








Project Gallery

Exploring Neolithic resilience and mobility in the Omani interior at Al-Khashbah KHS-A

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A newly discovered Neolithic site at Al-Khashbah KHS-A (Oman) reveals local adaptations to climate change in the Holocene. Results from radiocarbon dating show repeated occupations over 1000 years and key artefacts indicate coastal connections. KHS-A served as a short-term camp, enhancing our understanding of Neolithic lifeways in Arabia.

Keywords: Western Asia, south-eastern Arabia, Neolithic, lithic studies, zooarchaeology, archaeobotany

Introduction

The Neolithic period in south-eastern Arabia (*c.* 6500–3300 BC) diverges from traditional markers of Neolithisation such as sedentism, plant cultivation and the production of ceramics (Crassard & Drechsler 2013; McCorriston 2013). Instead, this period saw unique local adaptations, including innovations in lithic technology, cultural transmission, migration, pastoralism and specialised coastal fishing strategies. These adaptations coincided with shifting climatic conditions from the Holocene Humid Period to increasing aridity in the fourth millennium BC (e.g. Lezine *et al.* 2017; Maiorano *et al.* 2020). While coastal surveys and excavations have provided a foundational understanding of the chronology and material culture of the south-eastern Arabian Neolithic (e.g. Charpentier *et al.* 2023), the inland regions remain underexplored. Only a handful of inland sites have been identified (Figure 1), including Hayy al-Sarh in Oman (Bretzke & Parton 2020) and Jebel al-Buhais, Jebel Faya and Wadi Hilo in the United Arab Emirates (Uerpmann *et al.* 2013, 2018). The discovery of a large, repeatedly occupied Neolithic site at Al-Khashbah (KHS-A), securely dated through radiocarbon analysis, presents a crucial opportunity to study inland Neolithic lifeways and their adaptations to climate change. Our project investigates how mobile hunter-herder communities adapted to Holocene climate deterioration through mobility, seasonality and/or flexibility between

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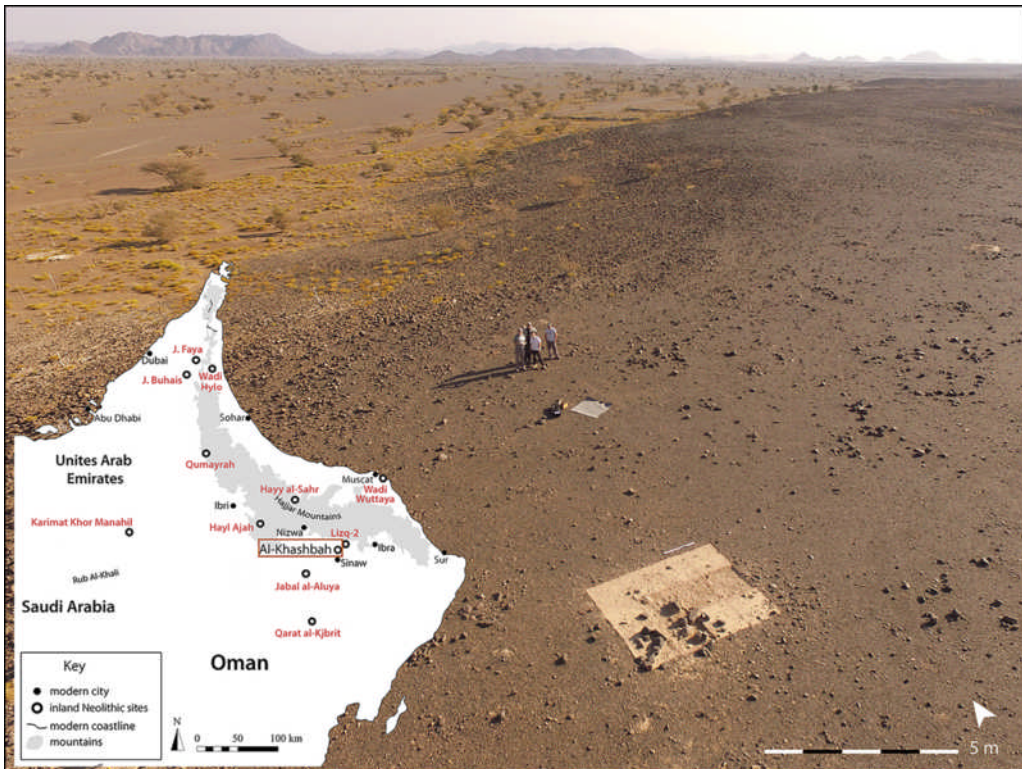


Figure 1. Overview of the KHS-A site looking north, with an inset map of northern Oman showing the location of KHS-A and inland Neolithic sites in the study region (in red) (figure by M.P. Maiorano & L. Proctor).

hunting and herding. By conducting a multidisciplinary analysis of KHS-A, we aim to reshape narratives of Neolithic desert-dwelling populations and archaeological conceptions of resilience in Arabia.

Investigating Neolithic Al-Khashbah

KHS-A is 4km north-east of Al-Khashbah village, in the southern piedmont of the Hajar Mountains (Figure 1) close to a large Early Bronze Age complex (Schmidt *et al.* 2021). In the Neolithic, this area may have been an attractive location due to chert-bearing geological formations and its position at a crossroads of east–west piedmont routes and the north–south Samad al-Shan pass. In February 2022, we surveyed several Pleistocene alluvial terraces north-east of Al-Khashbah, mapping geomorphology and identifying three possible Neolithic sites (Figure 2A: KHS-A, B & G) and five chert outcrops (KHS-C–G). These sites featured stone alignments, hearths and lithic scatters (Figure 2B). Based on size (approximately 3600m²) and feature density, KHS-A was selected for further study.

After documenting visible features and collecting artefacts, we placed a 2 × 2m test trench around structure KHS-A.1 to assess preservation potential (Figure 3A). Excavations revealed

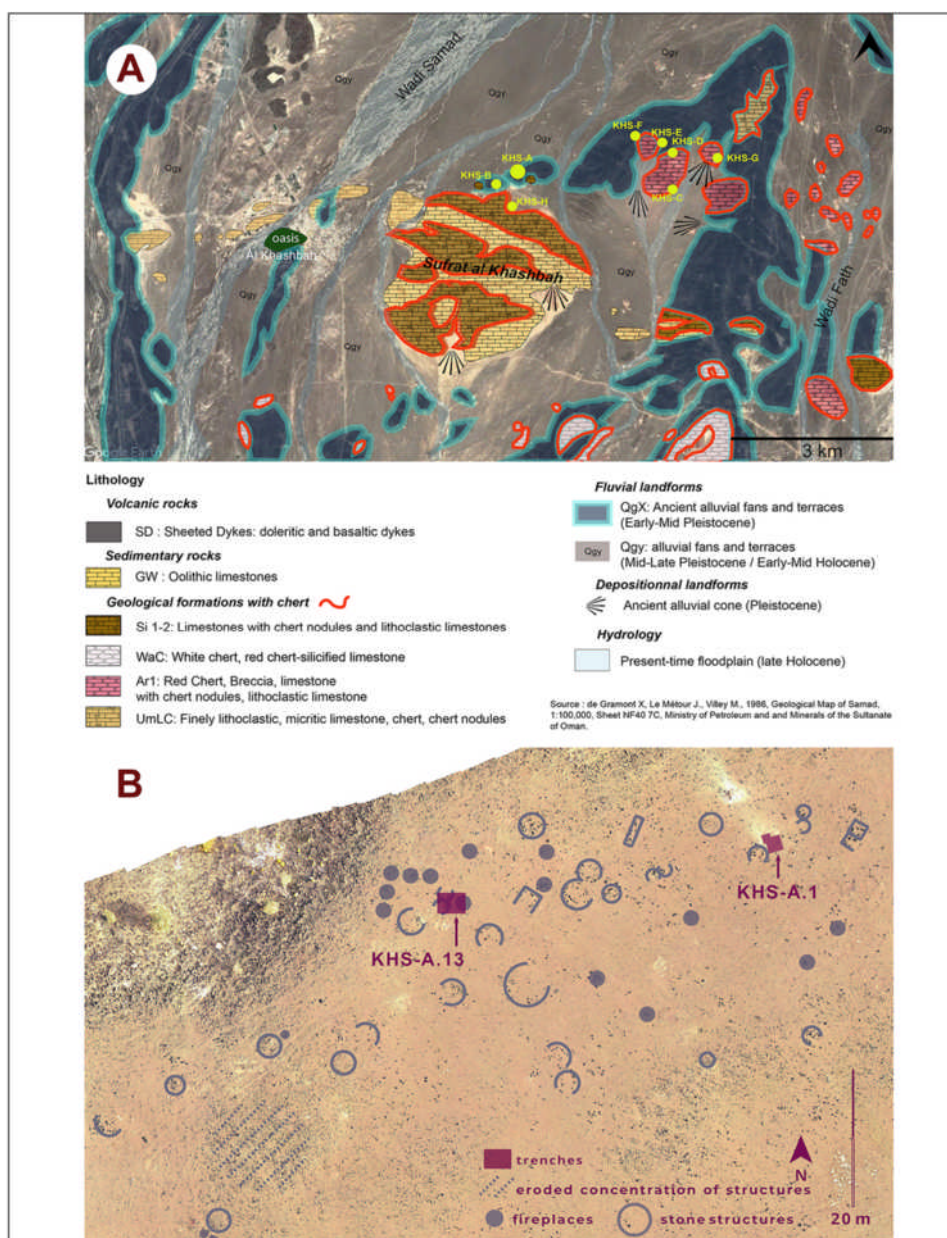


Figure 2. A) Map of identified archaeological sites, the main chert-bearing lithological units and ancient fluvial terraces. B) Portion of KHS-A showing trenches and visible stone features (figure by T. Beuzen-Waller & M.P. Maiorano).

at least two occupational phases, the second fireplace (B) was well-preserved with abundant charcoal fragments, and a sterile gravel layer was reached at a depth of about 0.3m.

In 2023, we excavated KHS-A.13 to expand our understanding of the Neolithic site. This trench consisted of a 3 × 4m exposure (Figures 1 & 3B) and a test pit (TP-A) in the north-east

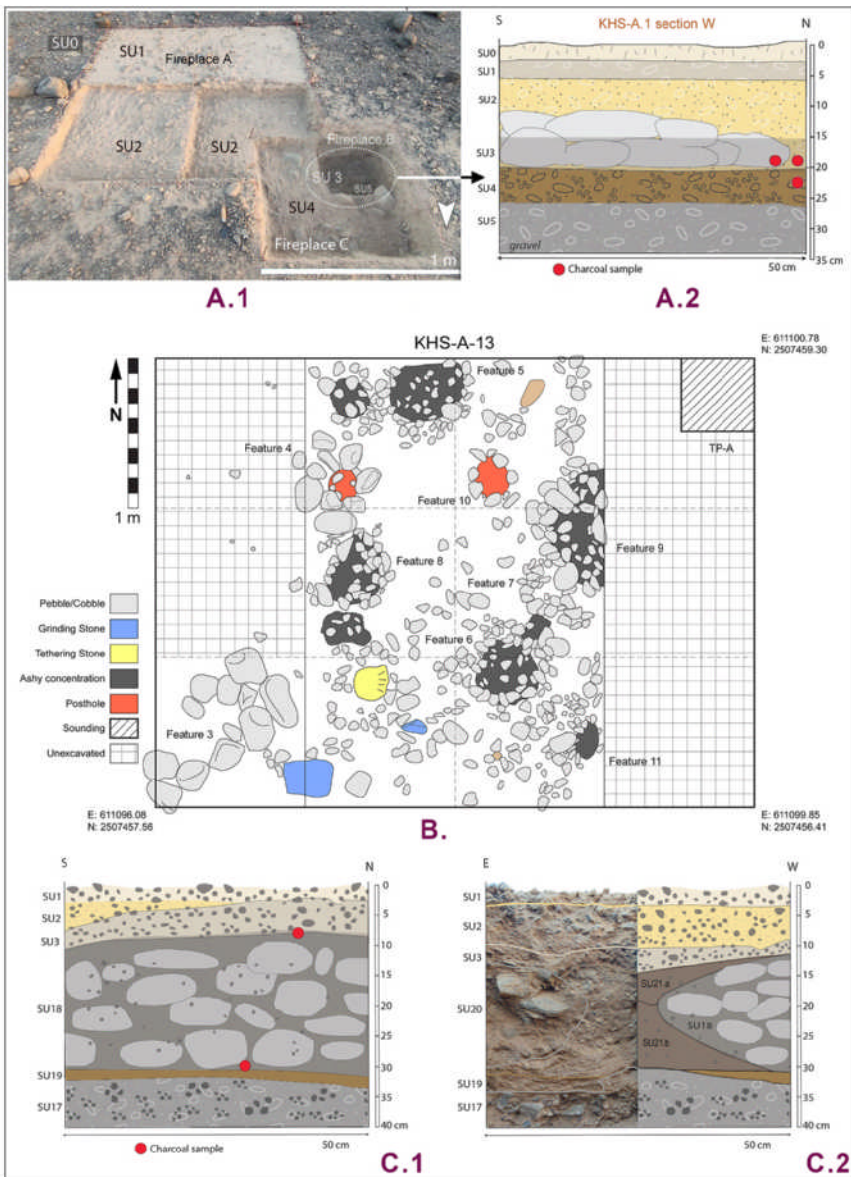


Figure 3. KHS-A.1 and section of the deepest sounding (A.1–2). Plan of KHS-A.13 showing the distribution of features and the largest ground stone tools (B). South (C.1) and west (C.2) sections of test-pit A (TP-A) (figure by L. Proctor & M.P. Maiorano).

corner to assess the depth of the archaeological deposit (Figure 3C). Ashy deposits alternated with sandy layers and small gravels, revealing multiple well-preserved fireplaces, ash pits, post-holes, large grinding stones and a possible tethering stone.

Radiocarbon results (Figure 4) suggest KHS-A was occupied at least twice over 1000 years. The oldest date (5753–5657 cal BC) came from TP-A (Figures 3C.1 & 4), while the most

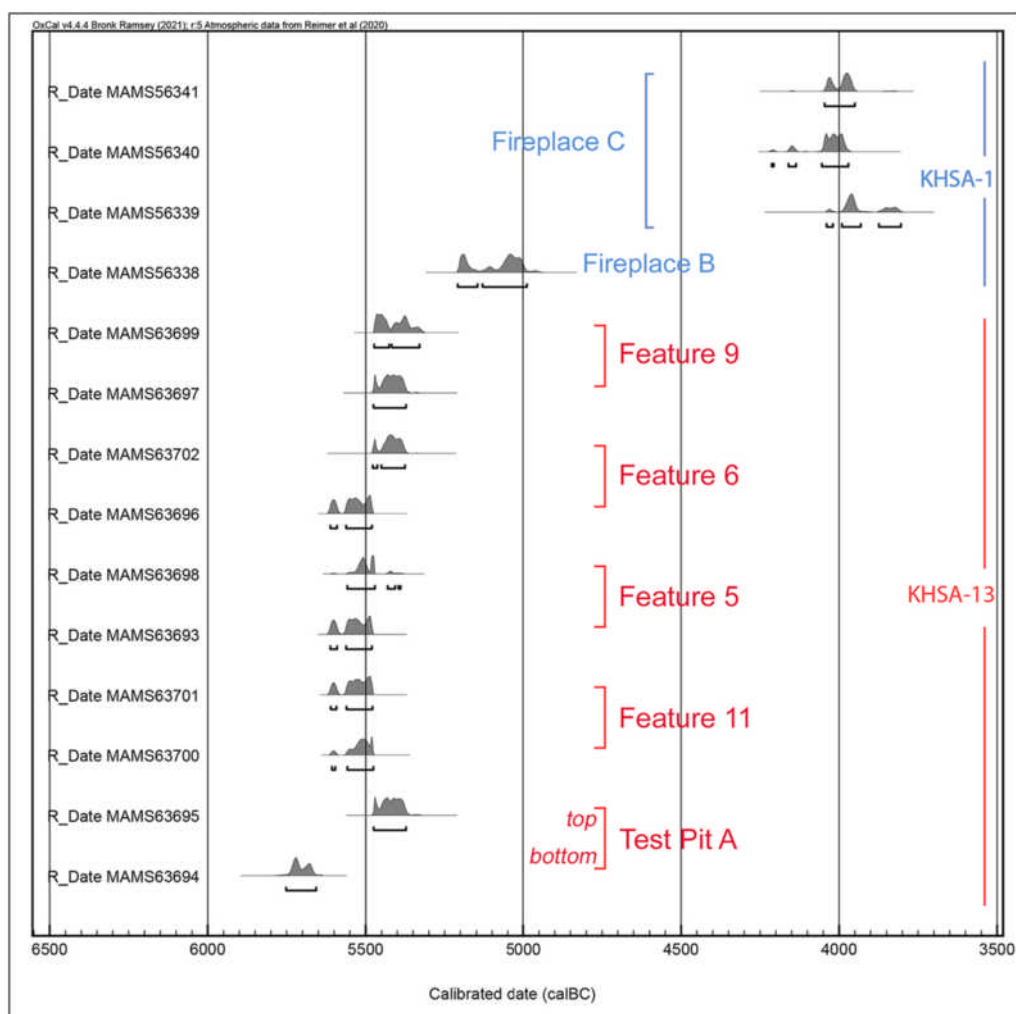


Figure 4. Calibrated radiocarbon dating results from KHS-A.1 and KHS-A.13 (figure by L. Proctor).

recent date (4040–3805 cal BC) came from Fireplace C in KHS-A.1. Remaining fireplaces consistently date to the sixth millennium BC suggesting that they were used simultaneously or repeatedly over a relatively short period.

A diverse range of materials was recovered from the excavations. Twenty-five beads, made by perforating the shells of marine gastropods, were found throughout the excavations along with several unworked shells and preforms (Figure 5A). The lithic material consists of a largely homogeneous, opportunistic assemblage of 2519 elements, mostly chert (98%, of which three-quarters are from the red radiolarite chert in the local Ar1 formation, Figure 2A), along with limestone (from Si 1-2, Figure 2A), quartz and basalt. The most common retouched pieces include perforators and notches, followed by scraping tools, denticulates and retouched flakes (Figure 5B). Unlike at most sixth–fifth millennia BC sites in Oman,

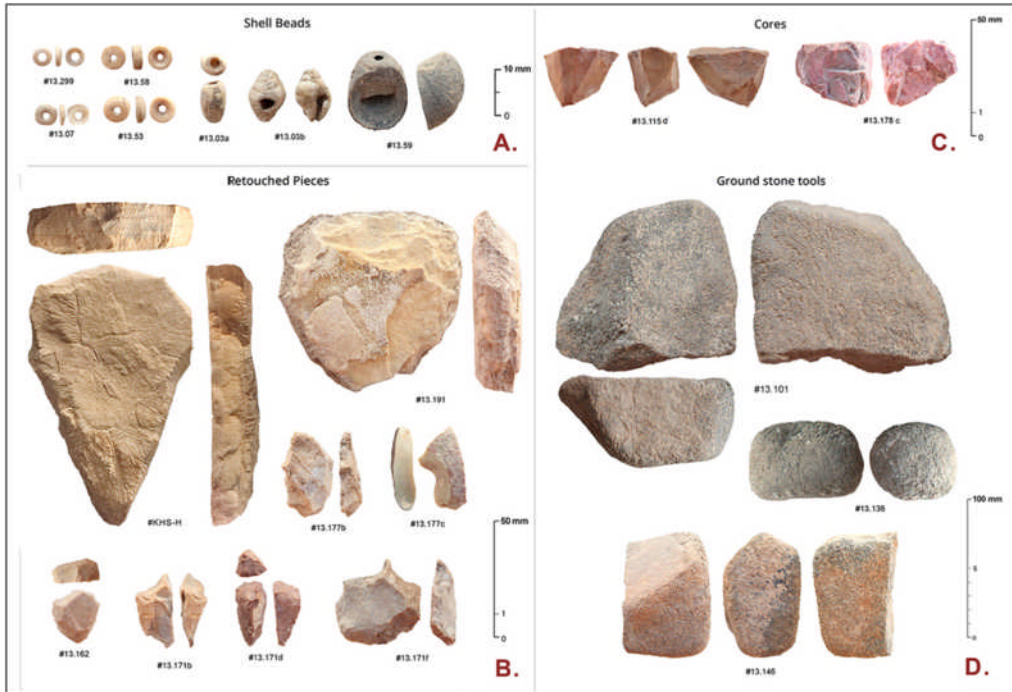


Figure 5. Shell beads (A), retouched flakes (B), cores (C) and ground stone tools (D) found at KHS-A.13 (figure by M.P. Maiorano).

bifaces are rare. Cores and debitage elements are currently being analysed (Figure 5C) to reconstruct production techniques. Hammers and grinding stones (Figure 5D) are also present, suggesting activities related to the processing of organic materials.

Archaeobotanical remains include more than 500 identifiable charcoal fragments (Figure 6a–c). Seventy-five per cent of the charcoal from KHS-A.13 is acacia (*Vachellia* sp.) from fireplaces 5, 6, 7, 9 and 11. Meanwhile, a more diverse range of taxa, including *Prosopis cineraria*, *Ziziphus*, acacia and, notably, white mangrove (*Avicennia marina*; Figure 6a) are identified in KHS-A.1. White mangrove grows only in coastal wetlands, and therefore provides evidence for connections between the Al-Khashbah and the Omani coast.

Faunal remains consist of 278 fragments of long bones and teeth of which we identified 36 post-cranial bone elements. Teeth, maxillary and mandibular elements ($n = 34$) could only be attributed to small to medium-sized herbivores. High fragmentation prevents conclusive distinction between domestic (caprines) and wild (oryxes or tahr) herbivores (Figure 6d).

Discussion and future development

In summary, the site of KHS-A promises to enhance our understanding of the Arabian Neolithic in inland Oman. Initial results suggest that the site was periodically occupied during the sixth and fifth millennia BC and was likely a short-term camp where people were engaged in stone tool/bead production and animal processing. Lithic remains from the site show unique

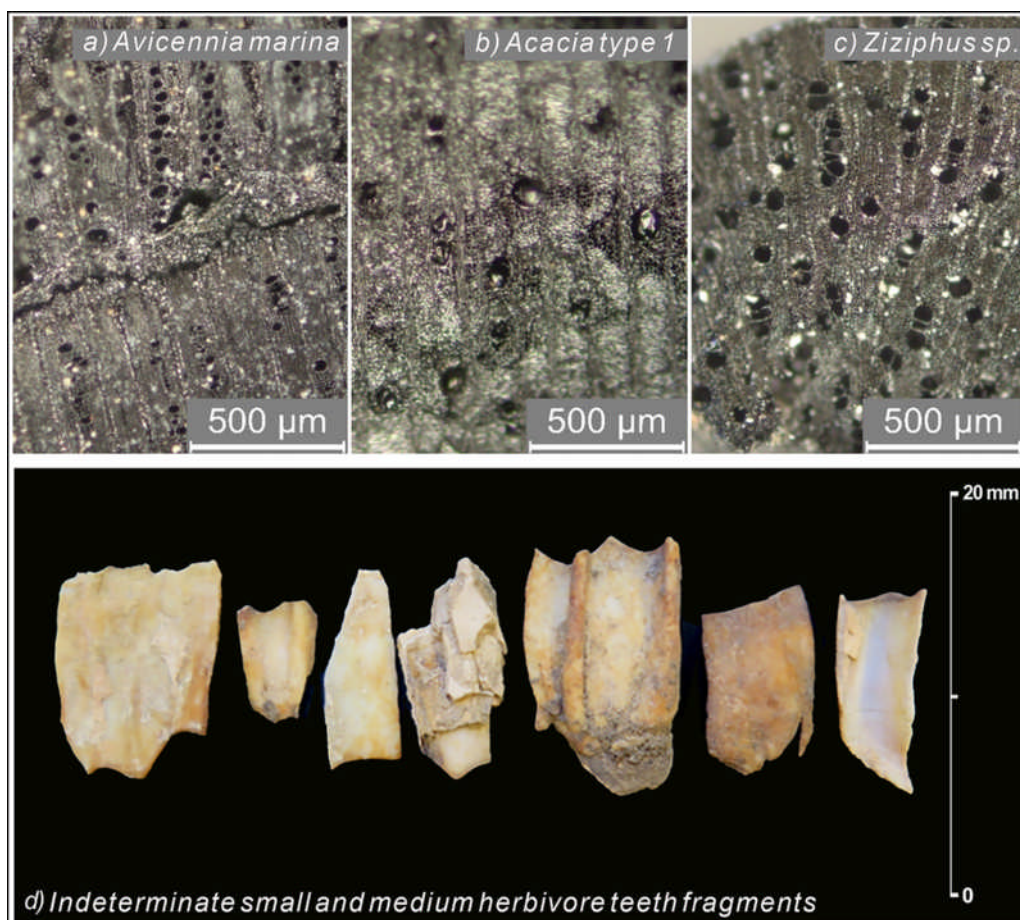


Figure 6. Transverse sections of identified wood charcoal (a–c) and tooth fragments (d) from KHS-A-13 (figure by L. Proctor & E. Maini).

characteristics that differ from contemporaneous sites on the coast, while seashell ornaments and mangrove wood hint at direct connections with the coast. Questions remain about Neolithic subsistence strategies, mobility and the environmental conditions in which they lived. However, the preserved stratified features containing artefacts and plant and animal remains present an unprecedented opportunity to ask these questions in central Oman.

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