure showing relative proportions of single cell dendritics (found in grass husks) to smooth long cells (found most frequently in grass stems) can provide some additional information about grass husks in samples where multicells from husks or stems are not present. Comparing **Fig. 49** with **51** shows that dendritic single cells indicate the presence of grass husks in several instances where multicells were absent (including B57, C75, C36, A20, B41 [3118], and to a lesser extent C34). For samples where only dendritics are present, it is only possible to infer the presence of grass husks and not to identify the grasses present to genera. The contexts with grass husk multicells have high proportions of dendritics in relation to smooth long cells in the single cell record; from this one can infer high proportions of husks when only the single cell record is available,

and this is suggested for fire-installation context B57.

Overall, contexts D19 to D34 and D42 seem to form a contrast with other surfaces, with more grass husk phytoliths present in both the single and multicell record. Wild grass phytoliths seem to be associated with some ashy or surface contexts, forming a spatial contrast with the storage contexts, and may derive from ashy remains of wild grasses present in dung/crop weeds removed prior to cereal storage.

Whilst multicell wild grass husk phytoliths were present on several surfaces (D42, D28, D21), the single-cell record for panicoid and chloridoid grasses also suggests that wild grasses were present in some other ashy contexts (C25, B57) and surfaces (C34).

Other types of plants identified include reeds (*Phragmites*) and sedges (Cyperaceae), which grow in wetland environments, including along river banks. These phytoliths may derive from several taphonomic routes, including through the ashy remains of fuel, such as tinder and burnt dung, or as crop contaminants if cereals were irrigated. The tree/shrub phytoliths present may also originate from plants burnt for fuel. There are no multicellular phytoliths from monocots found within the samples from the fire installations (B57, C36) which may either reflect the presence of wood fuel, since phytolith quantities from wood and bark can range between low and none, or that contexts were well cleaned in antiquity. If phytolith content is low, but ashy deposits were clearly present during excavations, then wood fuel is likely.

The large size (>100 cells) of many of the wheat husk silica skeletons, as well as the presence of large silica skeletons from cereal straw, suggests either irrigation or crops growing in poorly drained soils. There is no apparent change from the Neolithic to Aeneolithic in the samples analyzed, with wheat suggested as the dominant cereal type throughout. It is possible that some wheat silica skeletons are from einkorn, although this observation will require further reference materials to be studied. Generally multicell analysis can identify the husks of cereals and several other wild grasses to genera, although there are subtle differences between different wheat species in the numbers of pitting around papillae.<sup>158</sup> In phytolith reference material made from modern plants at University College London, it was observed that einkorn often had more pointy papillae than emmer wheat. **Fig. 52** shows a large wheat husk silica skeleton from C47 with clearly visible D shaped cork-cells (typical of

<sup>157</sup> Rosen/Weiner 1994, 130.

<sup>158</sup> Rosen 1992, 135.

wheat) but with more pointy papillae (more reminiscent of barley).

### Comparison with Džejtun

The primary role of wheat suggested by the phytolith record at Monjukli is consistent with the macrobotanical findings at Džejtun, which emphasize the dominance of glume wheat.<sup>159</sup> The phytolith record at Džejtun<sup>160</sup> also suggested the role of wheat for human consumption, and while in many samples there were actually greater proportions of phytoliths from barley husks, these were interpreted as potentially connected with animal diet since these samples were from a yard area and associated with spherulites. Some differences in the relative proportions of certain phytolith morphologies between samples analyzed from the two sites, including greater amounts of barley and *Phragmites* at Džejtun, may likely relate to the differences in types of archaeological contexts analyzed. For instance at Džejtun many samples analysed for phytolith content were from yard deposits (as well as off-site samples and mudbrick), whilst the samples discussed here from Monjukli Depe are mainly from hearths/ovens, storage contexts and surfaces.

### Comparisons of charred macroremains and phytoliths from Monjukli Depe

by Naomi F. Miller and Philippa Ryan

Results of phytolith and macroremains analysis can be compared in general and specifically for three deposits: D42 (RN 165 macrobotanical [M], RN 204 phytolith [P]), C47 (RN 5221 [M], RN 5185 [P]), and C36 (RN 5145 [M], RN 5162 [P]). Both analyses suggest that the primary cereal crop was wheat but that barley, too, was cultivated. Both phytolith and macrobotanical samples have remains of wetland plants in the form of reeds (*Phragmites*) and sedges (Cyperaceae). The suggestion from the phytolith analysis that irrigation was practiced is consistent with the predominant cultigens attested in the charred macrobotanical remains, which consist of six-row barley and bread wheat.

Comparisons of specific deposits raise an interesting interpretive problem. The macroremains are virtually all charred. Wood and dung fires typically burn at temperatures below the melting point of phytoliths, 1000 °C,<sup>161</sup> so phytoliths are released

into sediments through both fire and plant decay, enabling study of both charred and non-charred material.<sup>162</sup> Unburnt deposits may have redeposited charred remains and in situ phytoliths.

D42: Both analyses indicate a lack of wood remains and a presence of grasses. The low density of charred remains is consistent with an interpretation of a surface swept clean. The grass husk phytoliths seem to be from wild grasses, rather than cereals (although there are also some unidentified husks).

C47: Both analyses are consistent with an identification of the deposit as a storage facility with a high amount of husks, but the details do not give a clear picture of the depositional history. The charred macroremains suggest that the crop was free-threshing, not hulled wheat. The deposit might represent straw remains or stored grain threshing remains; one way to explain the charring would be the use of fire to kill insect pests. If mainly free-threshing wheats were stored, some wheat husk phytoliths (from glumes, lemmas and paleas) may be from small fragments of threshing detritus still present in tiny amounts with the naked grain.<sup>163</sup> If, alternatively, stored threshing remains are preserved, they would come from the grain heads rather than sheaves. The phytoliths do not suggest straw storage, as there are greater proportions of dendritic single cells (found in grass husks) in relation to smooth long cells (most commonly found in grass stems, but also in smaller quantities in other plant parts), and no cereal straw multicells. The phytoliths also possibly come from non-charred glume wheats, in which case there would be no equivalence between the macroremains and the phytoliths. This latter scenario would imply the storage of more than one type of wheat in the same context or perhaps different episodes of storage.

C36: the macroremains suggest that this oven fill is nearly all wood charcoal; the preservation of phytolith grass remains indicates that grasses and/or dung may also have been burnt. The low phytolith weight percentage (density) is consistent with mainly wood charcoal. The lack of multi-cell forms and presence of only small quantities of single-cell phytoliths also suggests grasses and other monocots were not important components within the ashy fuel remains of this oven. The small numbers of woody phytoliths present could be from the wood/bark or from any leaves still attached to branches.

<sup>159</sup> Charles/Bogaard 2010, 151.

<sup>160</sup> Larkum 2010, 149.

<sup>161</sup> Piperno 2006, 135.

<sup>162</sup> Piperno 2006, 21.

<sup>163</sup> Ryan made similar observations from a storage bin with free-threshing wheat at Çatalhöyük (unpublished laboratory notes).

## Preliminary results of microarchaeological analyses

by Peter Sturm

At least since the 1960s it has become clear that the archaeological record cannot be treated as a static snapshot from the past. Instead, archaeologists have now realized that the archaeological record is highly dynamic, transformed and shaped by a multitude of natural and anthropogenic factors.<sup>164</sup> Nevertheless a considerable part of archaeological research still rests on the assumption that the distribution of macroartifacts<sup>165</sup> encountered by archaeologists in the course of their excavations mirrors directly past activities and therefore indicates the functions and actual uses of different spaces. For instance, sherds of cooking vessels are thought to indicate domestic use of the spaces where they were found, while semi-finished objects or tools point to the practice of crafts.

We argue, however, that it is highly improbable that past people left large quantities of broken macroartifacts, including tools, craft refuse and other objects of their material culture, in the places where they were used or produced. Rather, the distribution of macroartifacts in prehistoric settlements is strongly governed by various discard habits, perceptions of cleanliness and the reasons for abandonment of a settlement. The deposition of macroartifacts inside houses and other domestic spaces is likely the result of atypical and individual events rather than ordinary usage. Ultimately, this means that the study of macroartifact distributions is often misleading when searching for daily routines.

In contrast, microdebris analysis is well suited to address questions concerning everyday practices and the habitual use of spaces.<sup>166</sup> It is based on the premise that small artifacts, fragments of objects and other culturally produced materials can be encountered in the places where they were generated or accidentally deposited in the course of everyday activities. On the one hand, this is simply due to their small sizes and the fact that they go unrecognized or are not perceived as disturbing. On the other hand, the presence of microartifacts in spaces of use may

be a function of the techniques of cleaning used as well as the absence of sealed surfaces.

## Sampling strategy

We took a total of 59 flotation samples during the 2010 season. Of these, 50 were processed in the field and are available for further analysis. The remaining nine samples were put in storage for processing in the coming season. Samples that came from undisturbed and well defined loci (i.e. classified as primary contexts) were preferentially taken for flotation.

Our sampling strategy was designed to obtain samples from as wide a variety of contexts as possible, including surfaces, deposits over surfaces,<sup>167</sup> bins, burials, fire installations, and ash layers. This was intended to provide an overview of the diversity of possible sample compositions and, ultimately, of activities carried out at Monjukli Depe. For the most part, samples were taken from well-defined contexts, such as bins and installations. Furthermore, we tried to obtain samples that allow for comparison between inside and outside areas, different phases of the same architectural feature, and so forth. In the case of bins, fire installations and burials, we attempted to obtain the complete matrix for flotation. While the first two are typically quite small in size, burials were submitted to flotation primarily to extract very small finds such as beads. For surfaces, deposits over surfaces, ash layers, and the like, representative samples were taken. Sample size ranged from approximately one to ten liters and averaged four liters. One sample, taken from a burial pit, reached 35 liters.

## Flotation procedure

Due to the number of samples and the local working conditions, light and heavy fractions were recovered from the samples by hand flotation. We employed a large water-filled barrel with a sieve fitted into it. The mesh size of the sieve used to collect the heavy fraction was one mm. The light fraction was collected by skimming the floating material with a sieve with a mesh size of 0.5 mm. For each flotation sample the volume was recorded and the soil then poured gradually into the barrel. Stirring gently by hand helped to break up lumps of sediment and release the floatable material.

<sup>164</sup> Schiffer 1987; Sommer 1991.

<sup>165</sup> The term macroartifact is used here to designate artifacts that are larger than 10 mm in their smallest dimension. In contrast, microartifact refers to objects ranging in size from one to 10 mm. The lower threshold of one mm is often chosen, since it becomes very difficult and time consuming to distinguish different materials at a smaller particle size. The upper threshold of 10 mm is a somewhat arbitrarily chosen compromise between the likelihood of encountering materials in situ (the smaller the better) and the likelihood of recognizing materials in the course of the excavation (the larger the better).

<sup>166</sup> Metcalfe/Heath 1990; Rainville 2005.

<sup>167</sup> The context type "deposit over surface" refers to deposits lying directly on top of a surface and ranging in thickness from three to ten centimeters.

Sample	Context type	Stratum	Vol. (ltr.)	Worked stone	Bone	Pottery	Burnt clay	Limestone	Unworked stone
A55 RN1201	undefined	I	3.6	–	0.2/1	–	0.3/2	–	0.2/1
A61 RN1248	ash layer	I	2.8	0.2/1	2.9/11	–	7.3/24	0.2/1	1.0/3
B37 RN3087	deposit over surface	II–III	4.8	26.6/1	14.6/26	1.5/5	97.9/53	–	7.2/6
B37 RN3103	deposit over surface	II–III	4.5	2.6/1	2.8/3	–	6.6/20	0.3/2	2.1/5
B41 RN3114	surface	II–III	4.8	–	14.4/19	–	2.3/13	–	–
B57 RN3187	fire installation	II–III	3.1	–	0.4/3	–	27.6/78	–	11/5
B73 RN3255	deposit over surface	II–III	3.5	–	1.3/8	0.7/5	4.3/18	–	16.4/12
B74 RN3264	surface	II–III	3.7	–	1.4/7	–	1.2/4	–	7.2/5
B78 RN3284	surface	II–III	6	0.6/1	1.3/3	–	–	–	0.2/1
B83 RN3301	bin/storage inst.	II–III	2.6	–	–	–	0.2/1	–	3.3/1
B88 RN3309	deposit over surface	II–III	3.1	0.2/1	–	–	0.5/2	–	0.7/1
C39 RN5157	surface	II–III	4.9	–	3.1/13	–	2.1/6	0.3/2	1.5/3
C40 RN5184	ash layer	II–III	3.1	0.3/2	18.3/10	–	5.6/18	0.2/1	1.0/2
C47 RN5185	bin/storage inst.	II–III	9.3	–	4.3/17	–	7.6/34	2.1/2	60.5/15
C47 RN5221	bin/storage inst.	II–III	4	–	0.5/3	–	6.2/19	–	8.6/7
C65 RN5259	surface	II–III	2.7	–	0.4/3	–	0.2/1	–	11.3/5
C67 RN5262	surface	II–III	3.8	–	3.3/7	–	–	–	1.0/3
C72 RN5284	deposit over surface	IV	4.6	–	5.6/26	–	2.4/10	1.4/7	19.6/11
C75 RN5318	possibly sterile fill	IV	3.5	–	0.6/5	–	1.0/3	–	–
C78 RN5325	deposit over surface	V	4.5	0.4/2	12.8/29	0.5/3	6.0/25	–	16.4/5
C80 RN5335	surface	V	3.8	9.2/1	3.3/17	–	9.9/48	–	1.2/3

## Sorting

The heavy fractions were first sorted into graded size categories. The smaller fraction includes those materials with dimensions of one to five mm, whereas the larger fraction consists of those larger than five mm. When collecting flotation samples during excavation, macroartifacts were included with the samples. This means that the larger fraction (>5 mm) may also contain conventional macroartifacts. Occasionally, when samples were taken from large loci or an unusual object was encountered, individual macroartifacts may have been separated out prior to collection of the sample.

In the next step, the heavy fractions were examined in order to identify the artifacts and other materials they contained. Categorization of these materials was dependent on what was present in the heavy fractions as well as which artifacts and other materials could be identified with a reasonable degree of confidence. Taking both of these factors into consideration, general classes of object types were created that should ultimately help address questions about how people at Monjukli

Depe dealt with materials and technologies. Based on the samples processed thus far, these categories comprise metal, pottery, worked stone (including but not limited to chipped stone), unworked stone, limestone, (animal) bone, and burnt clay.

The one to five mm size fraction was sorted under a stereoscopic microscope at a magnification ranging from 10× to 40×. The sorting of the size fraction exceeding 5 mm was done with the naked eye, occasionally examining specific materials under the microscope. Generally the sorting of the heavy fractions into discernible categories is a straightforward process. However, there are situations in which identification is ambiguous. This is especially the case with clay pieces. The distinction between burnt clay and pottery is often difficult to make, all the more so for the smaller size fraction. For this reason, I have favored a pragmatic approach in which some of the categories are not distinguished in the smaller size fraction. This applies principally to the non-artifactual categories (i.e. limestone, unworked stone). All material has been retained and can be revisited later, if needed.

**Tab. 22**  
Monjukli Depe. List of heavy fraction samples, with data on count and weight (g) (ct/wt) of components

**Tab. 23**

Monjukli Depe. Average weight density of heavy fraction samples by context type (g/ltr)

	Worked stone	Bone	Pottery	Burnt clay	Limestone	Unworked stone
ash layer	0.08	3.59	–	2.19	0.07	0.34
bin/storage installation	–	0.30	–	0.88	0.13	4.55
deposit over surface	1.19	1.48	0.11	4.71	0.07	2.50
fire installation	–	0.13	–	8.90	–	3.55
possibly sterile fill	–	0.17	–	0.29	–	–
surface	0.33	0.92	–	0.53	0.01	0.75

Subsequently, the identified material was counted and weighed by category. Precise counts are recorded for the artifact categories (i.e. metal, pottery, worked stone) but not for unworked materials. The same holds true for the bone count in the larger size fraction, whereas only an approximate value was recorded for the smaller size fraction. For the remaining non-artifactual categories, a rough count was recorded for the larger size fraction only; these materials were not separated out in the smaller size fraction.

### Results of analysis

The data factored into the analysis are composed of the larger size fraction of 20 samples (**Table 22**). The limited quantity of data constrains the statistical significance of the analysis and, hence, the resulting interpretations. The general trends exhibited may nonetheless be regarded as meaningful.

The analysis conducted consists of density comparisons between (a) context types, (b) excavation strata and (c) multiple samples from the same context. In order to arrive at densities, weight and count values were divided by sample volume. Use of density data allows for a broad range of comparisons, limited only by number and kind of available samples. Of particular interest are comparisons between different building phases of the same architectural feature, a particular type of context from different strata (e.g. fire installations), numerous samples from the same context (e.g. from one surface), or between inside and outside areas, to mention just a few.

Overall the microdebris analysis fully confirms the striking paucity of artifacts observed for macro-artifacts in the course of the excavation. However, the comparison of densities by context type shows notable differences (**Table 23**). Ash layers exhibit the largest quantity of bone (c. 3.6 g/ltr.). Bones from ash layers are also the least fragmented (with the highest weight-to-count ratio). They also contain some burnt clay (highly fragmented) but are otherwise almost devoid of material. Unsurprisingly, fire installations show by far the highest concentration of burnt clay and a considerable amount of unworked stone (and, together with bins/storage installations, the largest stones). Given that we encountered several fire installations with pebble-lined floors during the excavation, the relatively high density of unworked stone might be ascribed to these linings. Bins/storage installations yield very small quantities of bone, some burnt clay, but also a high concentration of unworked stone. This might suggest a pebble lining similar to those of fire installations, but none has been observed among the excavated bins. Generally, bins/storage installations appear to have been kept meticulously clean.

Surfaces contain bits of highly fragmented bone, burnt clay, unworked and worked stone. Thus, they suggest regular cleaning, despite preserving limited traces of domestic use. Deposits over surfaces, on the other hand, feature the largest quantity of worked stone (>1 g/ltr.) and are the sole source of pottery, albeit in minute quantities (c. 0.1 g/ltr.). They also contain some bone, large quantities of burnt clay and unworked stone. This context type shows the most varied microdebris composition of all context types. When comparing deposits over surfaces to bins/storage installations

**Tab. 24**

Monjukli Depe. Average weight density of heavy fraction samples per stratum (g/ltr)

Stratum	Worked stone	Bone	Pottery	Burnt clay	Limestone	Unworked stone
I	0.03	0.48	–	1.19	0.03	0.19
II–III	0.47	1.03	0.03	2.54	0.05	2.07
IV	–	0.77	–	0.42	0.17	2.42
V	1.16	1.94	0.06	1.92	–	2.12



and surfaces, two hypotheses may be proposed for their distinct compositions. Either they consist of tertiary materials relocated from trash dumps, or they attest to periods of intensive domestic use alternating regularly with the construction of a new surface.

Finally, the density values for what was thought on the excavation to be a sterile fill layer, comprising a single sample coming from a probable transition phase between Neolithic and Chalcolithic levels, speak for themselves. The sample is virtually empty of material, which, together with the lack of architectural features from this stratum, point to a possible abandonment or relocation of the settlement.

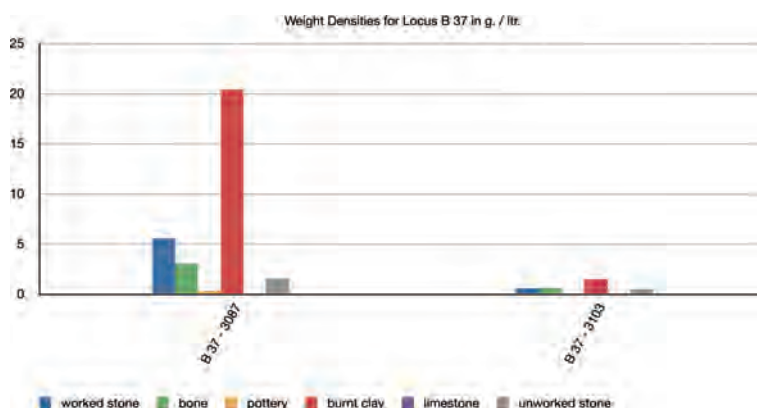
### Comparison by strata

The results from the comparison of densities per stratum reveal that earlier strata tend to contain more materials (**Table 24**). This is especially true for the categories worked stone and bone, and to a much lesser extent for pottery. However, while the Aeneolithic Strata II–III are comprised of 15 samples, Strata I, IV and V consist of only two samples each. The very small number of samples from these strata obviously does not permit calculations of statistical significance. Still, the results do fit quite well with observations made during the excavations.

As is to be expected, Stratum IV – the presumable hiatus phase – does not fit this pattern. Interestingly, however, the deviation is less marked than the comparison of context types might suggest. Whereas the sample from the lower layers of the hiatus phase is almost void of material (C75), the sample from the upper layers (C72) contains some quantities of material (**Table 22**). In this case, only through microdebris analysis did it become apparent that the hiatus phase is in itself heterogeneous. While at present the meaning of this differentiation is unclear, it might very well turn out that it can be ascribed to different use patterns in specific layers. Clearly, lumping all samples from one stratum together and comparing densities to other strata is a somewhat crude path of analysis. Once a larger number of samples has been analyzed, it will be possible to compare particular context types from different strata. This, in turn, will enable refined propositions about diachronic relationships on a very small scale.

### Variability of individual contexts

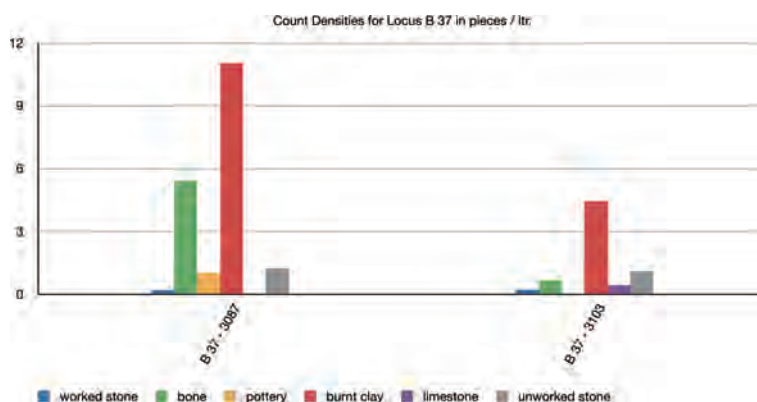
It is particularly interesting to compare multiple samples originating from the same locus. **Figs. 53** and **54** show two samples from locus B37 (deposit

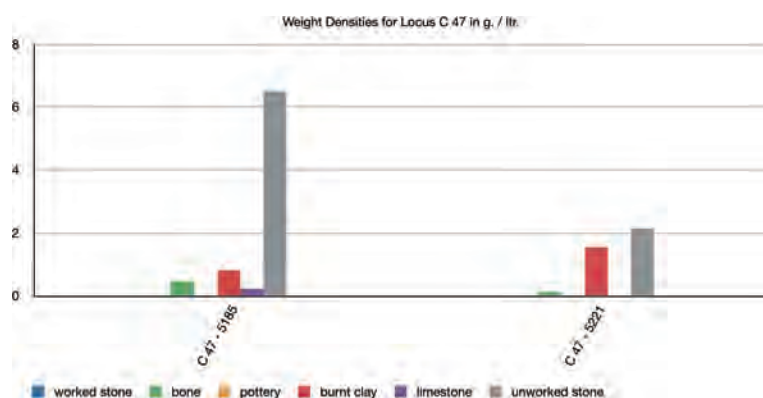


**Fig. 53**  
Monjukli Depe. Weight densities of various materials in two samples from B 37

over surface). Weight and count densities show a considerable degree of variation. Generally speaking, sample RN 3087 contains much more material than RN 3103. Moreover, the proportions of densities (e.g. the ratio of worked stone to bone) vary substantially. This is in stark contrast to the samples from locus C47 (bin/storage installation). **Figs. 55** and **56** illustrate that the overall density of material in these two samples diverges, too. But in contrast to B37, the proportion of densities of different categories is quite similar in the two samples. Hence, while both samples from locus C47 display a similar composition and point therefore to a homogeneous context from which they derived, the marked difference in microdebris composition in the two samples from locus B37 indicates a non-homogeneous context. This demonstrates that loci that look macroscopically the same might in fact have a non-homogeneous microdebris composition. It seems likely that certain types of contexts (e.g. deposits over surfaces, surfaces, ash layers) are more susceptible to variation in microdebris composition than others, but this remains to be explored. Presumably, such variation in microdebris composition within a single context can be as-

**Fig. 54**  
Monjukli Depe. Count densities of various materials in two samples from B 37





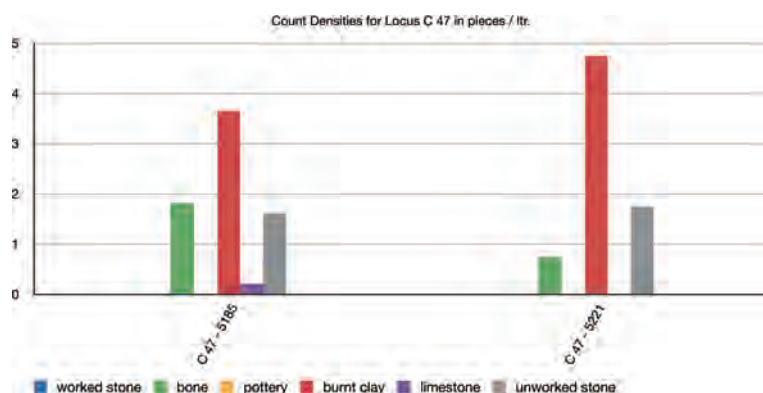
**Fig. 55**  
Monjukli Depe. Weight densities of various materials in two samples from C 47

cribed to different activity and disposal patterns. Ultimately, microdebris analysis should even make it possible to recognize varying activities carried out in different corners of one room or courtyard.

### Summary and prospects

Although the sample size for the present analysis is very small, some interesting insights can nonetheless be gained. Comparing densities by context type largely substantiates interpretations arrived at by more traditional observations. Surfaces and bins/storage installations appear to have been kept relatively clean, while deposits over surfaces feature the highest concentration of artifacts and the most varied microdebris composition of all context types, perhaps because they were formed by an accumulation of *in situ* uses or in contrast consisted of tertiary material redeposited from garbage dumps. Fire installations and perhaps bins/storage installations were often lined with small pebbles. Ash layers contain the largest pieces of bone, but are otherwise almost devoid of material. Microdebris analysis also showed that some levels without architectural features (here referred to as possibly sterile fill) lack noteworthy traces of domestic activities.

**Fig. 56**  
Monjukli Depe. Count densities of various materials in two samples from C 47



As a general trend the comparison of densities per stratum suggests that earlier strata contain more materials than later ones. It further helped to differentiate the nature of the hiatus phase (Stratum IV) from the lower, Neolithic layers. The comparison of samples from the same context illustrates one of the particular strengths of microdebris analysis, namely, that it is able to recognize variability in an otherwise seemingly indistinguishable context. Such variation within one and the same context can be explained by different practices. In turn, the ability to discriminate between various activities carried out in one room or open space can prove invaluable for a detailed investigation of past practices. Clearly, a sophisticated sampling strategy has to be employed in order to capture traces of human activities on such a small scale. It is, for example, essential to obtain multiple samples per context and to closely record details of their provenience. Generally speaking, by adapting the sampling strategy accordingly, it is feasible to answer very specific and varied research questions.

In addition to enlarging the data base and refining the sampling strategy, future work on microdebris analysis at Monjukli Depe will improve sorting and size categories. The 1–5 mm size category will be split into a 1–2 mm and a 2–5 mm category. This will speed up the sorting procedure, ensure better comparability with other excavations where microdebris analysis has been conducted, and allow better studies of fragmentation and trampling.

Despite the limited sample size, our results show that microdebris analysis can contribute valuable information to the archaeological investigation of prehistoric settlements. With a larger data base we expect to gain many more interesting insights into everyday activities and habitual routines of prehistoric people living in the piedmont zone of the Kopet Dag.

### Prospects and conclusions

by Susan Pollock and Reinhard Bernbeck

Our first season of work proved very successful in extending our understanding of the Aeneolithic and Neolithic periods in the Meana region. Our ultimate goal is to better understand the ways in which inhabitants of Monjukli Depe and surroundings made a living, how they structured their daily social interactions, and how and why their lives changed over time. As with all research, of course, many more questions remain to be investigated in future seasons. We mention just a few of them here by way of conclusion.

1. What were the regional relations within which the village at Monjukli Depe was founded and in which it prospered? In order to investigate this

question, we hope to conduct an intensive survey in the region between Meana and Čaača in order to document as fully as possible locations, sizes, and dates of other early villages.

2. What were the climatic, ecological, and topographic conditions that allowed village life to emerge and flourish in this area? To learn more about ancient landscapes will require the help of a geomorphologist who can study the non-cultural materials in stratigraphic soundings at Monjukli Depe as well as the sequences of deposition visible in wadi profiles.
3. How can the low density of archaeological artifacts at Monjukli Depe be explained? To address this question, we will need to investigate other areas and contexts at the site and undertake more intensive microarchaeological sampling, including the use of micromorphology in order to ascertain what kinds of materials and preparations were used in architectural constructions as well as to trace the minutiae of daily practices that may escape our notice using standard excavation procedures.
4. From which areas did artifacts and raw materials come to Monjukli Depe? While this question is easy to answer for some materials, for example lapis lazuli, it is less so for others, such as the various stones used for chipped and ground-stone artifacts. For example, it is of particular interest to investigate the sources from which ocher was procured, as it seems that intensive use of this material began before Stratum III but increased greatly in the latest strata at the site.

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## Summary

This report presents the results of the first season of renewed excavations at the Late Neolithic and early Aeneolithic site of Monjukli Depe in the Kopet Dag piedmont region of southern Turkmenistan. The project focuses on the microhistories of technological change in a region where change has long been explained on the basis of diffusionist models. In this initial season our work concentrated on building a reliable local chronology and on the systematic collection of floral and faunal remains as well as artifacts from well-documented contexts.

The three excavation units opened in 2010 yielded well preserved architecture as well as an abundance of faunal and floral remains. In contrast, the density of artifacts, especially pottery, was quite low, in particular in the Aeneolithic levels. A substantial suite of radiocarbon dates allows us to date the upper portion of the Neolithic sequence to the late 7<sup>th</sup> to early 6<sup>th</sup> millennium cal. BCE and the Aeneolithic occupation to the first half of the 5<sup>th</sup> millennium cal. BCE. Both the radiocarbon dates and the painted Aeneolithic pottery are suggestive of a distinctive, hit-

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herto unrecognized phase of the Aeneolithic, earlier than the “Anau IA” phase. We refer to it as the “Meana Horizon.” The floral and faunal evidence indicate heavy emphasis on domesticates throughout the sequence, based primarily on sheep/goat and wheat. There is also evidence for the use of irrigation.

## Zusammenfassung

Dieser Bericht enthält die Ergebnisse der ersten Kampagne neuer Ausgrabungen im spätneolithischen bis früh-äneolithischen Monjukli Depe in der Vorgebirgszone des Kopet Dag in Süd-Turkmenistan. Das Projekt konzentriert sich auf einen Ansatz mikrogeschichtlicher Erforschung von technologischem Wandel in einer Region, wo historischer Wandel lange auf der Grundlage diffusionistischer Modelle erklärt wurde. In dieser ersten Arbeitssaison konzentrierten wir uns auf den Aufbau einer zuverlässigen Lokalchronologie und die systematische Sammlung von Flora- und Fauna-Daten, ebenso wie von Artefakten aus gut dokumentierten Kontexten.

In den drei Grabungsschnitten des Jahres 2010 trafen wir gut erhaltene Architektur sowie eine Fülle von Fauna und paläobotanischem Material an. Im Gegensatz dazu war die Artefaktdichte vor allem an Keramik recht niedrig, insbesondere in den äneolithischen Schichten. Eine große Menge an Radiokarbonaten ermöglicht es uns, den oberen Teil der neolithischen Sequenz ins späte 7. bis frühe 6. Jt. v. u. Z. zu datieren. Äneolithische Schichten fallen in die erste Hälfte des 5. Jts. cal. v. u. Z. Sowohl die Radiokarbon-Daten als auch die bemalte äneolithische Keramik lassen sich als Indizien für eine separate, bislang nicht richtig eingeordnete Phase des Äneolithikums interpretieren, die wir den “Meana Horizon” nennen. Dieser datiert früher als die Anau IA-Zeit. Nach Ausweis der Flora- und Fauna-Reste waren domestizierte Tiere in der gesamten Sequenz von großer Bedeutung für die Subsistenz, in ers-

ter Linie Schaf/Ziege und Weizen. Zudem gibt es Hinweise auf die Anwendung von Bewässerung.

## Резюме

В статье представлены результаты первой полевого сезона 2010 года на поселении эпохи раннего энеолита Монджукли-депе в предгорье Копет Дага в Южном Туркменистане. Целью проекта являются исследование по развитию технологической базы на региональном уровне. Долгое время считалось, что в основе процесса исторической трансформации лежат диффузионные модели. В первый полевой сезон нами была предпринята попытка создания надёжной хронологической схемы региона. Особое внимание уделялось систематическому отбору палеоботанического и палеозоологического материала из чётко стратифицированного контекста.

В трёх раскопах, заложенных в 2010 году были обнаружены фрагменты архитектуры хорошей сохранности, а также большое количество палеоботанического и палеозоологического материала. Исходя из серии радиоуглеродных дат, начало эпохи неолита в регионе приходится на конец 7/начало 6 тыс. до н. э, в то время как начало эпохи энеолита – к первой половине 5 тыс. до н. э. Полученные результаты радиоуглеродного датирования, а также расписная керамика эпохи энеолита позволяют выделить фазу, названную нами «горизонт Меана» как отдельный хронологический период, предшествующий периоду Анау IA. Результаты анализа палеоботанического и палеозоологического материала дают возможность предположить, что на данный период домашние животные (в первую очередь овцы и козы) и пшеница играли наиболее важную роль в пищевой цепи. Кроме того, имеются признаки существования на тот период поливного земледелия.

