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## Disappeared by Climate Change. The Shepherd Cultures of Qulban Ceni Murra (2<sup>nd</sup> Half of the 5<sup>th</sup> Millennium BC) and their Aftermath

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**DISAPPEARED BY CLIMATE CHANGE  
THE SHEPHERD CULTURES OF QULBAN BENI MURRA  
(2<sup>nd</sup> HALF OF THE 5<sup>th</sup> MILLENNIUM BC) AND THEIR AFTERMATH <sup>1</sup>**

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**Résumé** – Le phénomène funéraire attesté dans le sud-est de la Jordanie témoigne d’une phase d’occupation méconnue de la région au cours du milieu de l’Holocène, en lien avec un mode de vie pastoral basé sur l’exploitation des ressources en eau des puits (« Early Mid-Holocene pastoral well cultures », 4500-4000 BC). À titre d’hypothèse, cette phase précoce d’occupation a pu aboutir au développement des premières « cultures des oasis » de la péninsule Arabique (« Oasis cultures », 4000-3500/3000 BC). Cette deuxième phase constitue, après la Néolithisation, un des derniers grands épisodes de sédentarisation des sociétés du Proche-Orient, reflet d’une importante capacité d’innovation et d’adaptation socio-économique permettant la conquête de nouveaux territoires arides pour une occupation sédentaire. L’occupation pastorale du Sud-Est jordanien constitue le prolongement oriental du phénomène de peuplement de la péninsule Arabique, caractérisé au cours de la période (acéramique) du Chalcolithique récent/Bronze ancien par la récurrence des structures funéraires mégalithiques de pierres dressées et des cairns. Le site de Qulban Beni Murra est l’un de ces complexes funéraires importants (>1 km<sup>2</sup>), et témoigne d’une grande diversité dans les types de tombes et de structures en présence. Il atteste aussi une série d’aménagements hydrauliques (dépressions creusées) alimentés par des puits (datés de 4400 av. J.-C. environ) qui sont le reflet d’une occupation pastorale qui a probablement abouti au développement dans cette région, après un

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assèchement du climat à partir de 4000, d'une économie basée sur l'exploitation des oasis, là où les ressources en eau étaient encore disponibles.

**Mots-clés** – Qulban Beni Murra, Chalcolithique récent/Bronze ancien, « cultures pastorales puisatières », économie des oasis anciennes, changement du mode de l'acquisition de l'eau, paléo-écologie de l'Arabie au milieu de l'Holocène.

**Abstract** – Sepulchral landscapes in southeastern Jordan give evidence of hitherto unknown early Mid-Holocene pastoral well cultures (4500-4000 BC), possibly followed by the region's transition to an oasis-type of life-mode, or its contact to Arabia's earliest oases cultures (4000-3500/3000 BC). The latter represents the latest major episode of sedentarisation in the Middle East and has to be considered as the most innovative and adaptive socioeconomic paradigm after the Neolithisation, allowing for sedentary use of arid lands from then on. The (aceramic) Late Chalcolithic/Early Bronze Age of Jordan's southeast appears to be part of the western fringe of the pastoral well cultures that once occupied all of the Arabian Peninsula, characterised by their extensive megalithic standing stone graves and cairn fields. Qulban Beni Murra was not only such a large sepulchral centre (>1 km<sup>2</sup>) with several structural types of burials and other built features; its series of watering complexes (troughs), fed by wells (dating around 4400 BC), gives testimony to a lake/well-based pastoralism that probably became the progenitor of well-based oases economies at hydrologically favoured spots after the climate got drier and colder from 4000 BC on.

**Key Words** – Qulban Beni Murra, Late Chalcolithic/Early Bronze Age, pastoral well-cultures, early oases economies, socio-hydraulic subsistence shift, Arabia's Mid-Holocene palaeoecology.

**ملخص** – تشير مخلفات القبور في منطقة جنوب شرق الأردن الى ثقافات بدوية غير معروفة حتى اليوم ارتبطت بأبار المياه خلال الفترة المتوسطة من عصر الهولوسين. والتي ربما تبعها تحول في المنطقة الى نمط حياة الواحات او التواصل مع ثقافات الواحات المبكرة في الجزيرة العربية (٤٠٠٠-٣٥٠٠/٣٠٠٠ ق.م). ويمثل هذا الأخير أحدث حلقة من التوطن في الشرق الأوسط والتي يجب أن تعتبر النموذج الأكثر ابتكاراً وتكيفاً اجتماعياً واقتصادياً بعد العصر الحجري الحديث. ما سمح بالإستقرار في الأراضي القاحلة واستخدامها منذ ذلك الحين. ويبدو أن جنوب شرق الأردن خلال الفترة المتأخرة من العصر الحجري النحاسي وبداية العصر البرونزي المبكر كانت جزءاً من الطرف الغربي لثقافة البداوة المعتمدة على ابار المياه والتي سكنت مناطق الجزيرة العربية وتميزت بمخلفات القبور والرجوم التي تحتوي على الحجارة المنتصبة. ومنطقة قلبان بني مرة لا تحتوي فقط على المقابر الحجرية والتي تغطي واحد كيلومتر مربع ومعالم مبنية اخرى بل تحتوي كذلك على سلسلة من المناطق المروية التي تغذيها الأبار وتؤرخ الى حوالي ٤٤٠٠ ق.م. وهذا يشير الى وجود البداوة التي اعتمدت على البئر او البحيرة كنظام سابق لإقتصاد الواحات والتي فضلت مناطق معينة خلال الفترات الجافة والرطوبة بعد ٤٠٠٠ ق.م.

**كلمات محورية** – قلبان بني مرة. نهاية العصر الحجري النحاسي وبداية العصور البرونزية. "ثقافة البداوة المعتمدة على الأبار". اقتصاد الواحات المبكر. التحول في الكفاف الاجتماعي المستند الى مصادر المياه. بيئة الجزيرة العربية القديمة في منتصف الهولوسين.

#### FIELD WORK AND RESEARCH QUESTIONS OF THE EASTERN JAFR JOINT ARCHAEOLOGICAL PROJECT

Field research in the context of the authors' Eastern Jafr Joint Archaeological Project<sup>4</sup> started at the drainage system of Wadis Sahab al-Abyad and al-Asmar and at the principal site of the area, Qulban

4. The Eastern Jafr JAP is carried out in collaboration with the Department of Antiquities of Jordan by ex oriente at Free University of Berlin and Mu'tah University, co-directed by H. G. K. Gebel and H. M. Mahasneh; the 2008, 2010, and 2011 seasons were co-sponsored by Research Cluster 2 of the German Archaeological Institute, Berlin. After 2012, the project is continued under the auspices of DoA and ex oriente. Several reports were published or submitted: MAHASNEH & GEBEL 2001, 2008; GEBEL & MAHASNEH 2006, 2008, 2012 n.d.a-b; GEBEL 2010; GEBEL *et al.* 2011.



The explicit understanding promoted by one of the authors (H. G. K. Gebel)<sup>9</sup>, that oasis socio-economy is the consequence of a vanishing favoured climate and not the result of a favoured climate, claims to be a novel approach to Arabia's history.

However, the western Late Chalcolithic/EB desert occupations started to be research fields of their own, e.g. U. Avner's work<sup>10</sup> for the al-Naqab and the Sinai or the more recent field works in arid eastern Jordan<sup>11</sup>. These occupations form the central parts of the "Mid-Holocene Green Saharo-Arabian Pastoral Belt"<sup>12</sup>, expected to stretch from Yemen to the western Maghreb<sup>13</sup>. The Saudi territories remain blank spots, although initial reconnaissance has been started<sup>14</sup>. All these records illuminate that we deal in the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC with a high complexity of material cultures and socio-economic and chronological diversities, with a high share of re-occupational interferences; the latter is typical for deflated land archaeology and offers dangerous traps for archaeology.

The objectives of the 1<sup>st</sup> phase of the Eastern Jafr JAP (2006-2010) were general surveys and hydrological prospections to understand the Holocene occupations and land-use in the region, together with a site survey, soundings and excavations at Qulban Beni Murra aiming at understanding the site's nature, hydraulic features, burials, and at gaining datable samples. By 2011 the 2<sup>nd</sup> phase started, by excavating collective burials, a pen camp site and hydraulic features from 4500-3500 BC, supported by geophysical and palaeohydrological prospections for water management in the region at that time. All aimed at gathering:

- Anthropological and isotope data to approach an understanding of the Late Chalcolithic/EB populations for insights on demography, mortality, morbidity, transhumance, kinship, social organisation (works of J. Pokrandt and J. Gresky in 2011 at the cairns in Wadi Sahab al-Asmar 6:1, **fig. 14**; 8:11, **fig. 3**; 9:41; 9:42 and 35; and Qulban Beni Murra B16 and G1), at recording.

- Structural evidence and mapping the layout of the *inselberg* pen camps Wadi Sahab al-Abyad 14 and Wadi Sahab al-Asmar 6 for insights on the nature of occupations and stratigraphy (works 2011 of H. M. Mahasneh and H. G. K. Gebel, B. Lischwesky, P. Keilholz, A. Suleiman, and Y. Abu Zagrit).

- At hydrologically prospecting by georadar certain areas at Qulban Beni Murra, Wadi Sahab al-Asmar 6 and Mshash al-Asmar (works 2011 of B. Khrisat and P. Keilholz), for their potential wells or other installations of water management<sup>15</sup>.

Encountering datable Mid-Holocene sedimentary environments/climatic archives in the region is expected to be a very difficult enterprise, as shown by first attempts of the project in 2010 and 2011 and experiences made at nearby Qa' al-Jafr<sup>16</sup>. Furthermore, disillusion governed the 2011 field work about chances to find unlooted or preserved burials in the area: It became evident from layers untouched by recent looters that most of the graves had been looted or re-occupied one or several times before, often already in Late Chalcolithic/EB times, but also in recent decades and years (e.g. **fig. 3-4**), resulting in a complete misplacement of the skeletons and related (intentional) fracturing of bones; other cairns (e.g., the ashlar line graves Qulban Beni Murra B16 and G1 and Wadi Sahab al-Asmar 6:1 and 35) had no preserved bone remains.

9. The thesis is taken up and further tested by J. Pokrandt's PhD project (Kiel University: Graduate School Human Development in Landscapes, in prep.).

10. AVNER 2002.

11. QUINTERO *et al.* 2002, WASSE & ROLLEFSON 2005; ROLLEFSON & MATLOCK 2007; ABU AZIZEH n.d. as well as the contributions of Abu Azizeh, Fujii, Müller-Neuhof, Rollefson and others in this volume.

12. GEBEL & MAHASNEH 2012.

13. E.g. the territories of the Saharan Arab Democratic Republic close to Morocco (S. Kröpelin, pers. comm.; ROCZEN 2008): Also there an impressive standing ashlar site was located.

14. ZARINS 1997, AL-GHAZZI 2004; Gebel's 2010 reconnaissance at Rajajil, al-Jawf-Province.

15. Other aims were, aside of continuing the general survey, the documentation of recent Bedouin land use and gaining informal insights on opportunities for heritage education which may prevent local Bedouins from looting the region's graves of the area (works with J. Baumgarten in 2010-2011). Concerning objectives 1-3: Apart from standard survey and excavation techniques, field techniques included Differential GPS and georadar.

16. DAVIES 2000, 2005.

### CHRONOLOGICAL AND PALAEOENVIRONMENTAL DISCUSSION

It needs to be stressed that —as long as we do not have a substantial body of absolute dates— our research and verification of project hypotheses remain in their beginnings; it is a condition of arid land prehistory that this obstacle will persist for a long time, thus requiring patience. It explains the tremendous dating problems we have for the 5<sup>th</sup>-4<sup>th</sup> Millennium BC climate oscillations and the regional and supra-regional archaeological chronology, making the chronological question the core question of all our preliminary conclusions on the cultural and environmental developments.

Until 2010, our *fossile directeur*, the “fan scraper”<sup>17</sup> (**fig. 8a-e**) was the only dating evidence we had from the many burial and pen sites in the region. As general as this, also the “nature” of the structures supported the rough dating of Qulban Beni Murra —and sites with similar structures— to the Late Chalcolithic/EB if compared, for example, with evidence from the al-Naqab and Sinai<sup>18</sup>. However, the distinction between the Late Neolithic and Late Chalcolithic/EB occupations of pen camps is yet an unsolved issue.

The first radiocarbon dates could be obtained from the supposed insulation material (coating of the troughs) of Space 12 of the well/watering complex D15 in Qulban Beni Mura, attributing the structure to the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC<sup>19</sup>.

Concerning the palaeoenvironmental background of food-producing societies in arid Arabia: A Late Chalcolithic/EB “peopling” of the Arabian Peninsula by pastoralists would not have been the first climax of this kind. Recent studies by P. Drechsler<sup>20</sup> and by H. P. Uerpmann, D. T. Potts and M. Uerpmann<sup>21</sup> suggest already for the earlier Holocene a “PPNB-related” influx of “villagers and herders away from the deteriorating environment of the southern Levant as a result of the 8.2 ka BP event” onto the Arabian Peninsula<sup>22</sup>. Indeed, we may expect the intrusion of herding groups into the Arabian heartlands from the more favourite and crowded Levantine (and Zagros) regions (and even from the Hilmand/Baluchistan?) at any green desert event via land corridors or along the coasts. Several Early-Mid-Holocene records witness such green desert events by lacustrine environments from the Arabian Peninsula<sup>23</sup>, and possibly such events were more numerous than hitherto anticipated by the conservative concept of one major Mid-Holocene climatic optimum. All recent discussions, especially with respect to monsoonal influences, hint at several wet intervals or climatic optima between 4500 and 2500 BC<sup>24</sup>. And, possibly it is too simplistic to expect a one-way development towards oases economies

17. SCHMIDT 1996; ROSEN 1997. L. A. Quintero, P. J. Wilke and G. O. Rollefson reported recently on the long-sought quarries and production centres for fan scraper blanks and large percussion blades near al-Jafr; 79 recorded sites including large quarries over 12 ha in the area, and three trench mines (QUINTERO *et al.* 2002).

18. AVNER 2002. The few diagnostic small finds from our sites confirm a Late Chalcolithic/EB date, too.

19. The date KIA43373 is cal BC 4459-4346 (Two Sigma Range); the humic acid fractions of the same sample and of KIA43374 have to be considered too old (cal BC 5217-5018 and 5056-4894: Two Sigma Ranges), but they suggest that Sample KIA43374 could also be from the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC (A. Dreves, Leibniz Labor für Altersbestimmung und Isotopenforschung, Kiel University, in letter; J. Pokrandt, Kiel University, pers. comm.). All dates used in this contribution are calibrated BC dates.

20. DRECHSLER 2009.

21. UERPMANN *et al.* 2009, p. 211.

22. The 8.2 ka BP cold event (WENINGER *et al.* 2009) appears debatable, at least when rubble slides are quoted for its existence (cf. GEBEL 2009; Chr. Zielhofer, pers. comm.).

23. E.g. MASRY 1974, GEBEL *et al.* 1989, ARZ *et al.* 2003, LÉZINE *et al.* 2007; recently ENGEL *et al.* 2011.

24. A recent publication by M. Bar-Matthews and A. Ayalon on Mid-Holocene climate records from the Eastern Mediterranean Soreq Cave, Israel, gave evidence of wet events at c. 6550-6450 BP and 4800-4700 BP and a dry period between 5700-5600 BP; the evidence nicely shows “several short-lived decadal- to centennial-scale climatic events” between 7000-4000 BP (BAR-MATTHEWS & AYALON 2011). Contradicting results are reported by ARZ *et al.* 2003 from the northernmost Red Sea, indicating a decreasing rainfall from the end of the 6<sup>th</sup> millennium BC. The role of the N-S variations of the monsoon and the W-E variations of the Mediterranean influence for the climate of the North Arabian deserts is also ill-understood: Their preliminary understanding and often contradicting results do not allow yet more firm conclusions and a refinement of climate models.

on the Arabian Peninsula, instead it may be imagined that the oscillations rather caused a more complex and polycentric formation of Arabia's oases in the Early Bronze Age — respectively after 4000 BC —, after the larger part of the pastoral population had to abandon mobile life modes and continued to use their well technologies as permanent oases settlers in areas with higher water tables. This process is expected to be related to the so-called 5.2 ka BP event, respectively the so-called 6000-5000 BP “Rapid Climate Change” (RCC)<sup>25</sup>. We very well have to expect a number of regional onsets towards oasis economy, and developing oases economies may have shown greater regional variability than today. For all debates on our preliminary theses, the seminal and in parts surely disagreeing views of D. T. Potts<sup>26</sup> have to be consulted.

We have to expect that the 2<sup>nd</sup> half the Arabian Peninsula's 5<sup>th</sup> millennium BC was characterised by extensive steppes with lakes and waterholes<sup>27</sup> — like the Sahara<sup>28</sup> — and featured comparatively high water tables. These environments hosted large groups of mobile pastoralists who dug wells into the wadi floors and in the proximity of lake shores, fed their flocks also at (purposely built) watering places, constructed pens and human shelters, and gathered at burial grounds to perform their funeral practices, manifested identity by commemorating ancestral ties, and negotiated their social relations. With Rajajil<sup>29</sup> and possibly at Rizqeh<sup>30</sup>, Qulban Beni Murra represents the western fringe of many such centers of potentially complex shepherd societies — or palaeo-Bedouin societies — which once occupied all areas of the Arabian Peninsula<sup>31</sup> which provided higher water tables and lacustrine habitats during the moister phases of the Mid-Holocene.

#### THE QULBAN BENI MURRA AND THEIR SEPULCHRAL LANDSCAPE

The megalithic burial grounds of Qulban Beni Murra (also called Biyar Beni Murra) cluster on the shallow and dissected banks of Wadi Sahab al-Abyad between 30°03'50"/30°05'04" N and 37°14'35"/37°15'35" E (UTM Grid reference is: Zone 37, UTM-E 331000-332000, UTM-N 3327500-3329000); the inclination of the wadi floor is 867-865 m NN, according to the surveyor's measurement, and 869-865 m a.s.l. according to USGS SRTM3 data. The location is some 13 km N of the Saudi border (**fig. 2**).

25. STAUBWASSER & WEISS 2006, WENINGER *et al.* 2009. A recent study of the irrigation system at the Late Chalcolithic/Early Bronze Age site of Tall Hujayrat al-Ghuzlan near 'Aqaba (HEEMEIER *et al.* 2009) shows that standards have to be developed and implemented to distinguish irrigation at hydrologically favored places from oasis types of irrigation in the Late Chalcolithic/Early Bronze Age periods. Would field irrigation under the favored conditions of a Mid-Holocene climatic optimum or a favored hydrological setting during a dry period not have provoked a different adaptation of oasis-type irrigation, including its socio-economic distinctiveness?

26. POTTS 1997.

27. GEBEL *et al.* 1989, cf. also NOBLET-DUCOUDRÉ *et al.* 2000.

28. CLAUSSEN & GAYLER 1997.

29. ZARINS 1979. Rajajil is subject to planned investigations from 2012 by a joint project of the Saudi Commission for Tourism and Antiquities, Riyadh, and one of the authors (H. G. K. Gebel) in collaboration with M. Grottker, Luebeck and Chr. Zielhofer, Leipzig. Rajajil (**fig. 26-27**) is expected to be a “sister-centre” to Qulban Beni Murra.

30. KIRKBRIDE 1960, 1969; Underbjerg 2002.

31. AL-GHAZZI 2004.

The site was first investigated in the Forties of the past century by members of the Arab Legion and by Kirkbride and Harding<sup>32</sup>; a graffiti on one of the ashlar in Area E informs about a visit by members of the Royal Air Force. The site is registered in *JADIS* under Number 3694.001<sup>33</sup>.

The immediate site (Areas A-F, **fig. 5**) extends for some 1.5 km along both sides of Wadi Sahab al-Abyad; its area is more than one square kilometer, not including outlying grave structures<sup>34</sup>. The shallow *hammada* hills flanking the wadi reach heights of 12-14 m above the wadi bottom.

In terms of the site's post-occupational preservation it has to be reported that both natural and anthropogenic influence destroys the site: Considerable temperature changes between day and night (up to 35 °C) make most ashlar and set stones fracture *in situ*, deflation reduces cultural layers, erosion cuts shifting runnels into surfaces, and the harsh and dry *hammada* climate together with soil parameters make organic material vanish; heat pops may occur on the smallest flint artifacts. The weathered products then form the deflated pavement surfaces bearing desert varnish. These stone pavements are very sensitive, and any truck movement "hurts" the landscapes "skin". In addition, Qulban Beni Murra became subject of large scale surface scraping during the 2010 oil prospectations.

Many of the megalithic structure ashlar<sup>35</sup> are leaning, most have fallen down and are embedded in the deflating surfaces. However, Area A (**fig. 7**) has the most ashlar still standing upright. It is sometimes difficult to reconstruct ground plans by the position of the fallen ashlar. The patinated ancient petroglyphs and pecked imagery on the site's ashlar are continuously disappearing by heat fracturing of the stones' layers<sup>36</sup>. As mentioned already above, anthropogenic impacts on Qulban Beni Murra's preservation are ancient grave and stone robbing (including recycling ashlar for later structures?), ancient re-occupation of burials and wells, and recent extensive illicit digging for antiquities<sup>37</sup>; probably all graves in the region have repeatedly been disturbed and looted over the millennia.

The general characteristics of the site's areas differ considerably from each other, both in terms of structure types, organisation of space, image inventories, surface finds. This leads to the question whether we deal with a single occupation with different groups represented by different ceremonial manifestations, or if we deal with several re-occupations during the Late Chalcolithic/EB represented by different styles and finds. Functional diversity is also obvious for the non-megalithic occupations of the site, although the interpretation of the structures often remains tenuous. A more detailed summary

32. KIRKBRIDE & HARDING (1944; cf. also STEKELIS 1945) report that "in recent years" one well (their No. 5) was excavated by the Arab Legion: bedrock had been attained without reaching water (depth not recorded in the publication). It seems that the site witnessed another mission in 1961: A son of M. N. Abu Tayyib from al-Jafr reported to us in 2008 that his father had joined a British team excavating at Qulban Beni Murra during 1961, supplied by helicopters starting from the al-Jafr airfield. Although we were able to trace excavations at one of the well structures (and remains of beer bottles), we were unable to find (published) confirmation of this enterprise. We also could identify the guide of Kirkbride and Harding of in the early 40ties: it was al-Hibbel A. Abu Tayyib from al-Jafr; one of his sons told us that the work permission to excavate in Qulban Beni Murra was then provided that time by Glubb Pasha.

33. *JADIS* 1994, Section 2: 192, Section 3: 2.

34. The site's limits are not clear at all, since quite a number of Late Chalcolithic/EB structures are outside its main Areas A-G. Including the dispersed outlying structures, the site may stretch over some 2-3 km<sup>2</sup>.

35. "Ashlar" is defined as a large square-cut stone, found standing upright, leaning or resting in surfaces. Individual ashlar, triliths, or lines of ashlar are marking spaces. The Qulban Beni Murra ashlar are tabular blocks of local silicified tabular sandstone whose thickness and shapes depend on the layered metamorphic bedrock from which they were extracted or are eroding (on-site). In most cases, the natural fractures in the bedrock determined the shape of the ashlar, but also intentional fracturing and occasional shapening by flaking is observed. The Qulban Beni Murra ashlar are rectangular or triangular blocks with average dimensions of 90x60x25 cm (length from 70-250 cm, width from 50-120 cm, thickness from 20-40 cm). Several spots along the wadi and tributary runnels were extraction places, some still showing the extracted but unused ashlar lying around.

36. GEBEL & MAHASNEH 2009.

37. Bedouins from al-Jafr are those being most active in looting the graves of the region. E.g. the ashlar-line Cairn 11 of Wadi Sahab al-Asmar 8 — the grave where the basalt statue was found in June 2010 — was looted only 10 days after the mission had left the area. Modern looters even enter the flint layers of the bedrock beneath the bottom of the graves and tend to further smash their human remains!



description of the Late Chalcolithic/EB remains is presented elsewhere<sup>38</sup>. The high structural variability comprises megalithic, “pseudo-megalithic”, and non-megalithic grave structures; “horse-shoe structures”; watering/well complexes (**fig. 6**); domestic camp structures; ashlar mining and supply areas; water harvesting instalments such as dams and modified natural basins/gullies; and a number of megalithic features which seem to have had a special function. The cairn types in Areas A-H (**fig. 5**) are not yet completely understood and apparently show traces of re-building during re-occupations; basically we deal with various types of multi-chambered cairns with ashlar lines and trilith groups (e.g. **fig. 10,13**), single/double-chambered cairns/graves with trilith groups (**fig. 9,11-12, 14**), occasionally with “horse-shoe structures” (e.g. **fig. 11**), and circular structures of standing stones (**fig. 7**).

A site survey in 2006 revealed 218 prominent structures in Areas A-F (**fig. 5**); more were added in 2011 when we included southern Areas G-H to the site’s territory. All eight topographical site units show remains of post-EB occupations (e.g. historical and recent Bedouin graveyards, camp remains), and no pre-Chalcolithic periods have yet been found. The site is aceramic throughout (except for less than 5 sherds possibly related to the Late Chalcolithic/EB: Jamie Lovell, personal communication); its lithic inventories are dominated by fan scrapers (**fig. 8a-e**).

The topographical site areas (**fig. 5**) with their predominant Late Chalcolithic/EB structures are: southwestern wadi slopes: Areas A-C, separated by a runnel (A/B) and a small wadi (B/C); wadi floors: Area D; northeastern wadi slopes: Areas E-F, separated by a wadi; southern hillock and spur: Areas G-H.

Area A is characterised by a 130 m long chain of circular megalithic structures (Structures A15-31, **fig. 7**), composed of circular space/room clusters (some 8 clusters with some 29 circular rooms) and ca. 8 individual circular space/room structures; isolated megalithic circular space/room structures; megalithic cairn graves; including a large space E of A15-31 structured by an arrangement of large ashlar (ceremonial place?, sanctuary?). Test trenches in Structure A23a-24a clarified that at least the latest use of the circular structures was connected to interior stone pavements, chipping floors (apparently resulting from [re-]shaping fan scraper edges), deposition of animal bones; a domestic use in that phase of the building is probable. Like the houses in Tall Hujayrat al-Ghuzlan near Aqaba<sup>39</sup>, in Structures A15-31 (e.g. **fig. 24**) decorations of ibexes and four-legged animals were found<sup>40</sup>.

Area B is characterised by isolated, partly very large megalithic ashlar-line chamber cairns with triliths in their southeastern exterior spaces and a quarry-related ashlar field between Areas A and B. The cairn graves with standing interior ashlar rows show many signs of additive/subsequent burials and added/extended peripheral pavements/pavement terraces (e.g. **fig. 13**): rows of subsequent chambers resulted in huge stone accumulations, but single/double-chamber cairns also occur. Fields of stone debris resulting from ashlar shaping accompany the structures. The ashlar fields between Areas A and B have raw ashlar left after extraction from bedrock and initial dressing. Contrary to other areas, Area B offers quite a number of grinding stones (mainly handstones), hammerstones, and the few pieces of pottery (J. Lovell, under investigation). Several unshaped basalt pieces and two “mace heads” (**fig. 8f-g**) were found in Area B which seems also to be richer regarding the surface appearance of various stone types. Except for the figurative decoration on a standing ashlar of B39 (**fig. 23**), no other petroglyphs have yet been found in Area B.

Area C is characterised by a chain of isolated megalithic chamber cairns/graves with ashlar, often with annex chambers, stone alignments, and ill-preserved “horse-shoe structure”. No figurative or other stone pecking/decorations were found in Area C. Parts of the collective burials in chamber Grave C4 (recently looted, remains excavated by us in 2008 and 2011) were preserved articulated in the main chamber and in an attached smaller chamber; probably animals were also buried in C4. In the old refills

38. MAHASNEH & GEBEL 2008; GEBEL & MAHASNEH 2012.

39. SCHMIDT 2009.

40. GEBEL & MAHASNEH 2009, fig. 5-6.

and the back dirt left by looters, more than 60 beads were found, mostly (>50) made from a black and whitish mineral and carnelian, and (>12) from *Conus* sp. and *Dentalium* sp. The fills also contained, most interestingly, several fan scrapers and three fractured grinding slabs (one in each chamber)<sup>41</sup>. More burials exist on the hilltops E and SE of Area C.

Area D is characterised by at least 9 larger isolated mounds with multi-“chambered” structures and depressions (the watering/well complexes, cf. the section below) along the western margins of the present-day “active” wadi bottom, and isolated, partly gravel-buried megalithic chamber graves with fallen ashlar all over the wadi bottom. Petroglyphic evidence is restricted to tribal tags (mostly from the various sections of the al-Sherrart)<sup>42</sup>.

Area E is characterised by isolated large megalithic ashlar-line chamber cairns with/without triliths and ashlar fields/quarries in its lower parts. The area shows a high degree of structural variability (e.g. **fig. 10-12**). As it is common for this culture, the single-/double-/multiple-chambered ashlar-line cairns are marked by ashlar on their NE-SE sides, and often triliths of smaller ashlar to the SE. The two horseshoe-shaped structures (each ca. 2 x 2 m, **fig. 11**) nearby Cairn E5a (**fig. 11**), outlined by a double-row of small stone slabs (ca. 20 cm) set upright into the surface, are characteristic but rare features of the site.

Areas F-H represent the “interior” margins of Qulban Beni Murra and bear isolated and small clusters of ashlar-line (chamber) cairns with/without triliths.

The functional as well as the potential temporal differences between Areas A-H will be the subject of future investigations. One of the most demanding questions is if the domestic character of Area D is related to any — and if yes, to which — of the funeral functions of the site in Areas A-C, E-H, including D, and whether the chain of isolated and clustered circular structures of Area A (**fig. 5,7**) could be domestic or was related to the funeral ceremonies, or served both. The ibexes and four-legged animals in Structures A15-31 and of Cairn B39 are also present in houses/special buildings in the Late Chalcolithic/EB site of Tall Hujayrat al-Ghuzlan<sup>43</sup> (cf. the discussion in the section below).

Qulban Beni Murra’s chipped stone industry is mainly represented by amorphous flakes and fan scrapers<sup>44</sup> which are the only diagnostic tool (**fig. 8a-e**). Embedded in the site’s deflated surfaces, they are equally distributed throughout the site, but concentrations of fan scrapers seem to occur (e.g. the 16 fan scrapers 30 m E of Structure C22). No cores or other types of tools were found except for a few bifacially worked flakes. The density of the fan scrapers does not appear to be too high, compared with other sites of the region where frequently they are found with structures interpreted as animal pens (wool shearing and butchering instrument?). Since neither raw material nor cores or the typical waste have yet been found at Qulban Beni Murra, its fan scrapers are expected to be imports.

## THE CAIRN FIELDS

While the Qulban Beni Murra Late Chalcolithic/EB cairn fields are by far — due to their “megalithism index”<sup>45</sup> — the most impressive ones in the region, many other locations have cairn fields, even larger

41. Field diary in PURSCHWITZ & AL-AMAREEN 2008.

42. Cf. KIRKBRIDE & HARDING 1944, fig. 3.

43. SCHMIDT 2009.

44. Among others, basic works on this tool are SCHMIDT 1996, ROSEN 1997, and QUINTERO *et al.* 2002. STEKELIS 1944 investigated a sample of fan scrapers from Qulban Beni Murra, which he related to a similar industry he identified as Neolithic and called Kilwian from the Achatberg of Jabal Tubayk (cf. RHOTERT 1938).

45. The bedrock of Qulban Beni Murra is characterised by thick banks of a hard sandstone (BENDER 1975: Ks1, “white sandstone/silicified sandstone/brown coarse-grained sandstone” of the Lower Cretaceous/Santonian), overlain by shallow tabular flint formations. This silicified tabular sandstone tends to erode in layers, providing the raw material for the ashlar: Taken from suitably banked qualities of the exposed bedrock on the wadi flanks, it allows — unlike other areas — a megalithic expression of structures. Possibly the location of Qulban Beni Murra was chosen for this raw material aspect.

ones like Wadi Sahab al-Asmar 9 and 10 (**fig. 2**). Neither there are standards of field sizes in terms of extension and number of graves recognizable, nor in terms of their cairn's arrangement, internal density or structural heights and lengths. However, a tendency is attested to place cairns in lines on ridges. Isolated cairns, or groups of 2-3 cairns dispersed in the landscape, are also common. Depending on exposed bedrock, available stones, duration of use, the stone cover of cairns is pronounced or shallow; the use of standing ashlar is a matter of the locality's bedrock, but it might have been a prestige issue to occupy banked bedrock areas for cairn fields.

The term cairn is used here in a very general sense, meaning a pile of stone covering burials in built chambers, between set stones, or in pits. Cairns are oriented towards the rising sun: here either stones/ashlars or a line of stones/ashlars are delimiting the grave(s) space towards E. The grave chambers or pits are located to the west; it seems as if the eastern line of stones/ashlars and the stone cover of the burials were extended when new chambers/pits were added. The ground plan of a larger ashlar-line chamber cairn tends to be D-shaped (**fig. 13**; a type also attested in Rajajil, cf. **fig. 26**). Often the cairns have smaller ashlars standing in groups of three (triliths) in their SE, and in addition very large cairns like Qulban Beni Murra B39 (**fig. 13**) have pavements in their perimeter. It is not understood yet why there is a considerable difference in the amount of stones piled up: Either this results from re-using material from deserted graves, or this has to do with an Iron Age/Thumudian re-use of the Late Chalcolithic/EB cairns (like one in the Wadi Sahab al-Asmar 10 cairn field, having Thumudian inscriptions).

A particular variation of the ashlar-line chamber cairn appears to be "chequerboard pattern" ground plans of 2-3 chamber rows behind each other (extending westwards), e.g. cairns Wadi Sahab al-Asmar 8:11 (**fig. 3**) and 9:41-42 (a type also attested in Rajajil, cf. **fig. 27**); in such structures standing ashlars may appear inside a cairn's ground plan.

The 2011 rescue operations at the looted cairns of Wadi Sahab al-Asmar 8:11 and 9:41-42, as well as in Qulban Beni Murra Cairn C4, secured information for the remaining anthropological material and grave goods. As explained above, it became evident from layers not touched by recent looters that these graves had been disturbed/looted at least once before. In the cases of Wadi Sahab al-Asmar 9:41-42 it is most likely that this happened in Late Chalcolithic/EB times, and seemingly there also was some intentional fracturing of human remains on which a fire burned (ritual "cleansing" of a burial?). Above it there is another dense layer of fractured human bones. The amount and preservation of the secured human remains from the aforementioned burials appear sufficient for basic insights into the Late Chalcolithic/EB population of the area. The excavation of cairns Qulban Beni Murra B16 and G1 and of Asmar 6:1 and 35 just revealed the grave structure (ashlar lines facing east with cairns/cairn chambers attached to the west) but provided no preserved human remains.

Most likely the cairns of the region belong both to the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC, and to the (earlier?) 4<sup>th</sup> millennium BC. At least we have some first radiocarbon indications (on human bones) for the 4<sup>th</sup> millennium (a cairn of Wadi Sahab al-Asmar 9- field), meaning that they coexisted with the well/watering structures of Qulban Beni Murra and the later pen camps of the (early?) 4<sup>th</sup> millennium (cf. **table 1**).

### THE WELL/WATERING COMPLEXES

The investigation of the hydrological setting of Qulban Beni Murra (by P. Keilholz) revealed that the major aquifer of Wadi Sahab al-Abyad was fed by two additional local aquifers immediately upstream of the well structures; Keilholz's earlier insights — that this favoured situation must have been supported from a sub-surface narrowing of the bedrock (the "QBM neck") pressing up the aquifers' water in the area of the wells — has been confirmed by the georadar and hydrological 2011 survey of B. Khrisat and P. Keilholz.

The Chalcolithic well/watering complexes rest in small mounds formed by the reddish insulation material (cf. below) and are slightly covered by the present surrounding *hammad* flats and active wadi

beds (cf. above). The ground plans of these multi-spaced “buildings” (e.g. **fig. 15-16**) are outlined by single-row and single-course walls/“wall-ettes” made of upright slabs and small ashlar. They form clusters of curvilinear, polygonal, oblong, and suboval spaces sharing their walls. Each complex has some 12 to 24 such spaces which often are further subdivided by ashlar/slabs (“compartments”), as well as a central or marginal depression (the well). It is connected to one or two (oblong) corridor-like spaces with lengths between 1.5 to 10 m, ending in a roundish or curvilinear space (e.g. **fig. 15**). Each complex has 1-3 spaces with interior stone piles, and ashlar still standing. The surfaces of the circular-oval depressions (diameters 2-8 m) are ca. 0.5 to 1.0 m deep and filled with sand. These depressions, all located along the major wadi course, are expected to indicate well mouths/rooms once tapping the aquifers at their highest level <sup>46</sup>.

One (D15) of the well mounds was excavated in 2008 (and again sounded in 2010); the structural remains are placed in a small mound composed of an enigmatic reddish and silty soil and the well digging gravels, resting on the Mid-Holocene wadi floor: the ground plan (**fig. 15**) includes a “well room” with a staircase leading to the well’s mouth (**fig. 17** left). The “well room” is joined by stone-paved curvilinear Spaces 3a-b and 4a-b as well as two tongue-shaped structures with end rooms (Spaces 7-9 and 10-11, up to 10 m long; **fig. 15**) which seem to represent trough lines with “compartments” leading away from the “well room”. The manual excavation of the well shaft did not reach its bottom and was stopped at 4.4 m <sup>47</sup>: Its upper part (1.2 m) is made of corbelling masonry (**fig. 17** right) and rests on (rather solid) wadi deposits into which small cavities were set to serve as steps/ledges/supports (**fig. 17** right); the vertical shaft is some 1.2 m in diameter. The paved spaces (not all troughs?) were lined and “chambered” by upright (0.5 m) standing slabs (**fig. 16**), and their gradient bottoms reached their highest points close to the well’s mouth. The gaps in the outer slab alignments must have regulated the access of the animals and would otherwise have been too high for ovicaprines.

The eroded reddish silty and very compact sediment in which the structural elements of the well/watering complexes are embedded appears to have been the insulation material <sup>48</sup> of the troughs; mixed with water, this material hardens to a “sherd”-like consistency.

The Chalcolithic date of the well is confirmed by radiocarbon dates to the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC (cf. above); fan scrapers were found in the areas of the well structures. It cannot be ruled out at all that the well shafts were re-excavated in later times. However, the partial excavation of Complex D15 showed unpatinated Late Chalcolithic/EB chipped stone material within its sand fill at about -2.5 m; but certainly this has no dating value, since the material could have intruded anytime later from disturbed Late Chalcolithic/EB layers.

The presence of well technology at Late Chalcolithic/EB Qulban Beni Murra would not be a particularly striking find <sup>49</sup>. What makes the find outstanding is the instance that pre-oases wells from present-day arid and hyper-arid Arabian lands are unknown or extremely rare <sup>50</sup>. The nearest and possibly Late Chalcolithic/EB well at Qulban Beni Murra is mentioned by J. Zarins <sup>51</sup>; it is located ca. 1 km W of Rajajil and has “small stone-lined troughs”.

46. Seemingly KIRKBRIDE & HARDING 1944 were convinced that the wells were from sub-recent times.

47. Work became too dangerous at this depth (claustrophobic reaction, breathing difficulties, moisture and flies, distrust in the stability of the wadi gravels).

48. Analysis and report by J. Pokrandt and others (POKRANDT in prep.).

49. Wells are known since the Early Neolithic of the Eastern Mediterranean (e.g. GALILI & NIR 1993, PELTENBURG *et al.* 2001, GARFINKEL *et al.* 2006), as well as other ways of water management (e.g. aquifer tapping in gorges, cisterns, and water/soil retaining walls; GEBEL 2004; FUJII 2006, 2007, 2010). There is yet no evidence allowing to link this sedentary (and seasonal) Early Neolithic water management with the 5<sup>th</sup>-4<sup>th</sup> millennium BC well/lake and oasis cultures of the Arabian Peninsula.

50. E.g. the work of U. Avner, which surveys all Late Chalcolithic/Early Bronze Age sites of the Negev and Sinai, only once mentions wells for the periods under consideration (AVNER 2002, p. 25, fig. 2, p. 84-85).

51. ZARINS 1979, p. 76.

### THE PEN CAMPS

Although Wadi Sahab al-Abyad 14 had been found already in 2001, it took us until surveying Wadi Sahab al-Asmar in 2010 to understand that it represents a camp-like settlement typical for areas with *inselbergs*. It seems that *inselberg* foothill zones are the specific settings for aceramic camp sites (Wadi Sahab al-Abyad 14, **fig. 18**; Wadi Sahab al-Asmar 6, **fig. 19-21; 16; 20, fig. 22; 21 and 23**), characterised by large (20-30 m) and small (3-5 m) circular and sub-circular enclosures/structures (sometimes in terraced succession, interpreted as pens, silos, habitation structures), terrace walls, various types of ground plans of unknown function (possibly some had ritual functions), hearths, platforms, cairns with/without ashlar/ashlar lines and other grave types, isolated (groups of) ashlar, rare ibex and other rock art. Dam-like terrace walls may occur along a camp's former wadi flank (e.g. Wadi Sahab al-Asmar 21); at another site (Wadi Sahab al-Asmar 16), a wadi-side field of large boulders in addition appears to have served as a "breakwater" structure. Where bedrock allows, structures can be megalithic; the structural diversity and horizontal stratigraphy of the sites is a challenge to understand. The size of the camps is 200-300 m in length and 50-100 m in width. The *inselbergs* must have functioned as windbreaks and as barriers/diversions for the aquifers and surface waters, making them ideal places to collect water by wells or *mshash* pools<sup>52</sup>.

The camps didn't use pottery, are characterised by chert and quartzite flake industries with fan and other scrapers, and have very few grinding tools. Wells and watering complexes, if not also gardens, are expected to have been buried by the wadis' post-occupational gravels, as it is true for some of the camps' structures; future geo-electric resistivity or geo-radar surveys may help to locate these. Some of the deflated camps seem to indicate a horizontal stratigraphy (e.g. Wadi Sahab al-Abyad 14, **fig. 18**), representing at least two occupations with domestic/pen and funeral functions. It might also be that locations other than the *inselberg*/outcrop areas carried camps in the region, and that geomorphological reasons are responsible for finding only those associated with *inselbergs*/outcrops. Although we call these sites "camps", their functional diversity, extensions, and seasonality may justify the term settlement.

Several structures were excavated in Wadi Sahab al-Asmar 6 (**fig. 14, 19-21**); they prove a functionally diversified structural occupation mainly represented by large curvilinear (animal) enclosures, smaller circular (domestic) structures (with shelter walls and bin-like supply structures at their interior perimeter, fireplaces, and floor pavements, often with central ashlar; (**fig. 21**) and silo-type features (**fig. 20**).

We are at the beginning of our study of these exciting sites, and have to await the first radiocarbon dates; although they possibly have Late Neolithic features (or are of Late Neolithic origin), some of their occupations may date in the 4<sup>th</sup> millennium BC, probably between 4000-3500 BC (fan scrapers, ashlar-line graves). We would not rule out that the sites represent early (but unsuccessful) manifestations of sedentary life in region, using remaining hydrologically favoured habitats for fields if not oasis-like horticulture (cf. the section on the Project Theses). The pens' function may not have been restricted to animal keeping; their dung may have provided seasonal fields, too. Like all 4<sup>th</sup> millennium BC settlements on the Arabian territories they would have their cairn lines/fields on the ridges nearby.

### THE ICONOGRAPHIC INVENTORY AND THE "COMMONSENSICAL IBEXSCAPE"

Our iconographic record for Wadis Sahab al-Abyad and al-Asmar comprises:

- Ibex/animal petroglyphs from Qulban Beni Murra;
- Ibex/animal petroglyphs from several sites of the region (e.g. Wadi Sahab al-Asmar 38<sup>53</sup>);

52. GEBEL *et al.* 2011: *mshash* pools are shallow (1-3 m) artificial water pools or holes with diameters ranging from 3-10 m. They collect seasonally available water; as opposed to wells, the *mshash* are not fed by perennial aquifers but by seasonal surface or sub-surface water, e.g. by seasonal slope springs as it has to be assumed for the *Mshash* Sahab al-Asmar.

53. MAHASNEH & GEBEL 2008, fig. 17-18.

— The statue fragments from Wadi Sahab al-Asmar 8:11 (**fig. 25**<sup>54</sup>).

Since rock and ashlar petroglyphs in general are difficult to date, and the find context of the statue fragments was the stone cover of a cairn, some dating considerations have to be presented at the beginning: It is our conviction that the ibex/animal petroglyphs discussed are of Late Chalcolithic/EB origin for the following reasons (apart from their general context with Late Chalcolithic/EB structures):

— The depictions on a central ashlar of Cairn B39 (**fig. 23**) and on the ashlars of the Round Structure Cluster A27 (**fig. 24**) and other Area A circular structures show an identical style resembling Hecht's well-dated fig. 4e<sup>55</sup>.

— The depictions are not randomly distributed like the *wasms* (sub-recent/recent tribal tags in the area) and occur in confined Late Chalcolithic/EB structural contexts; they are also related to basic functional elements of the structures (B39: central ashlar of the cairn; A27 and others: interior ashlar wall of circular structure). This indicates that they must be contemporary with the use of the cairn and the circular structures.

— Techniques and patination differ clearly from those of the subrecent and recent *wasm* that are found on many of the standing and fallen ashlars at the site.

— The depicted wild animalscape of Qulban Beni Murra's ashlar has a good analogue in the well-dated mural decorations found in Tall Hujayrat al-Ghuzlan (1<sup>st</sup> half of the 4<sup>th</sup> millennium BC), a site situated upon the alluvial fan of Wadi al-Yutum that enters Wadi Araba to the north of Aqaba<sup>56</sup>.

Thus we conclude that the petroglyphs discussed here are related to the function of the structures and date to the Late Chalcolithic /EB.

For the date of the two sculpture fragments we only have the evidence of their Late Chalcolithic/EB find context. The problem is that we do not have yet a safe understanding of the Late Chalcolithic/EB style of sculptures from the arid lands: Our finds definitely do not match the Rizqeh stelae believed to be Chalcolithic<sup>57</sup>.

Petroglyphic art is rare in Qulban Beni Murra<sup>58</sup> and the wadi systems around and is confined to specific buildings or certain rock outcrops. The two major discoveries<sup>59</sup> from Qulban Beni Murra's Structures A27 and B39 are presented here. One evidence relates to a broken but still standing ashlar belonging to the central line of 4-5 standing stones of Cairn B39 (**fig. 23**); the depictions were applied to the eastward facing side of the ashlar/structure. B39 is the largest cairn at Qulban Beni Murra; it features a successive occupation, a central row of standing ashlars, peripheral terrace pavements, and groups of three standing stones (triliths) in its SE part. The second occurrence of petroglyphs is associated with the 130 m long chain of circular structures in Area A; each of these circular structures has an interior diameter of between 3 and 5 m and features interior stone pavements and chipping floors. While B39 clearly represents a burial mound, the circular structures in Area A may have been structures related to the accommodation of the mourners and/or the practice of funeral rites at the site. Circular Structure A27 displays ibex/animal depictions on two standing ashlars (**fig. 24**) as well as upon the fragment of a fallen ashlar<sup>60</sup>; their depictions face inwards, i.e. towards the interior of the circular room<sup>61</sup>.

Technically, the petroglyphs were made by extensive pecking and engraving. Hecht's stylistic overview on ibex depictions from the Aqaba area serves as a very useful formal tool to address style,

54. GEBEL *et al.* 2011.

55. HECHT 2009.

56. SCHMIDT 2009.

57. KIRKBRIDE 1969, but cf. UNDERBJERG 2002. Similar "stelae" are known from al-Ma'akir/Qaryat al-Kaafa (al-Ha'il), from near al-'Ula (FRANKE 2012), and many other places including sites in Yemen.

58. Many of the rock engravings on the tabular silicified sandstone ashlar of Qulban Beni Murra may have vanished by erosion.

59. Isolated depictions are also found upon other structures (especially on ashlars of the circular structures in Area A), but these are sometimes difficult to identify due to their poor state of preservation.

60. GEBEL & MAHASNEH 2009, fig. 6.

61. Like for the houses/special buildings in Tall Hujayrat al-Ghuzlan near Aqaba (SCHMIDT 2009), in Structures A15-31 decorations of ibexes and four-legged animals were found (e.g. GEBEL & MAHASNEH 2009, fig. 5-6).

although the question is to what extent style is influenced by the bedrock type/quality upon which it is used: indeed, our ibexes from Qulban Beni Murra come close to his Style fig. 4:e. They differ clearly from the more slender animals of Wadi Sahab al-Abyad 38 of the area (“Ibex Rock”<sup>62</sup>) which we date to the Neolithic<sup>63</sup>; the ibex findings of Qulban Beni Murra do not show an extreme over-sizing of the horns’ diameters as is the tendency in the Neolithic.

No real scenic or group motifs were found in Qulban Beni Murra; rather, individual depictions populate more or less isolated the surfaces of ashlar. Apart from the well-identifiable ibex, all other animals are difficult to identify. In many cases, it is only evident that they represent four-legged creatures. However, some depictions are very close to Schmidt’s “predators” (Schmidt 2009). S. Fujii<sup>64</sup> presented convincing arguments that the slender long animal with short legs represents a cheetah and that it appears in hunting contexts, since the animal can be trained to assist hunting; Fujii offered many examples from prehistoric to medieval times from several parts of the world. In addition to the animals, unknown signs were also applied to the surfaces. No hand motifs or “worshippers” (cf. below, Hujayrat al-Ghuzlan) are attested.

The depictions of Qulban Beni Murra Area A and B39 rather reflect a common but restricted animal symbolism that was confined to the ibex<sup>65</sup> and (a) four-legged animal(s). This led to the understanding by one of us (H. G. K. Gebel) that —iconographically— Wadis Sahab al-Abyad and al-Asmar belong to the “Commonsensual Ibexscape”<sup>66</sup>: Our region is located at the junction of the *badiya*, the northwestern Arabian deserts, and the Wadi Araba/Sinai/al-Naqab rock art regions.

The ibex rather represents a motif of the mindscape of the people using the area. Since the animal petroglyphs are attested in primary (B39) or secondary (A27) sepulchral contexts, the question arises whether these depictions reflect an association with funeral rites or are just popular motifs representing a general veneration of these wild animals. I.e. whether they had a specific magical meaning, and/or whether they were part of the ritual/belief system of the Qulban Beni Murra shepherds. A specific sepulchral background of the Qulban Beni Murra ibex/animal depictions should be excluded since these motifs also occur in many other Late Chalcolithic/EB contexts. As of yet, we understand the depictions of Qulban Beni Murra rather as a reflection of a common but restricted animal symbolism that was confined to the ibex and (a) four-legged animal(s), representing a more unspecific commonsensual (as well as decorative?) iconography of veneration not specifically related to ritual contexts. If we deal with cheetah-ibex motifs it must not mean that we necessarily deal with hunting scenes in their Late Chalcolithic/EB context: Like for the Mesopotamian symbolism, these two animals may reflect a mythological perception of a religious idea.

The stone cover of Cairn 11 of the non-prominent —probably due to missing bedrock qualities for large ashlar— cairn field Wadi Sahab al-Asmar 8 became the location of two extraordinary sculptural finds<sup>67</sup>: a columnar basalt statue fragment (**fig. 25**, statue became called “Dalish”) and a statue head of calcareous sandstone. The cairn is a multi-chambered Late Chalcolithic/EB ashlar-line cairn oriented to the east and overlooking Wadi Sahab al-Abyad.

The basalt fragment represents a statue’s head and abdomen (length is 35 cm); it most probably shows a male with thick lips or a beard, a long nose, ear depressions, and expressive eye depressions<sup>68</sup>. The most intriguing features are two grooves around the head’s front and sides, and the neckline-like feature of a shirt or robe on the chest. Do these date the *aqal/dishdasha* dress as far back as ca. 4000-

62. MAHASNEH & GEBEL 2008, fig. 17-18.

63. Cf. also RHOTERT 1938.

64. Lecture at the 11<sup>th</sup> International Conference on the History and Archaeology of Jordan, Paris, 2010.

65. The ibex depictions of Qulban Beni Murra should not —at least— reflect an element of the immediate animalscape of the former site’s steppic environment, particularly since these animals are inhabitants of mountainous areas such as Jabal at-Tubayk to the south.

66. Cf. GEBEL & MAHASNEH 2009.

67. GEBEL 2010.

68. For the exact measurements and description of the features (of both statue fragments) cf. GEBEL *et al.* 2011.

3500/3000 BC? The piece was made of columnar basalt with a natural subtriangular section which facilitated the triangular to the plano-convex section of the statue's later shape. However, considerable pecking work must have been invested to further sculpture the raw shape, especially the chest's grooves, the "beard", the relief of the mouth/nose/eyes area, the grooves of the "aqal" and the round shapes of the front and upper part of the head. A reduction of the section below what was to become the head created the distinctly elaborated shoulders, from which no arms lead off. Induced by the nature of the raw material, the body/chest is parallel-sided and has the same width as the head. The head is designed in rather an abstract way, with large eye depressions between which a very long and parallel-sided nose starts to run vertically downwards, limited by a larger groove not connected with the neck's incision. The front of the head is high, and the proportions given to eyes and nose are remarkable<sup>69</sup>. The depressions of the eyes could have hosted applications (suggested by features on the other fragment, cf. below).

The second sculpture fragment<sup>70</sup> represents a head similar to that of the basalt statue: at least the left ear is indicated by a depression. Further similar features are the long nose, a "bulge" which here may represent lips. A striking and strange feature is the way in which the eyes are worked. On both sides of the upper nose two pairs of conical drillings were made, probably for an application to mark the eyes. The fracture above the neck and directly in the groove below the "lips" is probably related to the weakest part of the piece.

#### **THE PROJECT THESES: FROM STEPPE PASTORALISM TO OASIS HORTICULTURE (4500-3500/3000 BC)**

The Eastern Jafr J.A.P. follows explicit project hypotheses which are steadily modified according to each season's results. Through this, our interpretative frameworks are generated by verification and falsification and remain transparent and checkable throughout the years. The refined hypotheses based on our current data are presented below.

The project theses aim to approach the question of a climatologically induced transition from unknown mobile shepherd cultures of the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC to sedentary oasis life after 4000 BC, contrary to the understanding that the introduction of oasis socioeconomy is the result of a climatic optimum. We anticipate that parts of Jordan's southeastern *hammada* not only belonged to the long-distance pastoral networks of the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC of the Arabian Peninsula, we also expect that our research area was one of Arabia's incubator regions for the historically new oasis life-mode, whether or not it ended with a successful establishment of oasis life or found other ways of pastoral adaptations to the worsening natural conditions of the area after 4000 BC.

Our theses had again to be refined after we found in 2010 that pastoral people must actually have settled in the area on a (semi-) sedentary basis: Either the *inselberg* pen camp sites are 1– only Late Neolithic (representing a 6<sup>th</sup> millennium BC moisture phase), or 2– they represent onsets of seasonal settling in the region during the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium (Thesis 3), or 3– they were re-occupied in the period when the climate deteriorated and forced the shepherds to settle seasonally at hydrologically still favoured locations after 4000 BC (cf. above and Thesis 4), or the pen camps were visited during all three periods (**Table 1**; considers 2 and 3).

69. Similar proportions/styles are known from Pre-Pottery Neolithic sculptures and figurines (e.g. the famous green amulet head of LPPNB Basta; HERMANSEN 2004, fig. 2) which have been interpreted as of phallic meaning. Z. Kafafi interprets the Wadi Sahab al-Asmar- piece as the representation of a phallus, stressing its clear anatomical details like e.g. the neckline (personal communication). The Neolithic affinities of the piece may remember that certain iconographic features could have survived or were shared between cultures, or even that our pieces were "culturally recycled" in the Late Chalcolithic/EB and are of Neolithic origin. But this would make the sculpture fragments even more a sensation.

70. GEBEL *et al.* 2011, fig. 14.



The current project theses are the following ones <sup>71</sup>.

### *Hypothesis 1*

The extensive burial fields in the Wadi Sahab al-Abyad/al-Asmar region testify to aceramic Late Chalcolithic pastoral societies before 4000 BC whose subsistence and progressive population dynamics were favoured by a/the so-called Mid-Holocene climatic optimum/optima of the Arabian Peninsula, when the peninsula was characterised by extensive steppes, extensive aquifers with high water tables, and lake environments. Wells and watering stations in unfavourable areas allowed to cross and to exploit also such dry lands. These conditions not only sustained a progressive productivity of flocks, they also provided the pastoralists with large wild ungulate populations for hunting and possibly the nutritional value of wild date stands, easy to store and transport over long distances. Qulban Beni Murra has to be considered as one of the sepulchral and ceremonial regional centres of these hitherto unknown pastoral chiefdoms who based their migratory systems on well sites <sup>72</sup>.

### *Hypothesis 2*

In this period, the tribal modes of organisation established as a sustainable and prevailing social identity, with the specific (palaeo-) Bedouin territoriality and environmental knowledge and adaptation to (semi-) arid regions as known until today. Networks of these pastoral “green-desert” cultures during these optimum times of the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC existed from the Sinai to the regions east of Riyadh and in Yemen, belonging to a “Mid-Holocene Green Saharo-Arabian Pastoral Belt” stretching from the Sahara to the Oman/Yemen. The long-distance contacts of the pastoralists created similar cultural and ideological milieus. Early Egypto-Mesopotamian links may have used such pastoral networks via the al-Jawf/al-Naqab/Sinai regions for a direct exchange.

### *Hypothesis 3*

In favourite locations —especially at the major corridors with/without access to the routes of migratory ungulates habitats and favourite hydrological settings— already during these wet periods locally restricted (horizontal) transhumant patterns established and showed tendencies for a (seasonal) philopatry/sedentism, supported by their nutritional offer. However, this does not rule out that islands of permanent occupation continued to exist parallel from the PPNB on the Arabian Peninsula, remaining in post-Neolithic socio-economies.

### *Hypothesis 4*

When conditions got drier and colder in the 1<sup>st</sup> half of the 4<sup>th</sup> millennium BC (“Rapid Climate Change” period from 6000-5000 BP; Weninger et al. 2009) and the steppe habitats disappeared in many regions,

71. The basic ideas of the hypotheses have been developed by one of the authors (H. G. K. Gebel) in 2006, and are updated since then. He acknowledges the theses’ discussion he has with J. Pokrandt since 2010 who follows questions related to the progenitors of the oases cultures on the Arabian Peninsula, and their palaeoecology, in a PhD thesis (Pokrandt in prep.). It has to be stressed that our project theses try to link regional insights with a potential supra-regional trajectory on the Arabian Peninsula.

72. We follow the preliminary understanding that these mobile life modes must have been based on (middle-long range) migration between summer and winter pastures, maintained by interacting socio-territorial and ecological constraints. Research has to find eventual evidence of summer seasonality in the Qulban Beni Murra environments (as it has to be expected for this period in parts of the Wadi Sirhan Basin). One of the major questions is whether such sites belonged to isolated nets operating central burial grounds and ceremonial sites, or if they were shared locations in a complex web of rival tribes, representing the basis for even long-distance contacts across the Arabian Peninsula?

major parts of the hitherto mobile herders concentrated at remaining water-rich locations; regressive population dynamics were associated with this development. Mobile pastoralists became sedentary oasis horticulturalists while maintaining their tribal organisation/identity and well-related water management: They used their experience in well building and channel-type watering systems/troughs for the new oasis irrigation systems while domesticating the wild date palm growing at these water-rich locations: here gardens were created, and the roofs of palms leaves provided protection from sun and created “green house” micro-climates. A new, innovative and sustainable economy developed from a climatic change which the major part of the steppe populations on the Arabian Peninsula must have experienced as a destruction of their mobile life-modes. If Wadis Sahab al-Abyad/al-Asmar participated in this development, Mshash Sahab al-Asmar <sup>73</sup> may have been a location for such an oasis.

### *Hypothesis 5*

Depending on the natural, locally remaining water supplies during aridisation in the 1<sup>st</sup> half of the 4<sup>th</sup> millennium, Wadis Sahab al-Abyad/al-Asmar may either have been:

- An “incubator region” for the new oasis economy (whether finally successful or not);
- Become an area of a much reduced mobile pastoral life existing parallel to developing early oases at more remote and more favoured locations;
- A region from which mobile pastoral life and seasonal (settled) life disappeared to a large extent. Cairn fields would have continuously used/established by all three scenarios, of course in various intensity.

### *Hypothesis 6*

The Middle East’s sedentarisation trajectory (which started with the Neolithisation in the moderate and semi-arid zones and may have allowed to populate more arid areas by barrage water management <sup>74</sup>) was finally completed in the 4<sup>th</sup> millennium BC for the Arabian Peninsula’s arid zones, by an ecologically forced adaptation from well/lake-based pastoral life to channel-based oasis life.

## CONCLUSION

Many areas of the Arabian Peninsula must have witnessed higher precipitation, filled aquifers, (seasonal) lakes and vast steppe pastures during the early parts of the Mid-Holocene <sup>75</sup> / the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC, bringing pastoral life to hitherto dry and remote areas like Qulban Beni Murra. While limited pastures would have existed even in dry periods, allowing to sustain limited flocks year-round, the availability and reliability of a minimum of surface water for seasonal water access/ of reachable aquifers is indispensable. This certainly was the frame in which regions could participate to different extends in pastoral and oasis developments, and we have to expect a complex and regionally diversified pattern of “pastoralization” and “oasization” of Arabia <sup>76</sup>: The mid to late 5<sup>th</sup> millennium BC environments hosted large groups of mobile pastoralists who dug wells into the wadi floors and in the proximity of lake shores, fed their flocks at (purposely built) watering places, gathered at burial grounds, and may have developed already sorts of seasonal or permanent occupations. The region of Qulban Beni Murra may have participated in the latter developments. The following transition from the pastoral well cultures of

73. GEBEL *et al.* n.d.

74. FUJII 2006, 2007, 2010.

75. GEBEL *et al.* 1989, NOBLET-DUCOUDRÉ *et al.* 2000, LÉZINE *et al.* 2007; BAR-MATTHEWS & AYALON 2011 for the Eastern Mediterranean, and CLAUSSEN & GAYLER 1997 for the Sahara; H. Brückner and his team report a reduction of the Tayma lake’s size, northwestern Saudi Arabia, from 4000 BC onwards (ENGEL *et al.* 2011).

76. Even a polycentric and “time-shifted” introduction of oasis economy.

the late 5<sup>th</sup> millennium BC to well-based oases cultures at the beginning of the 4<sup>th</sup> millennium BC must be linked to the climatic deterioration of the 6000-5000 BC “RCC”, possibly culminating in the so-called 5.200 calBP drought event <sup>77</sup>. If Mid-Holocene Wadis Sahab al-Abayd/al-Asmar were more sensitive to drier and colder conditions than other parts of the Arabian Peninsula, the occupational character of our research area could have started to change from around 4000 BC. Whether the Wadi Sahab al-Abyad/al-Asmar region could or could not participate in a local “oasization”: Gebel’s hypothesis that mobile well-building shepherd societies became the origin of well-building oasis societies using a similar social organisation may characterise the overall historical trajectory of the arid Arabian Peninsula. The fortified well may have been the central element of the first oases’ living quarters <sup>78</sup>, sustained by channel irrigation and shadow gardening under the domesticated date palm. However, the introduction of oasis economy completed the sedentism trajectory in the Arabian Peninsula.

Future research has to substantiate this preliminary understanding, but one already may say that Qulban Beni Murra opened a new chapter of Jordan’s history, linking it to Arabia’s great past of innovative environmental adaptations to dry lands.

77. STAUBWASSER & WEISS 2006, WENINGER *et al.* 2009.

78. E.g. Early Bronze Age Hili 8, al-Ain/Buraimi Oasis, Abu Dhabi Emirate (CLEUZIQU 1989, CLEUZIQU & CONSTANTINI 1989) or the early oases in Oman’s Interior (FRIFELT 1985).

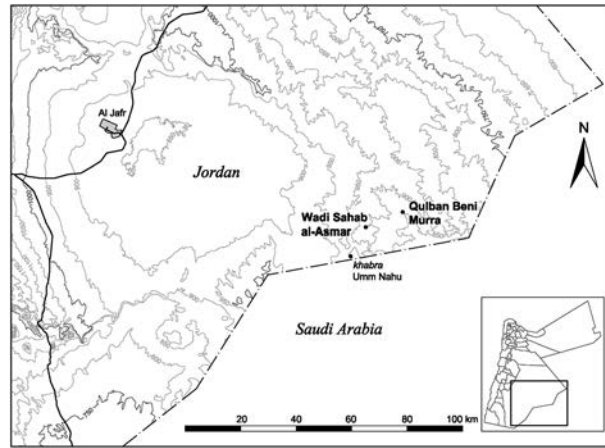


Figure 1. Location of Qulban Beni Murra in Wadi Sahab al-Abyad and of Wadi Sahab al-Asmar in the southeastern deserts of Jordan. (© P. Keilholz).

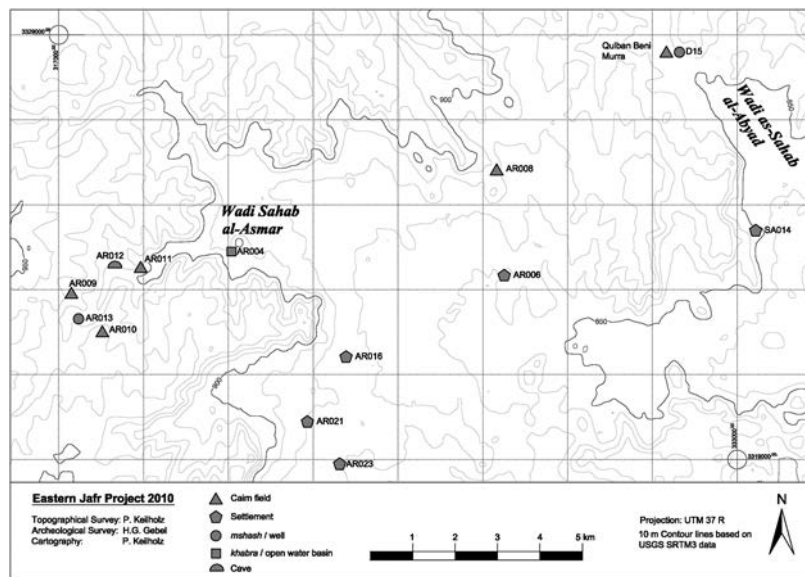


Figure 2. Map of the immediate research area in the Wadis Sahab al-Abyad/al-Asmar drainage system, major sites. (© P. K.).



Figure 3. Wadi Sahab al-Asmar 8: Multi-chambered ashlar-line Cairn 11, looted in 2010. View from N. (© H. G. K. Gebel).



Figure 4. Qulban Beni Murra: Beads from the looter's back dirt of Grave E44 (© H. G. K. G.).

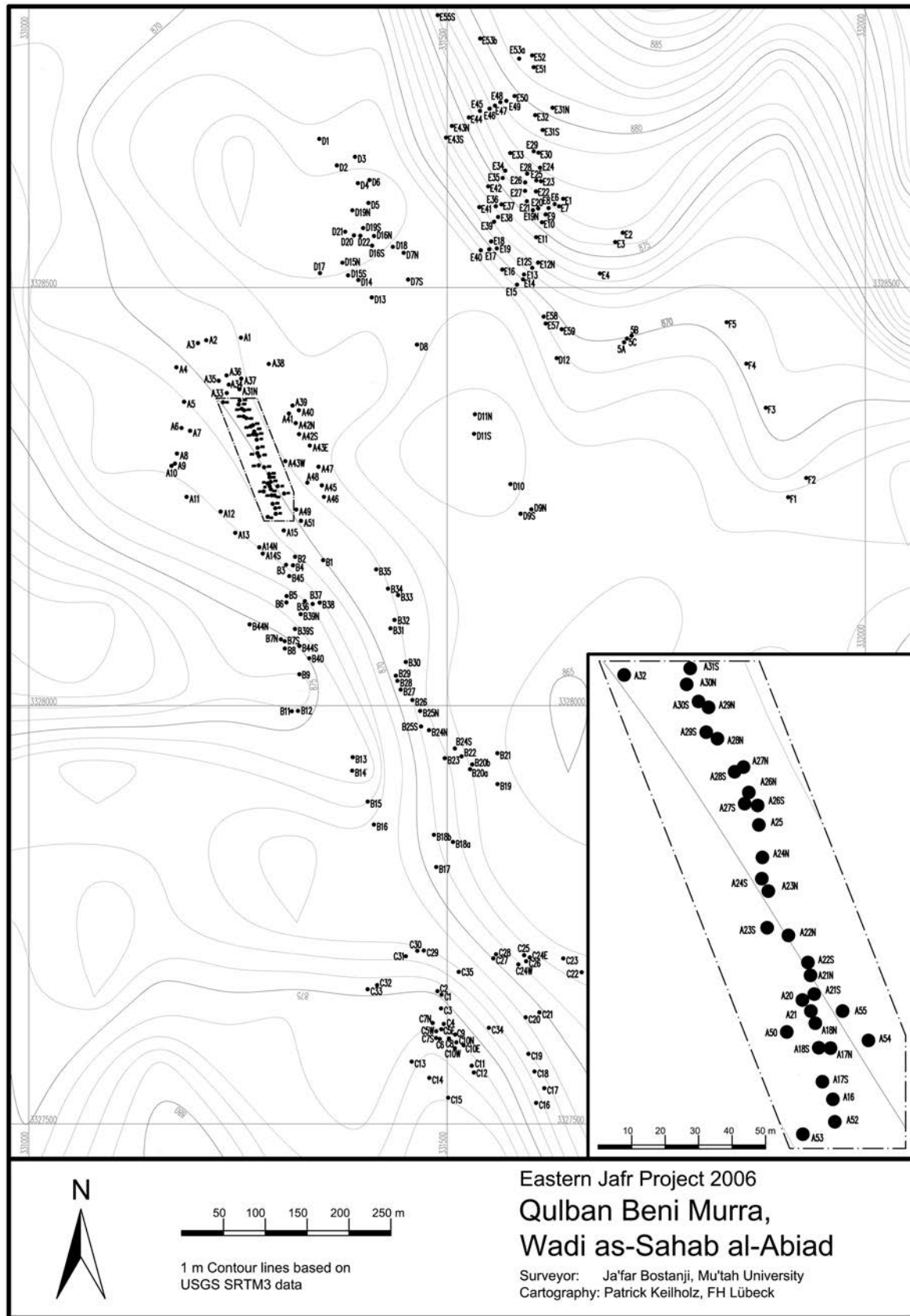


Figure 5. Qulban Beni Murra. Topographical map and distribution of structures in Areas A-F. Based on USGS SRTM3 data (© P. K.).

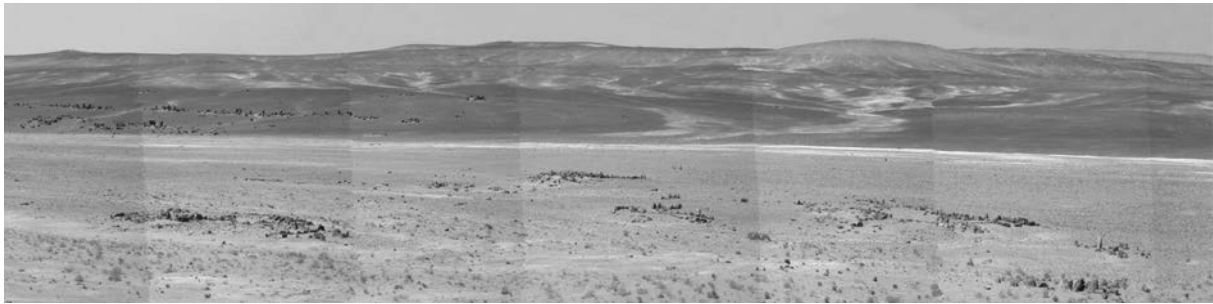


Figure 6. Qulban Beni Murra, Areas D and A: Panoramic view of watering/well complexes (Area D, foreground) and of megalithic structures on the slopes of Area A. View from NNE (© H. G. K. G.).



Figure 7. Qulban Beni Murra, Area A, Structures A15-31: Line of megalithic circular room clusters of unknown function. View from SSE (© M. Bshesh).



Figure 9. Qulban Beni Murra, Area C (and Area B at horizon): Part of cemetery with line of looted single/double chamber ashlar-line cairns. View from SSE. (© M. B.).

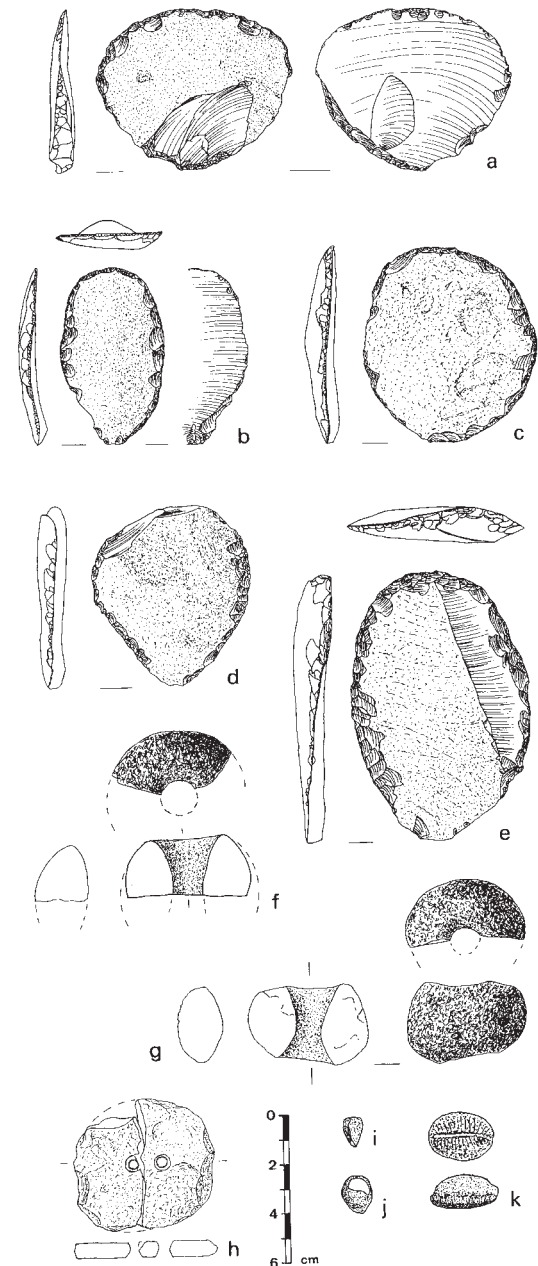


Figure 8. Qulban Beni Murra, Areas A-E: Selection of fan scrapers and small finds from (a) Area A (with dorsal and ventral bulb reduction); (b) Area B; (c-e) Area C (d with terminal/ distal hinge negatives, showing previous flat flakes taken from opposite directions); (f-g) fragments of basalt “mace heads”, found near Structure B31 (f) and on Area B (g); (h) broken knob-shaped disk made of soft limestone/ marl with two bi-conical perforations (Bedouin toy); (i-k) Area B (i small *Conus* sp., j *Nerita* sp., k cowrie (© H. G. K. G.).



Figure 10. Qulban Beni Murra, Area E, Structure E43: Looted multi-chambered ashlar-line cairn with standing ashlar aligned along their E side (© Y. Abu Zagarit).

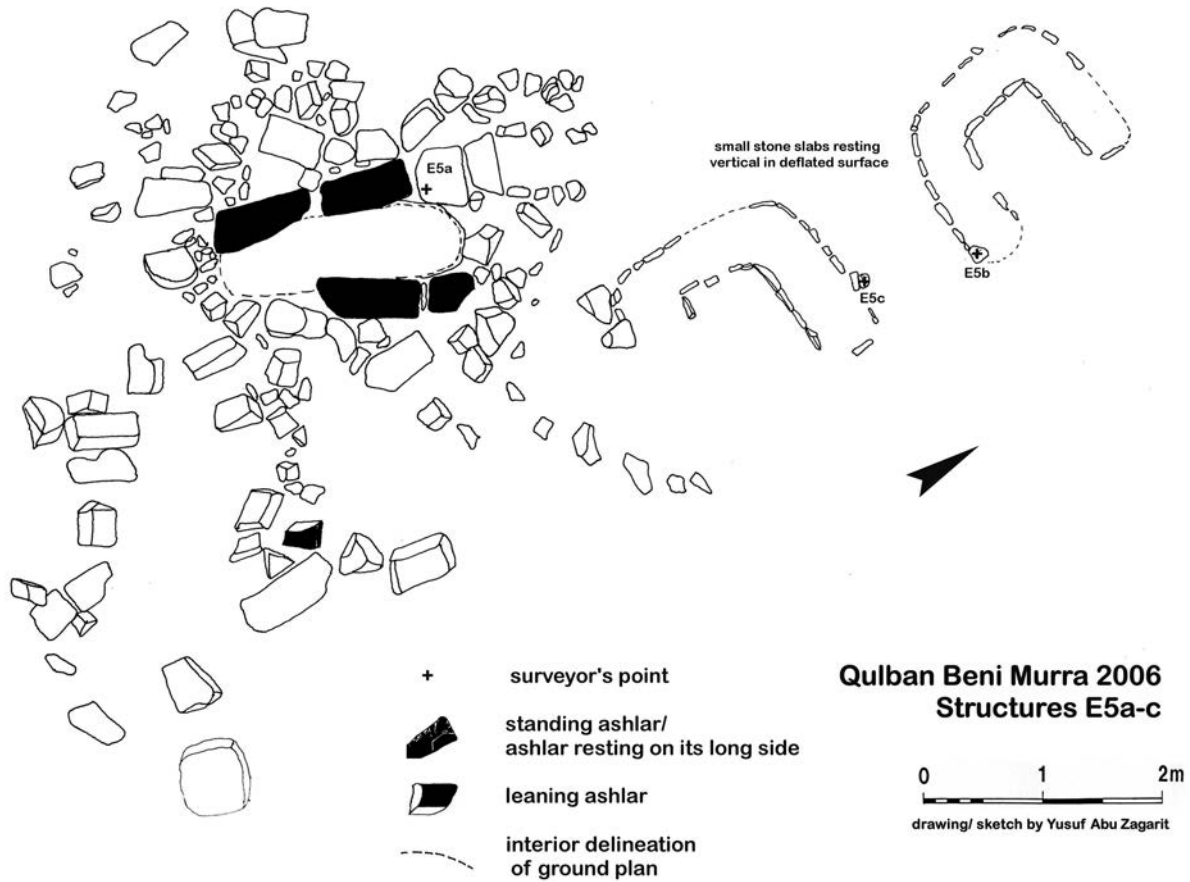


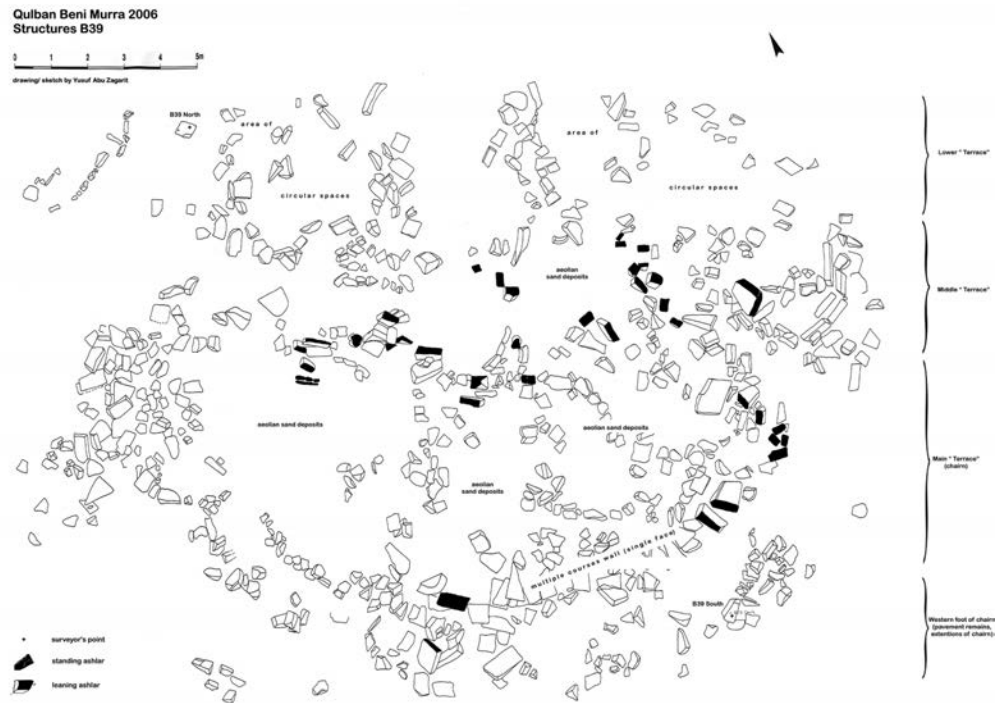
Figure 11. Qulban Beni Murra Area E. Structures E5a-c: Looted single-chamber cairn with broken ashlar stones and two associated “horse-shoe” structures (© Y. A. Z.).



Figure 12. Qulban Beni Murra, Area E, Structure E2: Looted (multi-?) chamber cairn with row of 4 ashlar (height ca. 2.5 m. View from NE) (© H. G. K. G.).



a



b

Figures 13a and b. Qulban Beni Murra, Area B, Structure B39: Successively used multi-chambered ashlar-line cairn with a interior row of standing ashlars, peripheral terracing pavements, and standing ashlar clusters (triliths) to the SE. Top: photo from SE (© photo M. B., drawing Y. A. Z.).





Figure 14. Wadi Sahab al-Asmar 6, Structure 1. Isolated ashlar-line cairn  
(© B. Lischewsky).

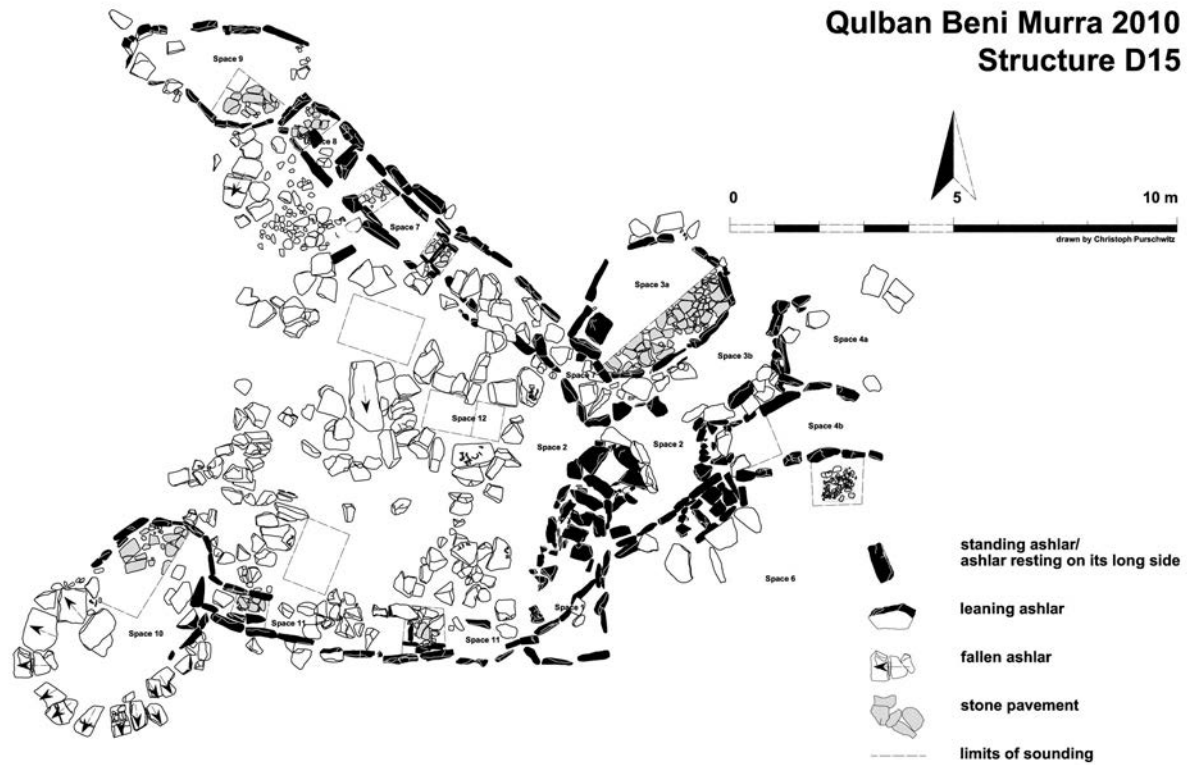


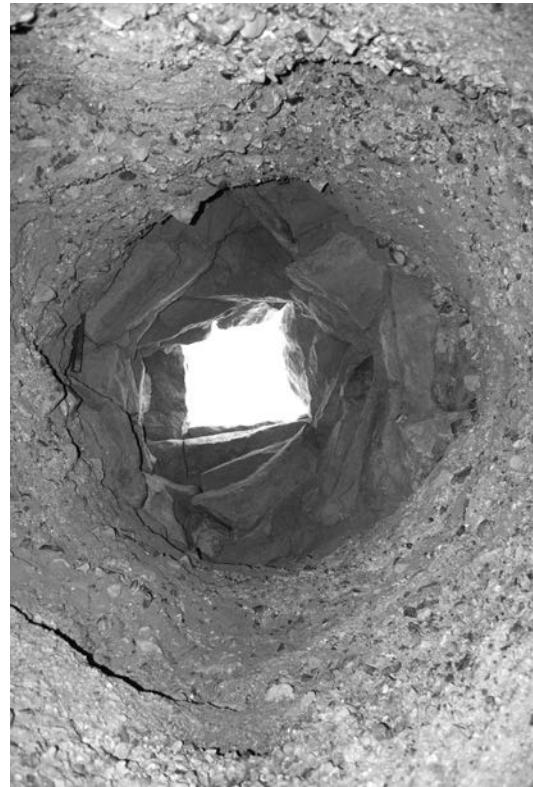
Figure 15. Qulban Beni Murra, Structure D15: Well/ watering complex, dated to the 2<sup>nd</sup> half of the 5<sup>th</sup> millennium BC.  
(field records: Pokrandt/ Keilholz, graph: Purschwitz).



Figure 16. Qulban Beni Murra, Structure D15: Well/ watering complex. View from E  
(foreground: Spaces 4a-b, 6) (© H. G. K. G.).



a



b

Figures 17a and b. Qulban Beni Murra, Structure D15: Well/ watering complex. left “well room” Space 2 with stairs leading to well mouth (Space 2). View from E.; right corbelling masonry of upper well shaft and well shaft in the wadi gravels with ledges/ steps. From inside the well (© H. G. K. G.).

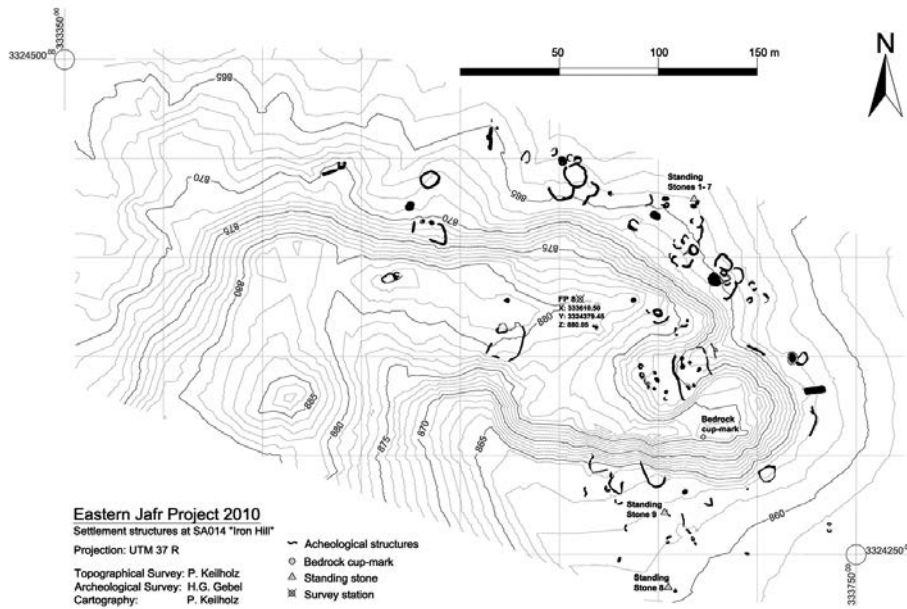


Figure 18. Wadi Sahab al-Abyad 14 (inselberg setting): Layout of a pen camp (© field records: B. L./H. G. K. G./A. Suleiman, graph: B. L.).

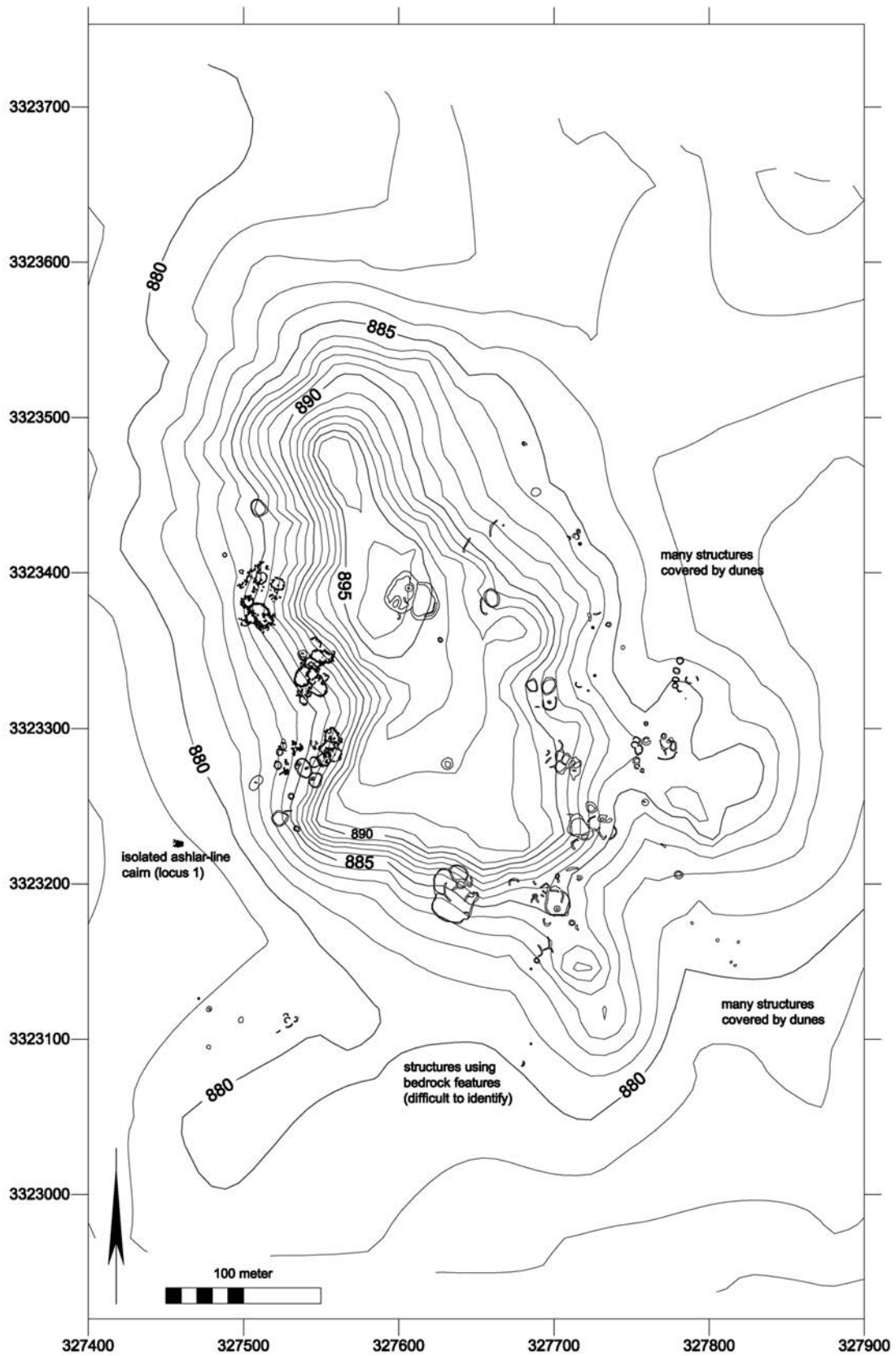


Figure 19. Wadi Sahab al-Asmar 6 (inselberg setting): Layout of a pen camp with curvilinear and round pens, domestic structures, silo-type features, hearths, platforms, terrace walls, cairns, mshash wells?

(© field records: L./A. S., graph: B. L.).



Figure 20. Wadi Sahab al-Asmar 6 (inselberg setting), Structure 3: Silo-type structure on the western slope, remains resting on an earlier phase. View from S (© H. M. Mahasneh).



Figure 21. Wadi Sahab al-Asmar 6 (inselberg setting), Structure 3: Northeastern part of the circular habitation Structure 3 on the western slope: with outer wall, entrance passage, stone bins, off-center ashlar. View from S (© H. M. M).



Figure 22. Wadi Sahab al-Asmar 20 (inselberg setting): Pen camp with circular/curvilinear structures (pens and domestic structures, diameters 4-20 m), platforms, graves with ashlar, terrace walls, breakwater walls (flood protection). View from NNE (© H. G. K. G.).



Figure 23. Qulban Beni Murra, Area B, Structure B39: Ashlar of interior ashlar line with animal petroglyphs, facing E; black scale is 50 cm (© H. G. K. G.).



Figure 24. Qulban Beni Murra, Area A, Structure A27 (looted): Ashlars with animal petroglyphs (© H. G. K. G.).

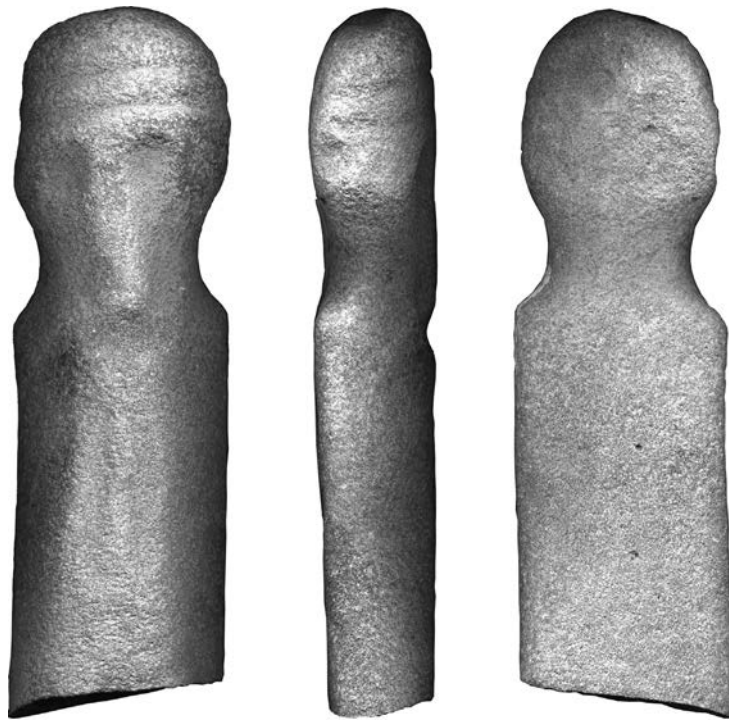


Figure 25. Wadi Sahab al-Asmar 8, Cairn 11: Statue fragment from the Late Chalcolithic/EB stone cover of the cairn, called “Dalish” (© H. G. K. G.).



Figure 26. Rajajil (al-Jawf Province, Kingdom of Saudi Arabia), Structure A: Multi-chambered ashlar-line cairn. View from N (© H. G. K. G.).



Figure 27. Rajajil (al-Jawf Province, Kingdom of Saudi Arabia), Structure M: Western part of multi-chambered ashlar cairn. View from SSW (© H. G. K. G.). Figure 27.

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