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The Stone Age of Qatar: new investigations, new finds; interim report

Julie E. Scott-Jackson, William Scott-Jackson, Faisal Abdulla Al Naimi,
Emma Tetlow, Rémy Crassard

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The Stone Age of Qatar: new investigations, new finds; interim report (poster)

JULIE E. SCOTT-JACKSON, WILLIAM SCOTT-JACKSON, FAISAL ABDULLA AL NAIMI,
EMMA TETLOW & RÉMY CRASSARD

Summary

This interim report summarizes the results of fieldwork carried out by the PADMAC Unit during 2012/2013 in a previously unexplored area of southern Qatar. The aim of this series of systematic surveys was to find undiscovered lithic surface-scatters/sites and characterize the assemblages. Prior to fieldwork, a detailed desk-based geospatial analysis of the topography, aerial satellite imagery, and geologic mapping were performed to identify areas for on-site investigation. The validity of these data was confirmed by a ground-truthing field exercise in December 2012. Work in this designated area continued during March and June 2013. Lithic surface-scatters/sites were discovered on the hills capped with (knappable) chert that surround and overlook large depressions, which appear to be fluvial in origin and may indeed have been palaeochannels and palaeolakes (geomorphological modelling suggests that this area of Qatar has remained above sea level for at least the past two million years). The initial analysis of the assemblages from the twenty-one lithic surface-scatters/sites discovered to date (June 2013) indicates that one lithic assemblage can be equated to Qatar Neolithic Group B. Of particular importance however, are the other twenty lithic assemblages that certainly predate the Neolithic (technologically and in terms of patination), appear to include two distinct assemblage types, and may represent two relatively contemporary specialized stages of the *chaîne opératoire*, or indeed two completely different phases of the Palaeolithic. It is envisaged that the next stage of this research will include the collection of sufficient lithics from each scatters to facilitate rigorous techno-typological analysis; further investigation of particular lithosols that may well incorporate embedded/stratified lithics; geomorphological investigations in the depressions; and the discovery of more lithic surface-scatters/sites with the aim of resolving the long-standing debate on the stone-age history of Qatar.

Keywords: Qatar, Palaeolithic, surface scatter, lithics, stone tools

Introduction

The targeting and analytical approach to the study of lithic surface-scatters/sites by the PADMAC Unit has led to the development of detailed techniques and methodologies for the discovery of this specific archaeology in previously unexplored remote areas (Scott-Jackson & Scott-Jackson 2012). Here we describe and illustrate the results of our active ongoing project in the south of Qatar, which is currently focused on finding undiscovered lithic surface-scatters/sites and characterizing these stone-tool assemblages. These investigations were undertaken in accordance with the Research Agenda for Qatar (Scott-Jackson & Scott-Jackson 2010) and the project guidelines of the Qatar Museums Authority (QMA 2012). To date (June 2013), we have discovered a total of twenty-one lithic surface-scatters/sites in the area of investigation (Fig. 1).

Geospatial analysis: research methodology

As the objective of the PADMAC Unit 2012/2013 fieldwork in Qatar was to identify areas of Palaeolithic potential in the previously unexplored area in the south (Fig. 1), the research area was first subject to ‘virtual exploration’ by using a 4 x 4 m high-resolution display of Google and Bing satellite mapping. For most of the area, a specific Bing tile (2013 Earthstar Geographic Image 14/05/2013) most clearly differentiated surface features. Traversing a grid, west to east and north to south, a complete aerial survey of the area was made using 3D imaging to identify topographic, geologic, and anthropomorphic features. A Geographic Information System (GIS) database was then created in Global Mapper (which allows fast analysis and overlay of Digital Elevation Maps [DEMs], satellite, and topographic mapping). Data was also exported to ArcGIS (which can be accessed in the field, via an

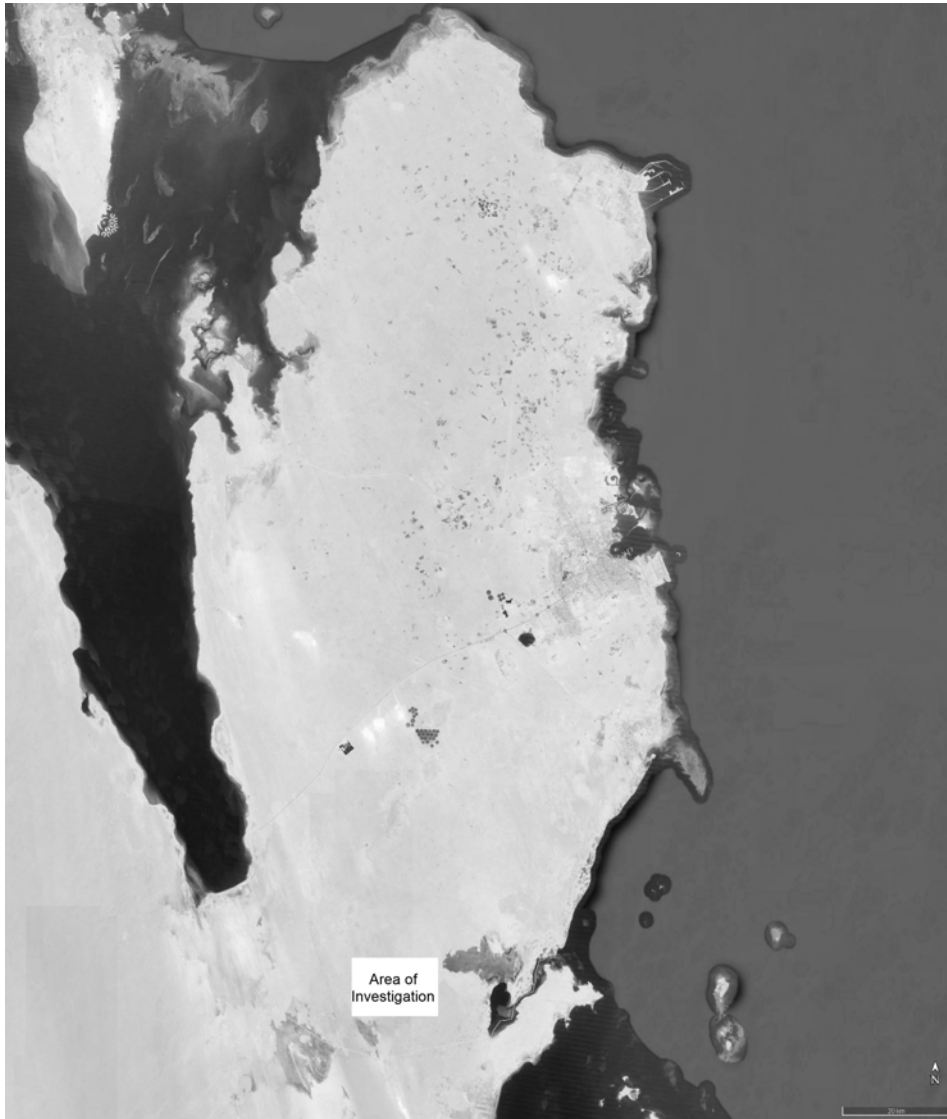


FIGURE 1. *PADMAC Unit (2012/2013): the area of investigations in the south of Qatar (Google Earth with modifications).*

iPhone4s running ArcGIS Explorer, and incorporates Bing mapping). The coordinates of specific areas of interest were also recorded for further, more detailed desk-based assessment, prior to on-site investigation. For each of the general areas of interest, DEMs and contoured GIS layers (see Fig. 3/a) were analysed to identify, for example, particular locations (within each area) on the edges of plateaus with views towards distant landscapes and views down into nearby low-level features. Next, geological mapping (Fig. 3/b) provided by Qatar National

Historic Environment Record (QNHER) was scanned and examined to look for areas of limestone and dolomite. Finally, overlaying this geology layer with the detailed Google (Fig. 3/c) and Bing (Fig. 3/f) satellite aerial photography facilitated the identification of chert-capped hills within the targeted research area.

Prior to fieldwork, the Bing mapping (given its recent acquisition date of 14 May 2013) was used to calculate feasible routes to the various areas of high potential, using existing tracks (where possible) and avoiding

fences, areas of soft/drifted sand, sand dunes, and military installations. These data were exported as tracks to MotionX running on an iPhone4s with an enhanced Bad Elf GPS receiver. This modus operandi permits the most effective use of time in the field.

Field surveys (December 2012; March 2013; June 2013)

A pilot field survey conducted in the area of interest (Fig. 1) during December 2012 confirmed the (desk-based acquired) satellite data. Slope profiles (Fig. 3/e) computed within Global Mapper were verified by the specific topography of the chert-capped hills surrounding a large depression (Figs 2 & 3/d) and the presence of associated lithic surface-scatters/sites.

The results of this pilot study and additional data derived from the desk-based assessment provided the rationale for a series of intensive targeted field surveys over a wider area (within the designated research area; Fig. 1) during March 2013 and June 2013. More lithic surface-scatters/sites were discovered in a similar context to the 2012 finds, that is, associated with the presence of chert (knappable raw material) which caps the range of hills surrounding two depressions.

Determining the density of the lithic scatters is somewhat problematical as they are generally found among extensive covers of naturally shattered rock/chert and sand/dust lithosoil. These specific lithosoil deposits are a target for future investigation as they may well incorporate embedded/stratified lithics.

Although the lithic surface-scatters/sites are invariably associated with outcrops of immediately available knappable raw material (chert), the presence of

raw material did not necessarily equate to the presence of surface-scatters. Less than 25% of the investigated outcrops incorporated lithic surface-scatters/sites. Whether this actually reflects some form of differential land use strategy by prehistoric people in Qatar is subject to detailed future analysis. Certainly, in the UAE, Oman, and the UK we have observed that Palaeolithic knapping sites tend to be associated with readily available knappable raw material and that they generally occupy the edges of high plateaus/ridges/hills, often with long-distance views, but are also ideally positioned to observe the activities of game and/or other people, at low levels in the passes, wadis/river valleys, or other lacustrine features (Scott-Jackson, Scott-Jackson & Rose 2009; Scott-Jackson & Scott-Jackson 2012).

The research methodology described here, which combines detailed multi-method desk-based assessment with intensive targeted fieldwork, allows the PADMAC Unit to identify areas with Palaeolithic potential but where no apparent evidence of Palaeolithic occupation exists. As such it also provides a basis for the analysis of geomorphic processes implicated in the preservation of lithic surface-scatters/sites and a means to explore prehistoric peoples' use of the landscape as a whole.

Lithic assemblage analysis — initial conclusions

The initial analysis of the twenty-one lithic assemblages newly discovered by the PADMAC Unit in the south of Qatar (Fig. 1) reveals that one assemblage is Neolithic but the other twenty assemblages predate the Neolithic.

The one assemblage (Site 220313.32.) that had come from an entirely different topographic context to the other



FIGURE 2. *Chert-capped hills surrounding a large depression.*

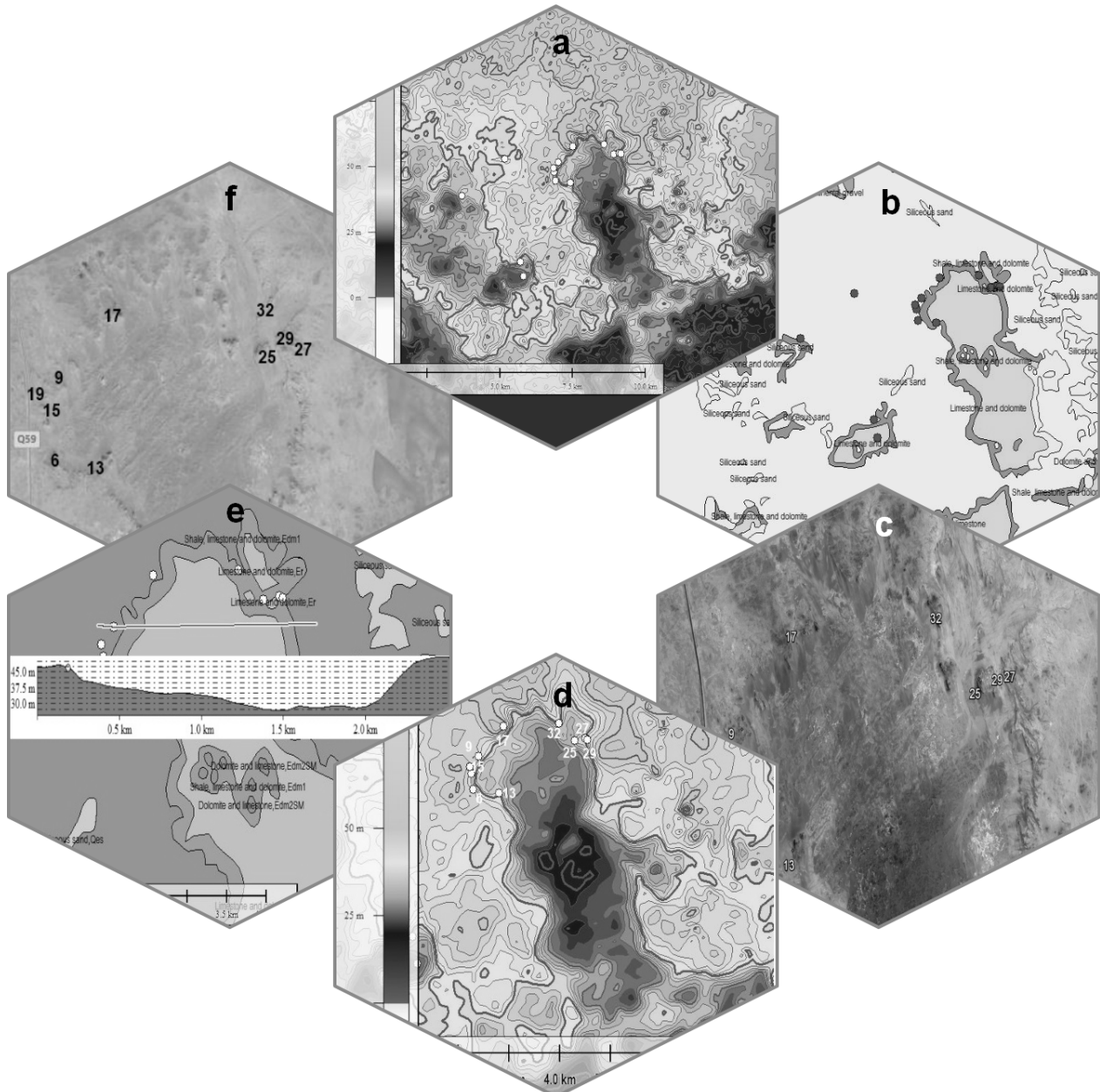


FIGURE 3. Cluster diagram — geospatial analysis: **a.** a digital elevation model and contoured GIS layer of PADMAC Unit 2013 area of interest; **b.** geo-referenced geology mapping; **c.** Google satellite aerial photography (March 2013 images); **d.** close-range topographic contours; **e.** a slope profile across depressions; **f.** Bing satellite aerial photography (2013 Earthstar Geographic image 14/05/2013).

twenty assemblages (i.e. being found on a small knoll within the main depression as opposed to the surrounding hill tops) is technologically similar in many respects to the Qatar Neolithic Group B as defined by Kapel (1967). This assemblage included three blade cores (one crested) (Fig.

4/c) showing signs of soft hammer production and a small hammerstone made from quartz. From an unrelated area (Area 220313.25) a small green (possibly serpentinite) cobble was recovered, seemingly used as a hammerstone (but then shattered, possibly in use). This was refitted

on site. Interestingly, quartz nodules and nodules of a green serpentinite-like material are to be found in the (3–8 million year old) fluvial gravel deposits of the Hofuf Formation c.10 km to the north of Site 220313.32 and Area 220313.25.

Of particular importance, however, are the other twenty lithic assemblages from the chert-capped hills surrounding the depressions (Fig. 2), which certainly predate the Neolithic (both technologically and in terms of patination) and which are characterized by flakes

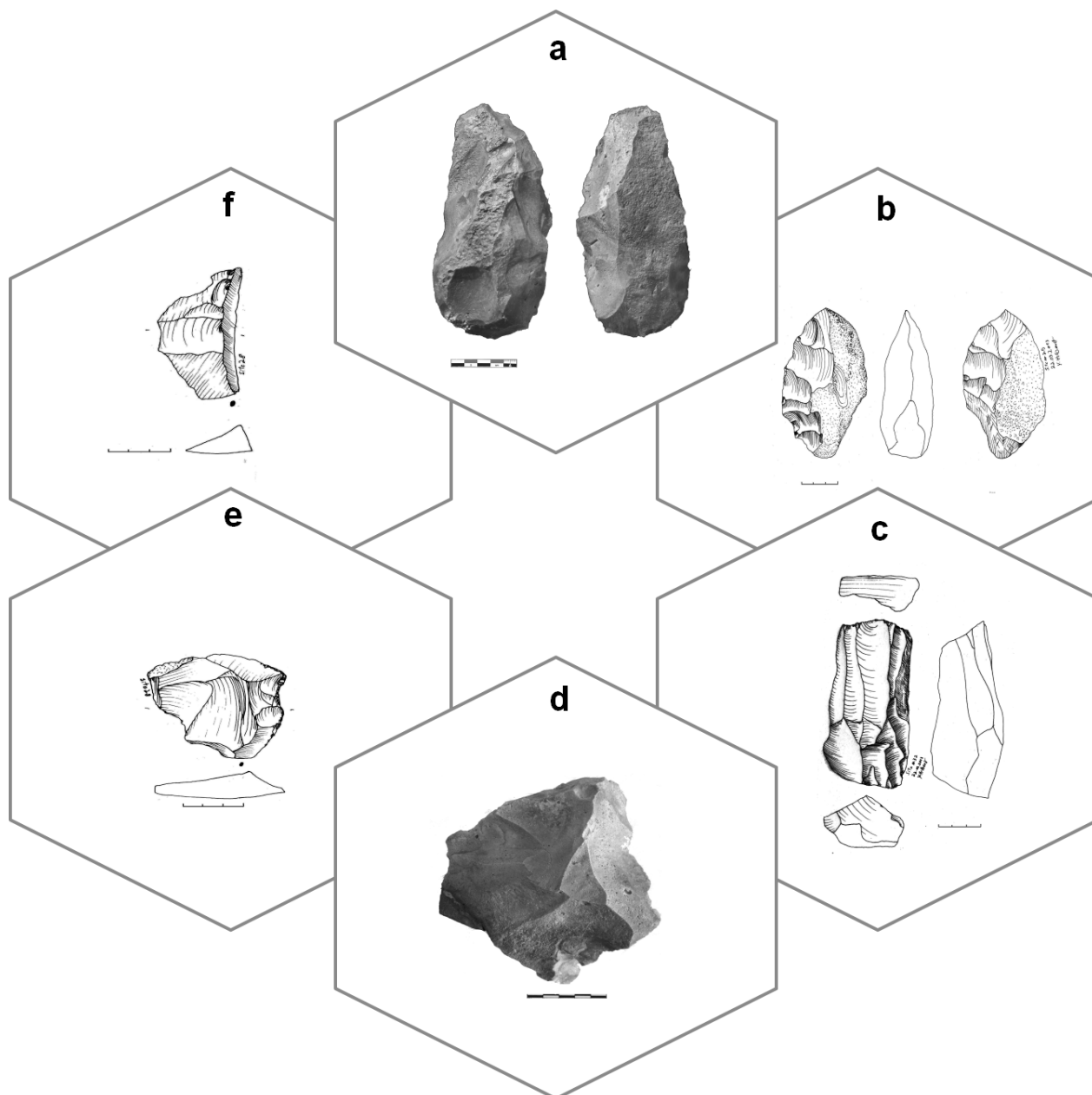


FIGURE 4. Cluster diagram — artefact analysis: **a.** large biface, 220313.29; **b.** biface preform, 220313.25; **c.** blade core, 220313.32; **d.** core, 110613.15; **e.** blank with lateral retouch, 220313.25; **f.** debordant, 220313.28 (line drawings Y. Hilbert).

with prominent bulbs and large unprepared striking platforms suggesting hard hammer production. They also appear to represent two distinct assemblage types,

the first comprising large, heavily struck coarse cores (Fig. 4/d) and bifaces (Fig. 4/a,b) and the second, more finely worked, smaller flakes (Fig. 4/e,f) including

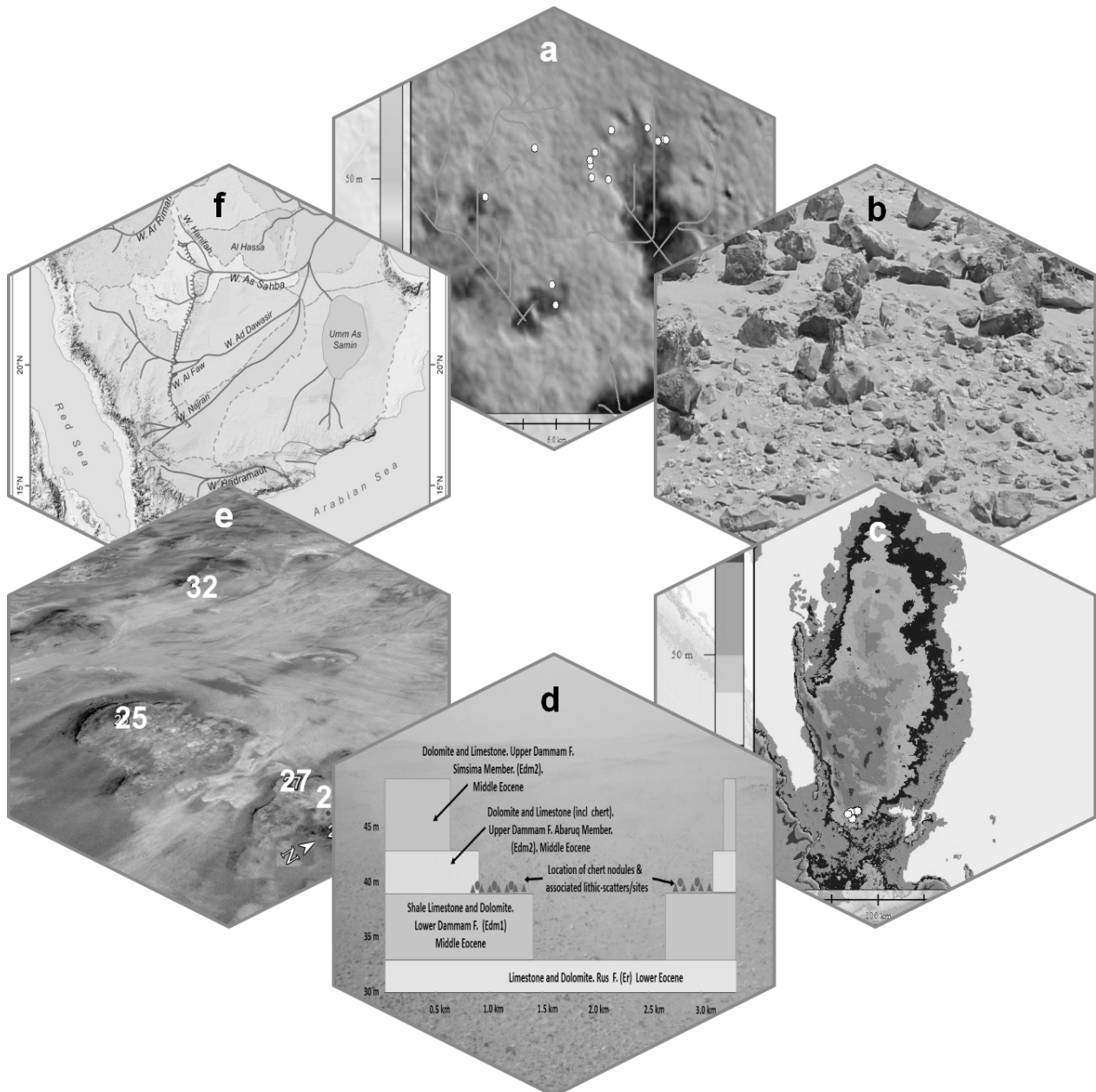


FIGURE 5. Cluster diagram — geomorphological context: **a.** calculated dendritic drainage systems; **b.** outcropping nodules of knappable chert; **c.** modelled sea levels at 15 m and 25 m (dark blue) above present sea levels; **d.** a schematic diagram showing the geologic column west to east across depression and the location of chert nodules and associated lithic surface-scatters/sites (50* vertical exaggeration); **e.** a 3D Google aerial satellite image of sites 25, 29, and 32 showing braided channels; **f.** a map showing the palaeo-drainage system on the Arabian Peninsula (Rausch et al. 2013).

unidirectional and centripetal Levallois-like technology (with refits but, as yet, no evidence of platform faceting). These distinct assemblages may represent two, relatively contemporary, specialized stages of the *chaîne opératoire* or two completely different phases of the Palaeolithic. This question may be resolved when the PADMAC Unit has completed additional techno-typological analysis of the assemblages later this year. It is also hoped that this intended analysis may go some way to resolving the long-standing debate over the chronological grouping in Kapel's *Atlas of the Stone Age Cultures of Qatar* (1967).

Geomorphological context

The migration in and out of Qatar by prehistoric people would have been governed by global climate change and tectonic activity, which effectively raised or lowered sea levels in the Arabian Gulf (Jameson & Strohmenger 2012). In addition, environmental change in Arabia has oscillated between climate extremes. Very dry periods resulted in desiccation and generation of arid deserts but, when the climate ameliorated, sub-tropical forest and savannah grassland prevailed (Parker 2010). During the Pliocene and Early Pleistocene, for example, three major rivers drained most of the Arabian Peninsula during a period of prolonged and intense precipitation (Fig. 5/f).

To investigate possible geomorphological processes implicated in landform modification we constructed various models. Utilizing data on sea-level change (Rohling et al. 2009) and tectonic uplift (Jameson & Strohmenger 2012), the digital elevation calculations (Fig. 5/c), indicate that at no point in the last two million years was the area, under investigation here (Fig. 1), inundated by the sea. Calculation of dendritic drainage catchments (based on current topology and using Global Mapper calculation routines) in southern Qatar suggests that the newly discovered lithic surface-scatters/sites overlook possible ancient drainage systems (Fig. 5/a) including major depressions (which may well, at some time, have been palaeolakes). These depressions appear to be the result of both fluvial and deflation processes (chemical and mechanical). Planned geomorphological investigations will help identify the formation process and time frames of these features and the associated hills with chert outcrops. Within these depressions,

braided channels suggest low gradient flow (Fig. 5/e). A stratigraphic geologic column (Fig. 5/d) of the area of investigation (Fig. 1) shows that the outcrops/nodules of knappable chert (Fig. 5/b) for the production of the lithic assemblages are derived from chert-rich exposures of the Abaruq member of the Upper Dammam Formation.

Conclusion and future work

The preliminary investigations reported here have demonstrated the presence of one Neolithic and twenty pre-Neolithic lithic surface-scatters/sites in a previously unexplored area in the south of Qatar. The presence of the Palaeolithic in Qatar has long been controversial, a question that our continued future investigations aim to resolve. Further planned research includes:

- The collection of sufficient samples from each lithic surface-scatter/site to conduct rigorous techno-typological analysis.
- The identification of potential stratified deposits for detailed investigation.
- Geomorphological investigations and analysis to clarify the formation processes of the relevant landforms (particularly the depressions) and their relationship to the lithic surface-scatters/sites.
- Finding and analysing more lithic surface-scatters/sites in Qatar for a better understanding of prehistoric land-use strategies.

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References

- Jameson J. & Strohmenger C.
2012. What's up with Qatar? How eustasy and neotectonics influenced the late Pleistocene and Holocene sea-level history of Qatar. *Qatar Foundation Annual Research Forum Proceedings 2012*: EEP4.
- Kapel H.
1967. *Atlas of the Stone-Age Cultures of Qatar*. Aarhus: Aarhus University Press.
- Parker A.G.
2010. Pleistocene climate change in Arabia: developing a framework for hominin dispersal over the last 350 ka. Pages 39–49 in M. Petraglia & J. Rose (eds), *The Evolution of Human Populations in Arabia: palaeoenvironments, prehistory and genetics*. Dordrecht: Springer.
- QMA.
2012. *Qatar Museums Authority (QMA) Archaeological Manual for Extensive Field Survey*. Doha: Qatar Museums Authority.
- Rausch R., Simon T., Al Ajmi H. & Dirks H.
2013. The Scarp lands of Saudi Arabia. *Arabian Journal of Geosciences* 6/3: 1–14.
- Rohling E.J., Grant K., Bolshaw M., Roberts A.P. et al.
2009. Antarctic temperature and global sea level closely coupled over the past five glacial cycles. *Nature Geoscience* 2: 500–504.
- Scott-Jackson J.E. & Scott-Jackson W.B.
2010. *A Palaeolithic Research Agenda for Qatar*. Oxford: PADMAC Unit Publication.
2012. The importance of Palaeolithic surface-scatters to our understanding of hominin dispersal and Neanderthal variability — Key methods for unlocking hidden data. *The European Archaeologist* 36: 47–50.
- Scott-Jackson J.E., Scott-Jackson W.B. & Rose J.L.
2009. Palaeolithic Stone Tool Assemblages from Sharjah and Ras al Khaimah in the United Arab Emirates. Pages 125–138 in M. Petraglia & J. Rose (eds), *The Evolution of Human Populations in Arabia: palaeoenvironments, prehistory and genetics*. Dordrecht: Springer.

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