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Revisiting the Acheulean at Namib IV in the Namib Desert, Namibia

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Abstract:

The site of Namib IV (S23° 44.829', E14 ° 19.720') is frequently cited as it is one of few Earlier Stone Age sites in the Sand Sea of the Namib Desert. The site was first investigated in 1978 by Myra Shackley, who described 582 artifacts exposed on the surface of the Namib IV pan as representing an Acheulean butchery site. Descriptions of the artifacts, their number, and area from which they were documented were inconsistently reported. Of particular importance is an absence of information on the location of the artifacts within the large pan. Recently rediscovered, the site of Namib IV is a rare example of a tool-rich and fossil fauna-bearing pan system in the Namib Sand Sea and provides an opportunity to explore the behaviors of Sand Sea-inhabiting hominins in the Earlier Stone Age. The SANDS (Survey and Archaeology of the Namib Desert Surface) project was developed to investigate when, how and under what environmental conditions hominins utilized these challenging landscapes and clarify the site formation processes that led to the preservation of the assemblages. This article presents the first archaeological research conducted at the site of Namib IV in more than 40 years. Typological and technological data was collected from surface-exposed large cutting tools (LCTs) at Namib IV and compared to Shackley's original assemblage. Data demonstrate that her 1978 collection is representative of the Namib IV site raises many new questions about the original research and the site and its assemblages. Importantly, we present the first formal description and size profiles of a new sample of large cutting tools from the site and introduce the SANDS research project.

Keywords: Earlier Stone Age, Large Cutting Tool, LCT, Namib Sand Sea, Namib IV, landscape archaeology, interdunal pan

1. Introduction

1 The Namibian Sand Sea (NSS) is a hyper-arid dunescape occupying a large area in the
2 Namib Desert, which stretches along the western coast of Namibia from northern
3 South Africa to Southern Angola. Specifically, The Namib Sand Sea (NSS) is located
4 between the ephemeral !Khuiseb and Koichab rivers in western Namibia. Frequently
5 referred to as the oldest desert in the world, survival on the hyper-arid landscape is
6 challenging to all mammalian life. Reports of Earlier and Middle Stone Age stone tool
7 assemblages exposed on the landscape surface across the Namib Desert, and in the
8 NSS, indicate hominin occupation and exploitation of this landscape since potentially
9 the Middle Pleistocene. Exactly when the NSS became as arid as today's landscape is
10 debated and remains a fundamental question influencing interpretations of NSS
11 hominin behavioral adaptation and the formation of the NSS archaeological
12 assemblages. The focus of this article is the site of Namib IV, which lies on an
13 interdune pan surface approximately 8 km south of the !Khuiseb River (Figure 1). The
14 site was first described in 1980 by Myra Shackley (Shackley 1980, 1982, 1985), who
15 designated it as an Acheulean butchery site due to the presence of large cutting tools
16 (LCTs) along with fossil fauna, including *Elephas recki* (Shackley 1980). Mesfin et al.
17 (2021) reanalyzed the Shackley lithic assemblage, which is curated at the National
18 Museum of Namibia, and also concluded that the stone tools represent those of a
19 butchery site. The bifaces were originally dated through proposed association with
20 *Elephas recki* fossils (Klein 1983), later dated with a single U/Th date on a tooth
21 fragment to 300-425ka (Shackley 1980), with biochronological interpretation by Klein
22 (1988) interpreted by Mesfin et al. (2021) as indicating an age of > 500 ka.
23 Interpretations of Shackley's stone tool assemblages, and their association with the
24 fossil fauna, are hampered by fundamental inconsistencies in reports of the context
25 and sizes of the assemblages. Exploring the behavioral implications of Acheulean-
26 bearing hominins occupying and exploiting resources in the NSS requires dedicated
27 multiproxy analyses of the site and its assemblages. To this end, a new investigation
28 was initiated with a goal to revisit Namib IV, resample the lithic and faunal

1 assemblages and contextualize those assemblages within a refined depositional,
2 chronological and palaeoenvironmental frameworks.

3
4 Namib IV is often cited as one of Namibia's few dated Acheulean archaeological sites
5 (Sandelowsky 1983, Hardaker 2011, 2020; Marks 2015, Kinahan 2020). However,
6 there are numerous inconsistencies between the three primary publications on the site
7 (Shackley 1980, 1982, 1985). In 2013, the site was rediscovered by a joint team from
8 the University of Iowa, the National Museum of Namibia, and Gobabeb Namib
9 Research Institute. Considering the importance of the site and the need to address the
10 questions arising from the inconsistencies in the publications (Shackley 1980, 1982,
11 1985) a new project was formed to reinvestigate the hominin occupations of Namib
12 IV. A preliminary visit was made in 2021 to assess the site and identify the best
13 methods of approaching it. A second larger multidisciplinary team was assembled and
14 began work at the site in 2022. This paper presents the preliminary results from the
15 first new investigation at the site by archaeologists in over 40 years. A new
16 archaeological sample is compared to Shackley's Namib IV lithic collection at the
17 National Museum. Importantly, the bifacial technology is also described which
18 provides a framework for placing the technology in the regional chronology and for
19 investigating hominin movement across the landscape.

20 21 **1.1. The Earlier Stone Age of the Namibian Sand Sea**

22 The small amount of published ESA material in the Namib Desert comes from only a
23 few surveys from more than 40 years ago in the Sand Sea's north (Shackley 1980,
24 1982, 1985), southwest coastal region (Corvinus 1983), eastern region along the Zebra
25 River just outside of the NSS (Hardaker 2011), and from reinvestigation of material
26 curated in the National Museum of Namibia (Mesfin et al. 2021).

27
28 Large quantities of bifaces, including handaxes, cleavers, and picks, were identified by
29 Hardaker (2011) during a survey along the Zebra River valley on the northeastern

1 edge of the Sand Sea (Figure 1). The central area of Hardaker's (2011) survey is in
2 the Tsaris Mountains of the Great Escarpment and has a different topographic and
3 geomorphic setting and environmental history than the NSS. Like many of the lithic
4 scatters in the Namib Sand Sea, these are largely without stratified deposits or clearly
5 understood spatial distribution on the landscape. While their documentation is helpful
6 for known distribution, the assemblages remain undated and the lack of chronology
7 impedes detailed analysis.

8
9 Corvinus (1983, 1985) observed similar ESA and MSA scatters within raised beaches
10 of likely early to middle Pleistocene age along the southwestern edge of the Namib
11 Desert. The density of ESA artifacts was highest near the mouth of the Orange River
12 at the west coast. Corvinus (1983) concludes hominin movement into the region from
13 the east along the Orange River. Resources diminished moving away from the riparian
14 environment and resulted in a limited north-to-south distribution once arriving at the
15 western coast. Nonetheless, handaxes, cleavers, and picks are found frequently around
16 the mouth of the river and as far as 45km north of the Orange River along the coast.

17
18 Shackley (1985) identified sites along the southern edge of the !Khuiseb River and
19 north of the Tsondeb Flats containing artifacts typical of the ESA (see Figure 1). The
20 interdune flat/pan of Narabeb on the southern edge of the ancient Tsondeb Flats
21 (Figure 1, site A) was observed to have both ESA and MSA material including bifaces
22 (Seely and Sandelowsky 1974; Shackley 1985) but again these sites consist of surface
23 scatters with no variation in elevation, or lithics found within vertical stratigraphy. Our
24 2021 and 2022 seasons of field work at Narabeb failed to identify any ESA material
25 and created more questions about the coordinates of the some of the sites provided in
26 Shackley's 1985 publication. The same is true for the site of Narabeb West (Figure 1,
27 site B), which was reinvestigated in 2022. The coordinates provided by Shackley
28 (1985) for Narabeb West are 8km away from the coordinates believed to be the
29 location of the site and fall on a large dune, rather than an interdune pan or flat.

1 Narabeb West was reported to have bifaces (Shackley 1985) but no ESA material was
2 identified at by our team at the coordinates associated with the curated artifacts at the
3 National Museum or the surrounding interdunal pans and it is likely that the actual site
4 is located elsewhere (Leader pers. obs). Since these locations were probably deduced
5 from aerial photograph comparisons at the time, we can sympathize with the challenge
6 to derive accurate map coordinates in a landscape of towering, constantly changing
7 aeolian dunes interspersed with extensive interdune areas covered by water-
8 transported cobbles.

9
10 The ESA site of Tsondab Route, situated along the !Khuseb River (perhaps named
11 after a location along a route from a crossing of the !Khuseb River to the Tsondab
12 Flats used by earlier researchers at Gobabeb; Figure 1, site C) was also observed by
13 Shackley (1985), but the artifacts at this location have not been reinvestigated by our
14 team as its coordinates do not align with its map placement (Shackley 1985). The site
15 is said to include bifaces and cleavers that are similar to Namib IV (Shackley 1985).

16
17 Anibtanab is an interdunal pan site northeast of Namib IV next to the !Khuseb river
18 ravine (Figure 1, site E). The sample assemblage contains 209 MSA artifacts and a
19 single quartzite handaxe, as well as highly fragmented fossil faunal material (Leader et
20 al 2022). However, because the ESA is limited to only a single artifact, further
21 research must be conducted at the site before making comparisons to denser sites such
22 as Namib IV.

23
24 The site of Bosworth (Figure 1, site D) is a low-density surface scatter southeast of
25 Namib IV situated near Tsondabvlei, the current endpoint of the ephemeral Tsondab
26 River. The assemblage contains a large flake component likely attributable to the
27 MSA, but with some larger flakes which may suggest earlier material. Typologically
28 ESA material includes four handaxes with rounded butts (Shackley 1985).

1.2. Archaeological investigations of Namib IV

Shackley's 1980 paper first introduces Namib IV and presents 394 artifacts from a random surface sample of "22,500m²" (Shackley 1980) but provides no detail on the location of that sample within the pan surface. That sample size is equivalent to about a third of the total pan (which is 64,000m²) and would contain a significantly higher number of artifacts (pers. ob.). In the second Namib IV publication (Shackley 1982) Shackley discusses 394 artifacts from a random surface sample of 2,500m², perhaps suggesting a misprint of the area in the original 1980 paper. The 1982 paper also incorporates into the analysis an additional 107 artifacts, but provides no information on the collection area of that sample. With these two samples combined, the 1982 paper discusses a total of 501 artifacts, but again provides no location on the pan and only one of the two samples were from a given spatial area.

The third paper by Shackley (1985) only discussed 82 artifacts from the southern area of the pan. These are said to have been collected from 150m². No mention of the previous 501 artifacts is made or why only 82 artifacts are discussed. Adding further confusion to the size of the assemblage from the site that the National Museum of Namibia curates, which consists of a total of 300 artifacts (discussed later).

Finally, Shackley discusses the finding of *Elephas recki* fossils at the site, suggesting that the fossils demonstrate the site as a butchering site (1980). In the paper no mention of the location or deposit in which the fossils occur is given, and therefore it is difficult to ascertain whether or not the fossils are even associated with the stone technology chronologically. No fossils from Shackley's Namib IV discussions have been located at the National Museum. Our investigation at the site has identified two fossil beds which appear to be in different deposits and may be very different in age. Based on a photo from Teller et. al. (1990), we believe the *E. recki* fossil may have been discovered just south east of Fossil Bed 1 (Figure 2).

1
2 **1.3. Geological, geomorphological and chronological context of the**
3 **Namibian Sand Sea**

4 The Namib Sand Sea (NSS) is located in the central part of the Namib Desert between
5 the ephemeral !Khuiseb and Koichab rivers in western Namibia. The Namib is
6 frequently described as the oldest desert in the world, with a general pattern of
7 persistent aridity with long-term slow landscape erosion for at least the past 15 Ma,
8 interspersed with wetter periods with accelerated denudation (Van Wateren and Dunai
9 2001). The Namib Sand Sea (NSS) may largely be Plio-Pleistocene aged (e.g. Ward
10 et al., 1983; Ward 1987), or younger if the Kuiseb Canyon incision timing from
11 cosmogenic isotopic data indicates more-widespread humidity capable of hampering
12 dune accumulation (Van Wateren and Dunai, 2001) and not just higher rainfall over
13 the highlands of the Great Escarpment. Overall, the cosmogenic data is equivocal.
14 Whilst the incision of !Khuiseb Canyon is 2.8 to 1.3 Ma (middle reaches) and to 0.4
15 Ma (upper reaches), low denudation rates within interfluvies on the gravel plains do
16 not support a wetter Namib Desert coastal margin (van Wateren and Dunai, 2011).
17 Furthermore, NSS dune accumulation may respond more strongly to sediment
18 availability and windiness than to increased moisture balance. The NSS is underlain
19 by an extensive consolidated Palaeogene aeolian deposit, the Tsondab Sandstone
20 Formation (TSF) (Ward, 1988; Kocurek et al. 1999; Stone 2013).

21
22
23
24 **2. New Research**

25 The SANDS project was developed to investigate the following questions: (a) is
26 Shackley's lithic sample from Namib IV biased by collection practices ; (b) are the
27 stone tools and fossil fauna assemblages stratigraphically and temporally associated;
28 (c) is there any spatial patterning in the stone tool and faunal distributions across the
29 site; (d) can a detailed technological analysis of a broader lithic sample from Namib

IV clarify technological trends or patterns; and (e) how was the Namib IV site formed and what were the prevailing environmental conditions in the area when hominins occupied the pan. Here we present some preliminary results from the first visits to Namib IV.

2.1. Methods

2.1.1. Lithic sampling

In 2021 and 2022, a new sample of artifacts (referred to as ‘South Sample’) was studied at the site of Namib IV. Following a survey of the whole pan, this area was targeted because it was the area that seemed most likely to have yielded the majority of the Shackley assemblage (Shackley 1985; Figure 2), although the locations of her sample are not reported consistently. Using a map of the site, the sample area was divided into grid squares and a randomly generated location on the pan was selected for the data collection. The sample includes all surface-exposed artifacts from a 50x8 m area at the southern end of the pan (S23° 44.829’, E14 ° 19.720’, see Figure 2).

In addition to the randomly located South Sample, a sample of bifaces was studied, referred to as ‘LCT Sample’. Many of the bifaces recorded for the LCT Sample were disturbed by prior research during Shackley’s visit to the site in the late 1970s. At that time, a large number of handaxes and cleavers were moved and placed in groups where they could be photographed together. These biface groups are still clustered around other ESA material, such as flakes and cores, which are possibly associated with a specific context. Because of this historic displacement, our biface sample location is not randomly selected but has incorporated these groupings in addition to randomly scattered LCTs for the LCT Sample.

2.1.2. In situ lithic analysis

All artefacts were assessed in the following manner: Typologies were assigned based on Leakey (1971) and Kuman’s (2001) descriptions, and standard variables recorded

1 (maximum length, width, and thickness, raw material, weight) in situ. On flakes, the
2 number of dorsal scars was counted and the amount of cortical surface was estimated
3 to the nearest ten percent grouping (i.e. 0-10%, 10-20%). Facettes on flake striking
4 platforms were counted. Once data was collected and recorded, each artifact was
5 returned to its position in the 50x8 m sample area. The same variables were also
6 recorded on Shackley's 1978 lithic sample curated in the National Museum in
7 Windhoek, Namibia. The same researcher conducted the data collection to avoid
8 interobserver bias and ensure data integrity. This collection was then compared to the
9 "South Sample" for similarities. Several statistical tests were applied, including
10 Kolmogorov-Smirnov and Chi-square tests to further assess the similarities of the two
11 collections.

12

13 2.1.3. *Site documentation*

14 To assess possible associations between fossil fauna and stone tools across the site,
15 and provide sedimentological evidence for the formation and evolution of the pan,
16 several geotrenches (see Figure 2) were excavated at: a low-relief ridge south of fossil
17 bed 2 (GT1); on a slightly raised terrace associated with most ESA lithics (GT3); at
18 fossil bed 1 (FB1 and FB2); on the southwestern edge of the pan where modern dune
19 sand overlies a calcrete outcrop (GT2); and between GT1 and Fossil Bed 1 (GT4) to
20 explore the nature of the underlying sediment in one of the topographically-lowest
21 areas of the pan. Geotrenches were located to achieve four specific goals: (1) to
22 explore the depth and stratigraphic context of sediments immediately below the stone
23 tool- and fossil-bearing surfaces; (2) to explore sequences of sediments across
24 topographic features to investigate the nature of unit variability and make stratigraphic
25 correlations across space; (3) to attempt to find stone tools or fossil fauna within
26 stratigraphically constrained sediments; and (4) to provide exposures of sediments
27 documenting the formation of the pan for sampling for sedimentological and
28 microbotanical analysis (e.g., diatoms; Teller et al., 1990) to facilitate site formation
29 and palaeoenvironmental assessment. Sediments were described in the field in terms

1 of Munsell color, structure, sorting, texture, and biogenic/pedogenic features. Bulk
2 samples from target units were collected for carbonate, organic matter, particle size,
3 geochemical and microbotanical analyses. Results from sediment analyses and
4 luminescence dating of target units will be reported elsewhere.

6 **3. Results**

7 **3.1. *Geomorphological context of Namib IV***

8 The interdunal pan site of Namib IV sits in the northern portion of the Sand Sea about
9 8 km south of the !Khuiseb River and 20 km north of the Tsondab River (see Figure
10 1). The site is represented by an extensive interdune pan surface on which stone tools
11 and fossil fauna are found. The north-south elongated pan extends 1092 m north to
12 south and at its widest 508 m east to west and, on average, is 587.5 m.a.s.l. The dunes
13 to the east and west are long chains of star dunes, and rise up to ~130 m above the pan
14 surface to elevations of about 680-723 m.a.s.l. There are also smaller superimposed
15 dune ridges. The pan surface gently slopes from east to west and from north to south.
16 A narrow east to west orientated sand ridge has separated the pan surface into two
17 areas – a northern, slightly elevated pan, and the larger, elongated and lower southern
18 pan. The surfaces of both pans are characterized by a range of cover types: (1) mixed
19 sands deriving from the contemporary dunes and the underlying Tsondab Sandstone
20 Formation; (2) poorly sorted fine to medium sized, rounded to subrounded quartz
21 pebbles; and (3) eroded, reworked calcrete precipitate clasts, including rhizoliths.
22 Significant variability is seen in the composition of the surface-exposed sediments
23 across the dune surface. Within the pan, surface topography is characterized by low-
24 relief terraces controlled by horizontal calcrete beds and peneplained outcropping TSF
25 with several extensive flat surfaces separated by elongated shallow depressions. A
26 deflated pebble-rich bed dominates the northern pan, while finer-grained sediments
27 characterize the southern pan, with higher densities of finer pebbles concentrated in
28 shallow depressions. Artifacts and fossil fauna are most abundant in the southern pan,
29 and initial detailed survey of stone tool and fossil fauna distribution suggests a

1 correlation between different terrace levels and artifact type – a pattern that is
2 currently the subject of dedicated analysis through total station mapping of the site for
3 high-resolution spatial analyses.

4
5 The spatial distribution of lithic and faunal artifacts across the Namib IV pan surface
6 is important when considering the integrity of the assemblages, consistently a
7 significant concern when trying to constrain the age, technology and environmental
8 context of assemblages, or attempting to contextually correlate surface-exposed
9 assemblages across space and time (e.g., Fanning and Holdaway, 2001; Zerboni, 2011;
10 Borrazo, 2016). Surficial lithic assemblages are common on arid landscapes and are
11 often considered to be deflated or extensively reworked and considerably time-
12 averaged (e.g., Fanning et al., 2009), limiting their interpretative resolution. However,
13 dedicated geoarchaeological research has shown that it is possible to identify multiple
14 process and their effects on surface assemblages (e.g., Adelsberger et al., 2012),
15 providing opportunities to distinguish aspects of assemblages that may preserve useful
16 behavioral data (Marks, 2015). Despite very little documentation by Shackley of intra-
17 pan provenances of ESA artifacts, initial observations in the field suggest the
18 assemblages are not completely homogenized through long-term dispersive mixing
19 and may indicate that spatial patterning reflects differential mobilization and
20 preservation of components of assemblages in certain areas, which may be linked to
21 the complex topography and ultimately the hydrology of the pan (e.g., Nicoll, 2010).
22 Ongoing analysis of lithics on the pan surface, the underlying sediments and
23 topography, will provide greater clarity on the formation and taphonomic history of
24 these assemblages and is planned. Particle size analysis, combined with detailed
25 spatial documentation of the clastic component, including the artifacts, will help
26 clarify the susceptibility of mobilization across the landscape (e.g., Bertran et al.,
27 2012). The presence of fossil fauna in the pan provides significant potential for both
28 palaeoenvironmental reconstructions (e.g., Shackley, 1980) and chronological control
29 (e.g., Klein, 1983; but see Todd, 2005) but it isn't yet clear if the fossil fauna is

1 associated with the ESA or MSA lithic assemblages, limiting the fauna's usefulness
2 until their association is clarified.

3 4 **3.2. Initial observations of underlying sediment stratigraphy**

5 From south to north, the following sedimentological observations can be made from
6 the geotrenches. At GT3, a massive red cemented sand, interpreted to be the TSF
7 bedrock underlies a single shallow (0.5 m), rocky, grey-green, consolidated, shale-
8 like, silt-rich (field texture analysis) unit (*sensu* Besler, 1996). In GT1, a massive
9 cemented red sand unit (TSF) (just > 1m) is interbedded and capped by consolidated
10 grey-green silt units that extend to the landscape surface. Both GT3 and GT1 occupy
11 slightly higher elevation areas on the pan. The consolidated silts in the upper reaches
12 of GT1 are heavily fragmented and calcretised and are exposed across this higher
13 elevation area. In contrast to these higher elevation southern and southwestern sites,
14 the sediments beneath the surface calcretes exposed at Fossil Bed 1 at the eastern
15 edge, and GT2 at the southern edge are not cemented.

16
17 At GT4, a fine-grained consolidate silt occurs below 1 m (interpreted as an upper unit
18 of TSF) and is overlain by a cross-bedded yellow red to pinkish white sand, dipping
19 north-north-west at an inclination of between 14 to 24°. Sporadic iron/manganese-rich
20 nodules are found within these beds. The near-horizontal surface covered in modern
21 sand truncates the bedding of the underlying units in a clear disconformity.

22
23 At FB1 and FB2 the lowermost sediment encountered is a pale yellow very dry sand,
24 with orange-stained rootlets, overlain by a finely laminated calcrete, followed by a
25 slightly bedded, but heavily mottled silty, fine sand unit, which at FB1-1 is
26 interstratified with variably thick calcrete units towards the top. In FB1, some sandy
27 organic-rich lenses are intermittently present. Both sequences are covered by a
28 variably thick massive and locally laminated poorly indurated fossil-bearing calcrete
29 that is exposed on the landscape surface. A similar sequence is observed at GT2

(Figure 3). At the base of the GT2 sequence is a massive red grading into a yellow sand (similar color to modern dunes) that grades into a massive pale fine sand. This is overlain by a reddish yellow silty sand with some interstratifying thinner, brown-black and orange-yellow lenses. This unit is overlain by a white fine silty sand with occasional isolated small quartz pebbles and intermittent red sand laminations. The white sand unit is overlain by a brown silty stratified sand, rich in organic matter. The sequence ends an indurated massive and locally stratified calcrete covered by a thin mantle of red dune sand.

3.3. *Lithic assemblages*

Lithic artifacts are present on the surface over an area >64,000 m². The highest density scatters of both MSA and ESA artifacts, however, are found at the southern extent of the pan (Shackley 1985; Figure 4), referred to here as ‘South Sample’. Fossil-bearing calcrete deposits are exposed throughout the central and eastern portions of the pan. The calcretes, which preserve abundant root casts, indicate past occurrences of at least intermittent periods of standing water in this part of the pan. A number of *xòràs*, or shallow waterholes dug by oryx or other game, suggest that water may still accumulate after sufficient rain. It is therefore probably not coincidental that the areas with highest artifact density appear to sit adjacent to areas where standing water once collected.

3.3.1. *South Sample*

The South Sample assemblage includes 140 artifacts (Table 1). There are 20 formal tools including ten scrapers, seven denticulates and three Levallois points. The randomly selected 50x8m sample area did not produce any bifaces. Flakes and flaking debris make up 71.5% of the total sample. The majority of the sample is made up of types of debris (N=61) such as incomplete flakes (n=15) which retain their striking platform, flake fragments (n=21) which are the medial or terminal portions of the flake, split flakes (n=2), shatter (n=13), and core fragments (n=7). The most frequently found core type is an irregular core (n=12) showing no specific organization in

knapping strategy. No Levallois cores were found in the sample area, though three Levallois points were present.

Quartz is the preferred raw material with 84.3% (n=118) of the artifacts produced on it, while the remainder are produced on quartzite (n=22). No other raw materials were identified in the sample area.

Flakes with single platforms or fully cortical platforms are the most frequent platform type (69.2%). Multi-faceted platforms are found in smaller numbers (n=6, 15.4%).

3.2.2 Shackley's 1978 Sample

The 1980 sample includes 300 artifacts curated at the National Museum of Namibia.

The assemblage has five bifaces, four handaxes and one cleaver. Other formal tools include three scrapers and one knife, but no denticulates or Levallois points. Flakes and flaking debris account for 47% and 44.6 % respectively. Other debris (n=134) types include incomplete flakes (n=13), flake fragments (n=74), shatter (n=40), split flakes (n=1), split pebbles (n=2) and core fragments (n=2). The most common core type is irregular core (n=9) but also found in the assemblage are casual cores (n=4), two centripetal cores and one chopper core. The assemblage is produced on quartz 60% (n=180) of the time with quartzite used for 40% (n=120) of the artifacts.

3.2.3 Assemblage Comparison

The sizes of the artifacts from the South Sample and Shackley's sample are visually similarly distributed (Figure 5). The smallest component of Shackley's sample is 2cm while South Sample has fifteen pieces in the 1-1.9cm group. Neither assemblage has artifacts less than 1cm maximum length. Whilst a Kolmogorov-Smirnov test ($\alpha=0.05$)

1 shows a statistically different distribution for the recorded lengths of unbroken flakes
2 ($p=0.0003$), a test on elongation (w/l) shows no statistical difference ($p=0.1467$),
3 indicating that the overall character of the assemblage is similar.

4
5 Raw material is also visually fairly equal between the two assemblages (Figure 6),
6 quartz being the dominant raw material and quartzite fluctuating between 15-45% in
7 the various artifact categories. The highest quartzite group is Shackley's sample of
8 formal tools, which may be because the sample includes bifaces. Despite visual
9 appearances, a Chi-square test comparing proportions of quartz to quartzite across
10 broad typological groupings within each sample (defined in Table 1) is moderately
11 significant (Cramers $V = 0.390$). Removing typology and relying purely on
12 proportions of quartz to quartzite artifacts returns a less significant result ($CV=0.242$).

13
14 One further discrepancy between the Shackley's sample and the South Sample are the
15 bifaces. The random location on the pan for the South Sample collection produced no
16 bifaces. Shackley's sample has four handaxes and one cleaver.

17 18 **3.3 Large Cutting Tool Sample**

19 Bifaces are scattered across the southern area of the pan in low density, but there is a
20 clear high-density area on and next to the deposit with which they are likely associated
21 (see Figure 2). As mentioned previously, many of the bifaces, though not all, were
22 moved and placed in several clusters for photographs in 1978. These clusters are also
23 on and near the deposit associated with the bifaces, but the tools' proveniences have
24 been lost.

25
26 A new sample, LCT Sample, of bifaces, handaxes, and cleavers, was recorded. This is
27 particularly important because no detailed biface data is available from Shackley's
28 sample beyond our new measurements of the four handaxes and one cleaver in the
29 Namib IV material from Shackley's 1978 collection at the National Museum.

1
2 The LCT Sample consists of thirty-two cleavers along with twenty-two handaxes.
3 Thirteen LCT flakes show neither a point or a flat “bit” of a cleaver, and were classed
4 as neither handaxe nor cleaver because they were less-worked large flakes from a
5 cobble. Cleavers are all produced on flakes from large quartzite cobbles which are
6 split lengthwise from the end or the corner of the flake (Figures 7 and 8). Minimal
7 additional shaping is used, averaging only 6.35 additional removals (Table 2). On
8 average they are 16.96 x 10.71 x 4.74 cm which is slightly smaller than the handaxes
9 which are 18.08 x 9.96. 4.07 cm. This is perhaps due to the shape of the raw material
10 as cleavers have a tighter size distribution (Figure 9). In comparing the bifaces from
11 the LCT Sample to Shackley’s 1985 sample, the handaxes from LCT Sample are
12 larger (Figure 10 and 11). Shackley’s sample does have a cleaver (n=1, Figure 12)
13 included in the curated material, but that is too small a sample to be used for
14 comparison.

15 16 **4. Discussion**

17 The arid landscape of the northern NSS bears evidence of hominin occupation in the
18 form of stone tool artifacts that, in areas, form dense surface scatters typologically
19 representative of at least intermittent occupation from the ESA. Shackley’s initial
20 documentation of LCTs and fossil fauna from Namib IV proposed some intriguing
21 hypotheses regarding Pleistocene hominin exploitation of this landscape, but
22 fundamental inconsistencies in the reports limit contemporary assessments of these
23 assemblages within the technocultural and palaeoenvironmental context of the
24 Namibian Stone Age, and within the context of the Namib IV pan.

25
26 It is often assumed that surface sites such as these lack stratigraphic context, and as
27 such the scatters have been largely overlooked, leading to a biased picture of early
28 hominin distribution in arid environments the world over (Knight and Zerbini 2018).
29 Despite the challenges posed by desert surface assemblages, their ubiquity offers

1 insights into hominin behaviour over longer time scales within these marginal
2 environments: migrations; resource distribution and exploitation; and raw material use
3 and discard (for example Blumenschine et al. 2012). Whilst fluvial runoff features
4 such as the !Khuseb and former Tsondab River have cut into and eroded the
5 Palaeogene TSF, the sands of the NSS represent a depositional phase. There is
6 widespread evidence for conditions wet enough to develop reticulated drainage
7 networks (Paillou et al. 2020) and for rivers to flow intermittently deep into the NSS
8 until the Late Pleistocene (Stone & Thomas 2013). These clues for open surface water
9 are obscured, literally and figuratively, by the massive dunes of the NSS, which
10 Lancaster (1989) estimated to have accumulated over 2-3 Ma by volume. The dune
11 sand originates from the Orange River that migrate from south to north along the coast
12 and eastwards from the coast to the interior. Minimum age estimates for the formation
13 of the NSS are well in excess of 1 Ma, based on a north-south transect of cosmogenic
14 burial ages, (Vermeesch et al., 2010), suggesting that it takes near-surface sand at least
15 that time to be transported across the area. Whilst smaller dune forms may migrate
16 very fast, the star dunes and linear dunes to the east of the sand sea are the least
17 migratory features (Stone, 2013) even though they may accumulate/migrate quite
18 rapidly (Bristow et al. 2007, Chandler et al. 2022). This means there that interdune
19 pans may be exposed for significant periods, providing an opportunity to explore
20 questions about hominin occupation and migration within a relatively stable
21 landscape, and Namib IV is a site with multiple forms of evidence to combine for a
22 complete picture of the environment and hominin technology.

23 From a site formation perspective, the following preliminary interpretations can be
24 proposed. Though further high-resolution spatial mapping is planned, the MSA
25 deposits and LCTs (ESA deposits) are observed to be separated both spatially and by
26 elevation, suggestive of association with different deposits. The fine sediments
27 exposed in the geotrenches allude to a complex low energy alluvial sequences
28 depositing sediment over weathered and eroded TSF rocks with intermittent periods of

1 standing water or saturated sediments in the lower soil profile forming sequences of
2 pedogenic calcretes that seal root-penetrated sands, indicative of soil formation.
3 Interstratifying pale and red horizontally-bedded sands suggest a punctuated
4 deposition of more distal sediment sources and locally reworked dune sands into the
5 pan, while darker sands are visibly rich in organic matter. Deflated pebble-rich
6 pavements in the northern pan suggest prolonged presence of fluvial networks. Lighter
7 color sands are indicative of presence in water in two ways: (1) mechanical
8 transportation of sand from a different source, or washing off the coatings on the sand;
9 or (2) precipitation of calcium carbonate during periods of sediment wetting and
10 evaporation. Near-horizontal bedded silty sands are indicative of shallow, low energy
11 alluvial deposition, while cross bedded sands (e.g., GT4) are indicative of a migrating
12 sand dune (slip face), and in this case the near-horizontal surface indicates this was
13 then partly eroded mostly likely by water that then filled the basin. Evidence of water
14 on the Namib IV landscape is clear, when that water was present in relation to the
15 stone tool and fauna assemblage formation is the next question. Although we eastern
16 geotrenches didn't reach the TSF contact, understanding the morphology of the
17 bedrock is important for modelling the palaeohydrology of the area. The
18 geomorphological evolution of the pan is a crucial process to further clarify given its
19 influence on the possible transport of different elements of the stone tool and fossil
20 faunal assemblages. Taphonomic analyses of both materials will help decipher their
21 history within this complex environment. The freshness of the stone tools, nature of
22 the sediments and localised distributions of the assemblages suggests a spatial
23 distribution of geogenic process that may have enabled the preservation of older
24 landforms in the pan.

25 Namib IV is often cited as an example of an ESA site in Namibia, but scrutiny of the
26 published assemblages has raised questions that need to be addressed. The first
27 archaeological work conducted in the late 1970s offers only hints at methods, sample
28 locations, and sample sizes. Rather than continue to accept that the curated material is

1 an accurate representation of the site, a new random sample with a known location and
2 area was studied. Ultimately, the artifacts collected from the South Sample
3 demonstrated that Shackley's sample (1985) was probably obtained from an area
4 similar to the 50x8 m used in the South Sample. The sample is consistent with a MSA
5 sample and produced mostly on quartz. However, bifaces are numerous on the large
6 pan surface, though none fell in the South Sample collection area.

7 The bifaces are evidence of hominins collecting large ovular clasts in the !Khuiseb
8 River valley as a source of raw material. Quartzite raw materials derived from the
9 vicinity of the !Khuiseb have been linked with Namib IV and other sites in the Sand
10 Sea through x-ray fluorescence, indicating hominin movement from the river valley
11 into the dune environment (Marks et al. 2014, Leader et al. 2022). Further work is
12 needed to determine if bifaces were knapped on site or knapped elsewhere and brought
13 to the site. The cleavers are produced by removing a large end or corner struck flake
14 from an ovular river cobble and finished with only a few additional removals. The
15 cleavers are unique in their final form which often includes a long but curved cleaver
16 "bit". Compared to other cleavers in the Acheulean, the cleavers at Namib IV are
17 minimally worked but have a highly functional working edge.

18

19 **5. Conclusions**

20 Namib IV is an ESA and MSA pan site between the Tsondab Flats and the !Khuiseb
21 River between high dunes of the Namib Sand Sea. MSA artifacts are found in
22 moderate density across the entire surface of the pan site but in higher numbers
23 towards the southern end of the pan. ESA artifacts are also scattered across the
24 southern end of the pan, and appear in high densities near calcrete deposits, possibly
25 indicative of their association with those deposits and with surface water resources.

26

27 The bifaces were originally dated through proposed association with *Elephas recki*
28 fossils (Klein 1983), later dated with a single U/Th date to 300-425ka (Shackley 1980;

1 Mesfin et al 2021). However, the known date range of *Elephas recki* and its presence
2 in this part of Southern Africa has been called into question, raising the possibility of a
3 misidentification (Todd 2005). No distinctive fossil material could be located in the
4 material from Namib IV curated by the National Museum to allow re-identification.
5 Further, the association between two different fossil deposits at the site and the artifact
6 deposits remains, for the time, unknown. As such, the previous date range provided by
7 Shackley (1980) of 400-700 kya cannot yet be confirmed.

8
9 Bifaces are dominated by large cleavers produced on river cobbles. They are
10 consistent with Acheulean technology but remain undated. Cleavers are more
11 frequent than handaxes which occurs in other Early Acheulean sites in Southern
12 Africa (Leader 2014) but is not always the case (Lotter et al. 2017, Lotter et al. 2022).

13
14 The site was originally interpreted as an ESA butchering site based on the bifaces and
15 faunal remains (Shackley 1980). However, the paleoenvironmental, depositional
16 record and chronology is not yet understood. Ancient ephemeral fluvial channels
17 (Paillou et al. 2020, Stone & Thomas 2013) and persistent alluvial pans supporting
18 peripheral soils formation, vegetation and support for grazing animals may have
19 played a role in attracting hominins to this now hyper-arid environment.

20 21 **Future work**

22 High resolution spatial and taphonomic survey of the entirety of the surface material is
23 planned for the next field season, which may link ESA artifacts with specific deposits.
24 Additional geotrenches will refine pan-wide stratigraphic correlations and attempt to
25 expose the morphology of the underlying TSF. In addition, additional and expanded
26 geotrenches will hopefully yield in situ artefacts. Depositional and paleoenvironmental
27 features will be examined through microscopic studies and local sedimentary and
28 geomorphological features will be linked with broader, regional hydroclimatic
29 conditions through remote sensing. In addition, chronological control of sediments in

geotrenches will be attempted by luminescence dating, utilizing protocols that extend the age-range of the dating technique.

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Figure and Table Captions

Figure 1. Map of the research region showing the site of Namib IV. Left Image: survey areas, 1: Corvinus 1983, 2: Shackley 1985, 3: Hardaker 2011. Right image: Close up of ESA sites in the survey area from Shackley 1985, A: Narabeb, B: Narabeb West, C: Tsondab Route, D: Bosworth, E: Anibtanab, and Namib IV.

Figure 2. The site of Namib IV is located between the !Kuseb River to the north and the ancient path of the Tsondab River to the south which flowed northwest.

Figure 3. Geotrench 2 eastern profile exemplifying uncemented sediment sequences exposed in FB1 and FB2 geotrenches.

Figure 4. MSA flake blade produced on quartzite from South Sample.

Figure 5. Comparison of maximum lengths of Shackley's sample and South Sample.

Figure 6. Raw material comparison.

Figure 7. Quartzite cleavers on end struck cobble flakes.

1 Figure 8. Quartzite cleavers on end struck cobble flakes.

2

3 Figure 9. LCT Sample handaxe and cleaver size distribution.

4

5 Figure 10. LCT Sample handaxes and cleavers compared to Shackley's (1985)
6 handaxes. (cleaver n is too low in Shackley's 1985 sample for comparison.)

7

8 Figure 11. Handaxe on quartz from South Sample.

9

10 Figure 12. Cleaver from Myra Shackley's 1980 assemblage curated at the National
11 Museum of Namibia in Windhoek.

12

13 Table 1. South Sample and Shackley Sample Totals

Cores	<u>South Sample</u>			<u>Shackley Sample</u>		
	Total (%)	Quartzite	Quartz	Total (%)	Quartzite	Quartz
Bifacial Core	1	1	0	0	0	0
Irregular Core	12	2	10	9	3	6
Casual Core	3	1	2	4	1	3
Chopper Core	2	1	1	1	1	0
Pebble Core	2	0	2	0	0	0
Centripetal Core	0	0	0	2	0	2
Total	20 (14.3)	5	15	16 (5.3)	5	11
Flakes						
Cortical Platform	13	2	11	25	11	14
Single Face						
Platform	14	1	13	85	26	59
Multi-Faceted	6	2	4	7	5	2

Platform						
No platform data	6	1	5	24	9	15
Total	39 (27.9)	6	33	141 (47)	51	90
Tools						
Handaxe	0	0	0	4	2	2
Cleaver	0	0	0	1	1	0
Scraper	10	4	6	3	0	3
Denticulate	7	0	7	0	0	0
Levallois Point	3	2	1	0	0	0
Knife	0	0	0	1	1	0
Total	20 (14.3)	6	14	9 (3)	4	5
Debris /						
Incomplete						
Flake Fragment	21	2	19	74	33	41
Split Flake	2	0	2	1	0	1
Incomplete Flake	15	2	13	13	7	6
Shatter	13	0	13	40	19	21
Split Pebble	3	1	2	4	0	4
Core Fragment	7	0	7	2	1	1
				134		
Total	61 (43.6)	5	56	(44.6)	60	74
Total	140	22	118	300	120	180

1

2

3 Table 2. Biface Size Profiles

Typology/Clast	Length (cm)	Width (cm)	Thickness (cm)	Scar Count	Mass (g)
Max.	22.5	13	6.6	15	1531

Cleaver Quartzite Cobble Flake (n=34)	Avg.	16.95	10.71	4.74	6.35	918.67
	Min.	11.1	6.4	3.4	1	511
	Std. Dev.	2.599	1.51	0.72	3.47	282.73
	Max.	21.4	12	6.6	14	1430
Handaxe Quartzite Cobble Flake (n=22)	Avg.	18.08	9.96	4.87	8.47	827.28
	Min.	12.8	8.1	3.7	5	476
	Std. Dev.	2.35	1.06	0.69	2.71	200.5
	Max	22.2	12.5	5.8	12	1514
LCT Quartzite Cobble Flake (n=13)	Avg.	17.48	10.31	4.45	5.18	885.53
	Min.	14.1	8.9	3	0	385
	Std. Dev.	2.31	1.27	0.96	3.54	299.65

1
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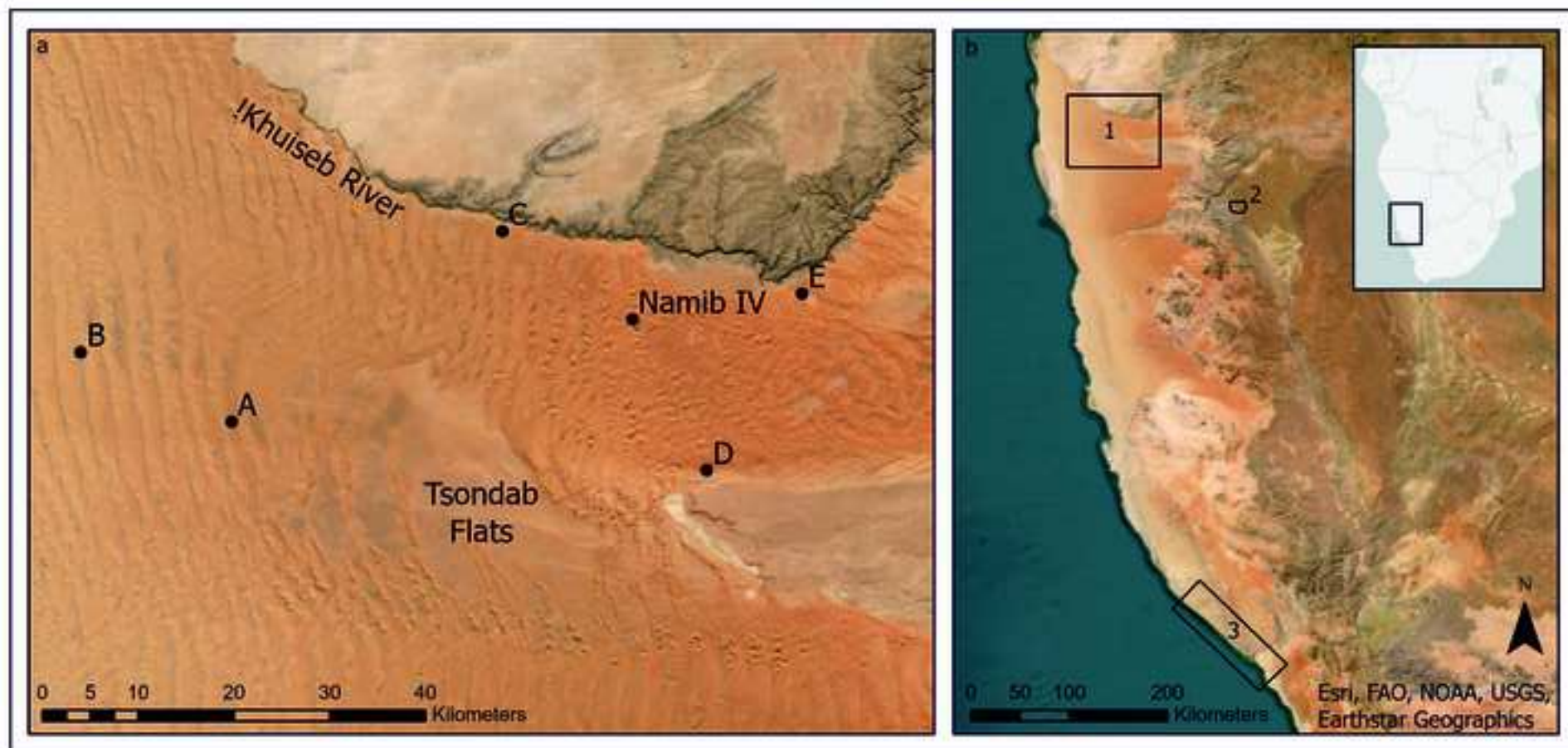


Fig 2

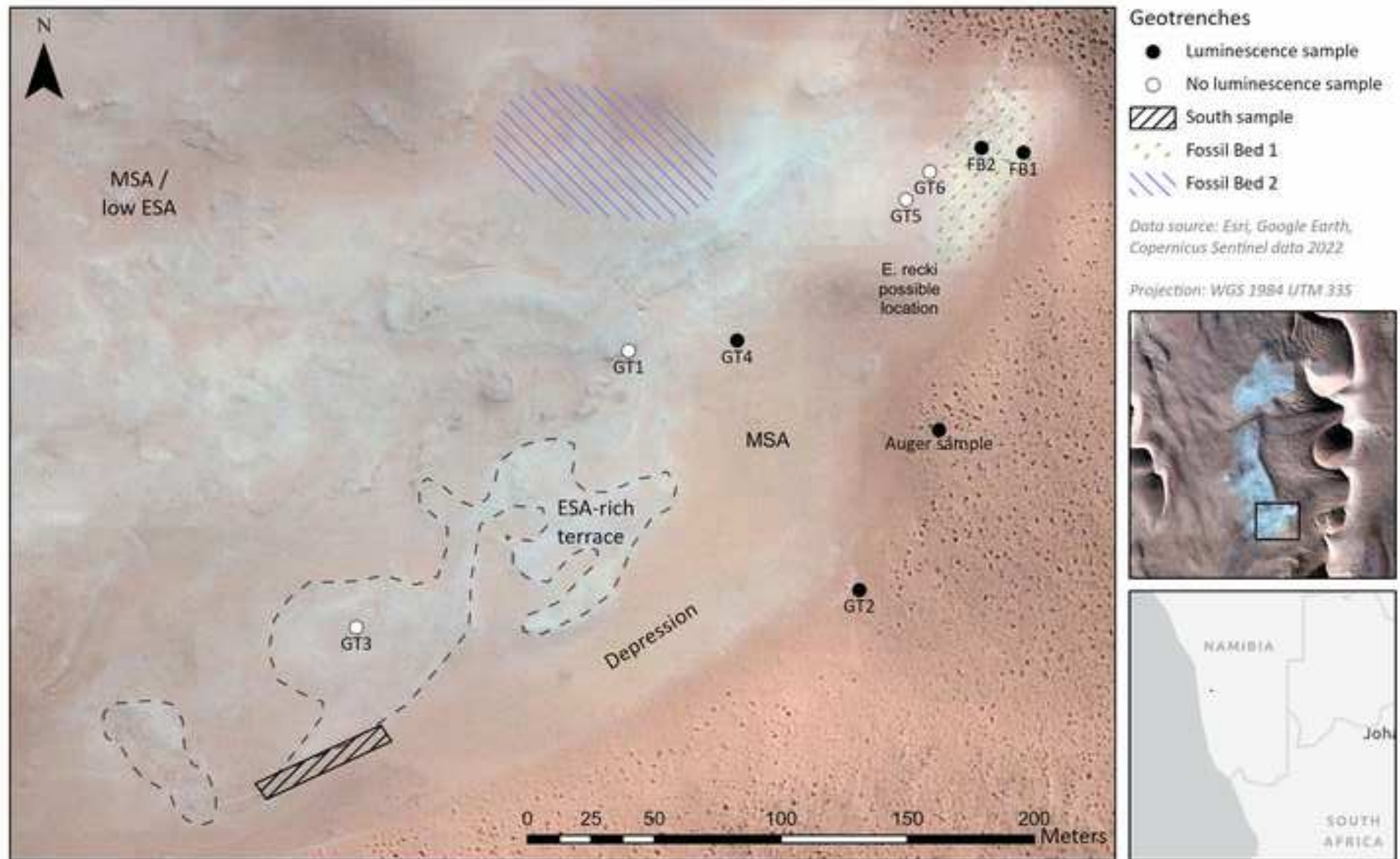


Fig 3



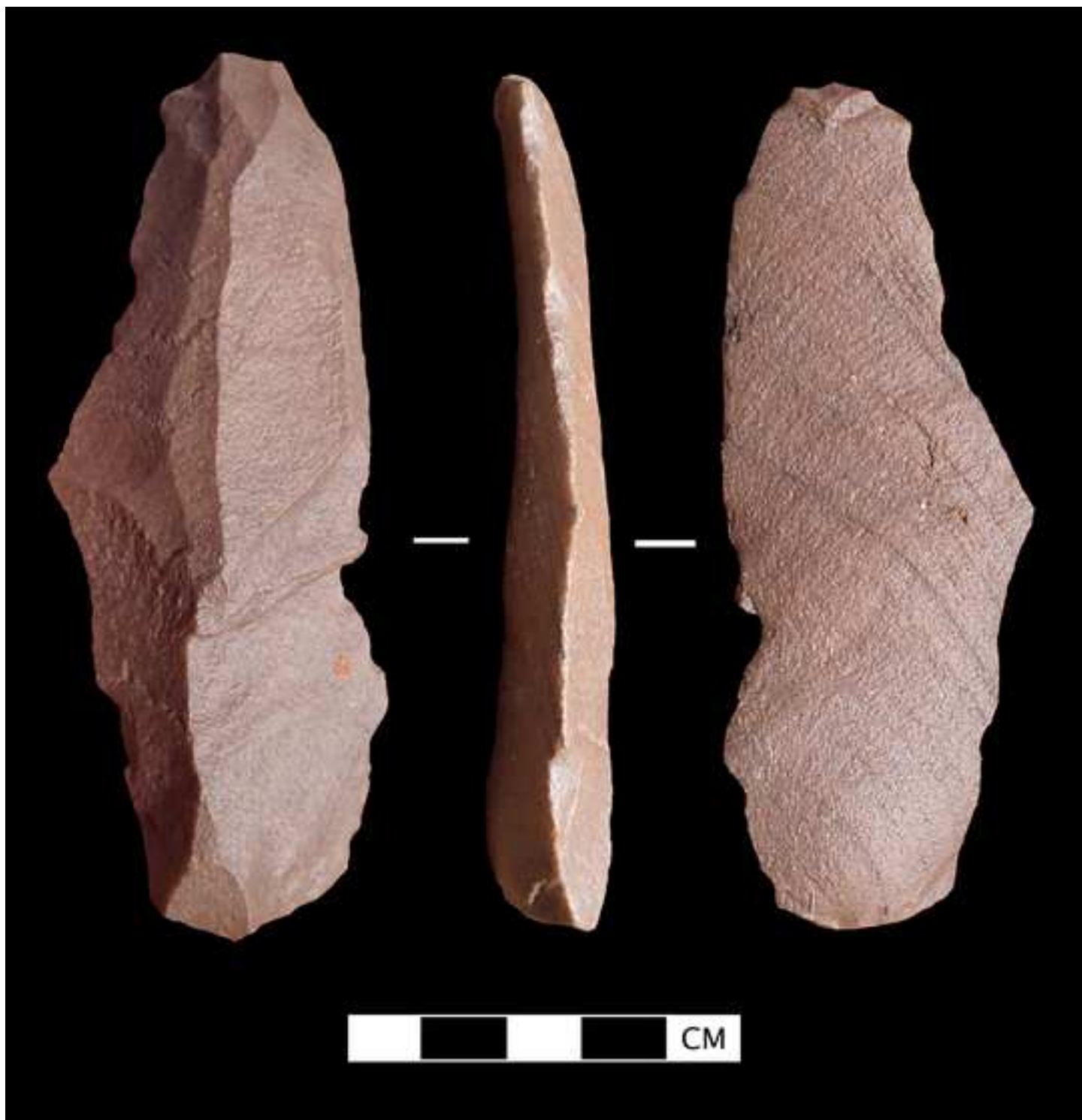
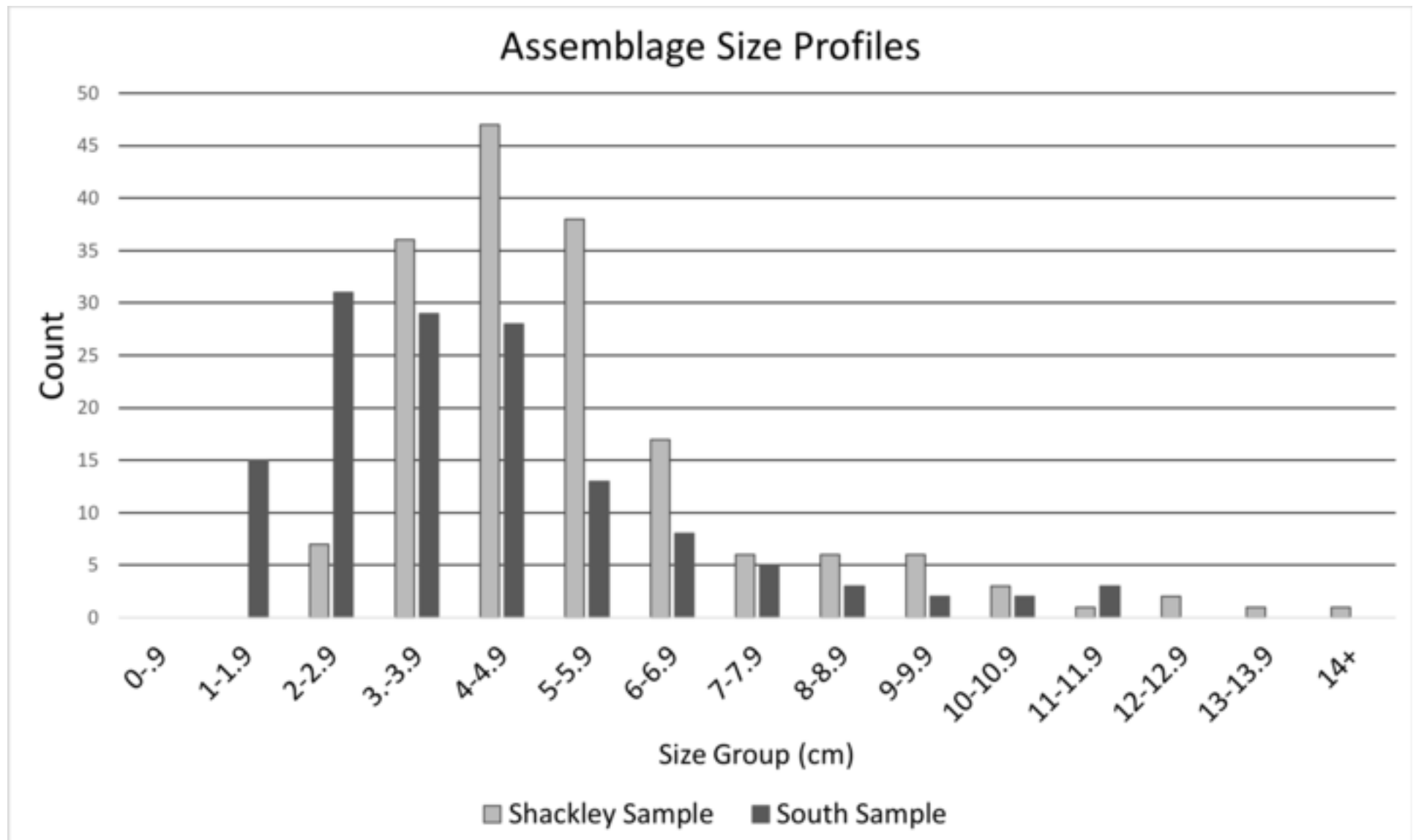
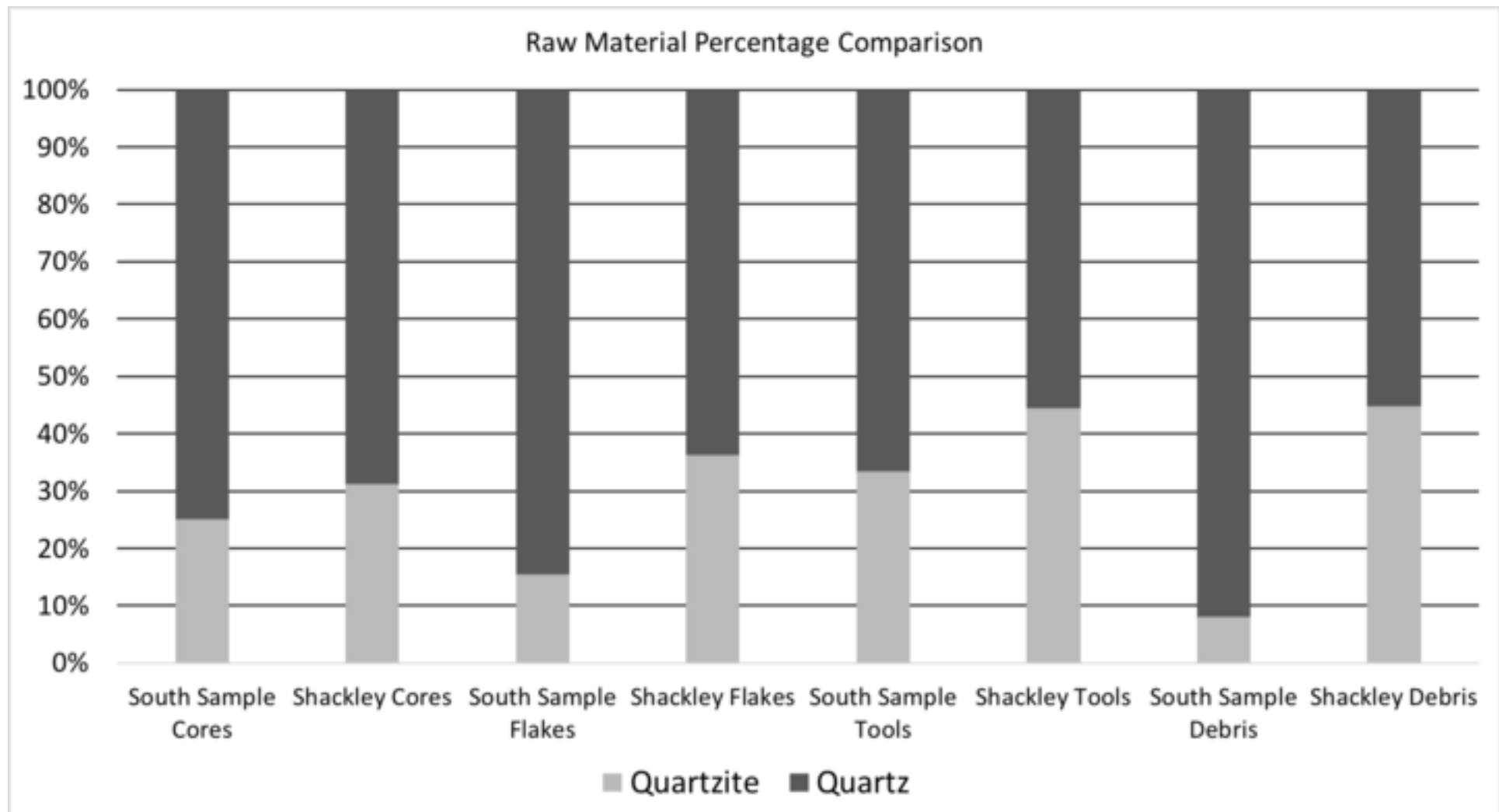


Fig 5





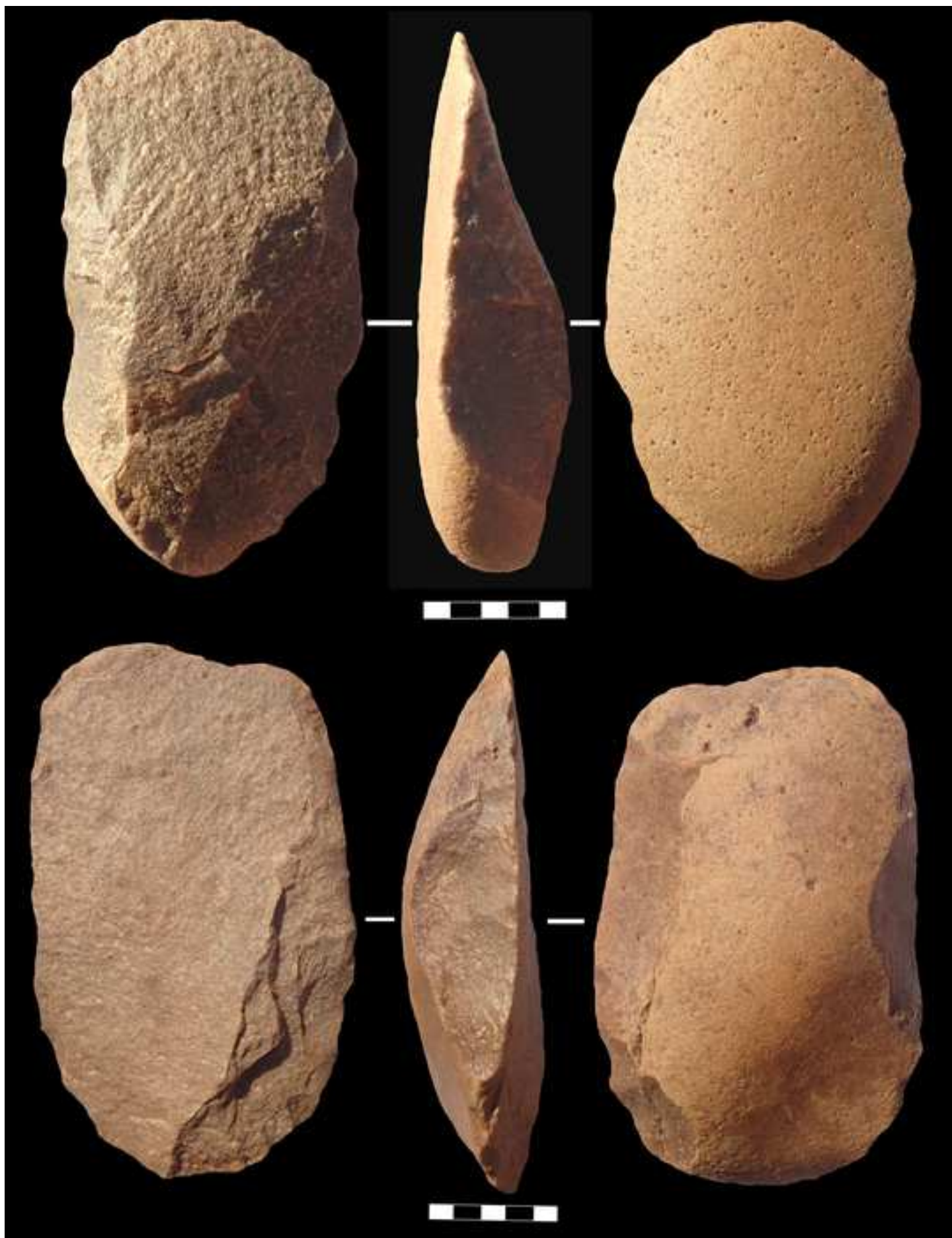


Fig 8

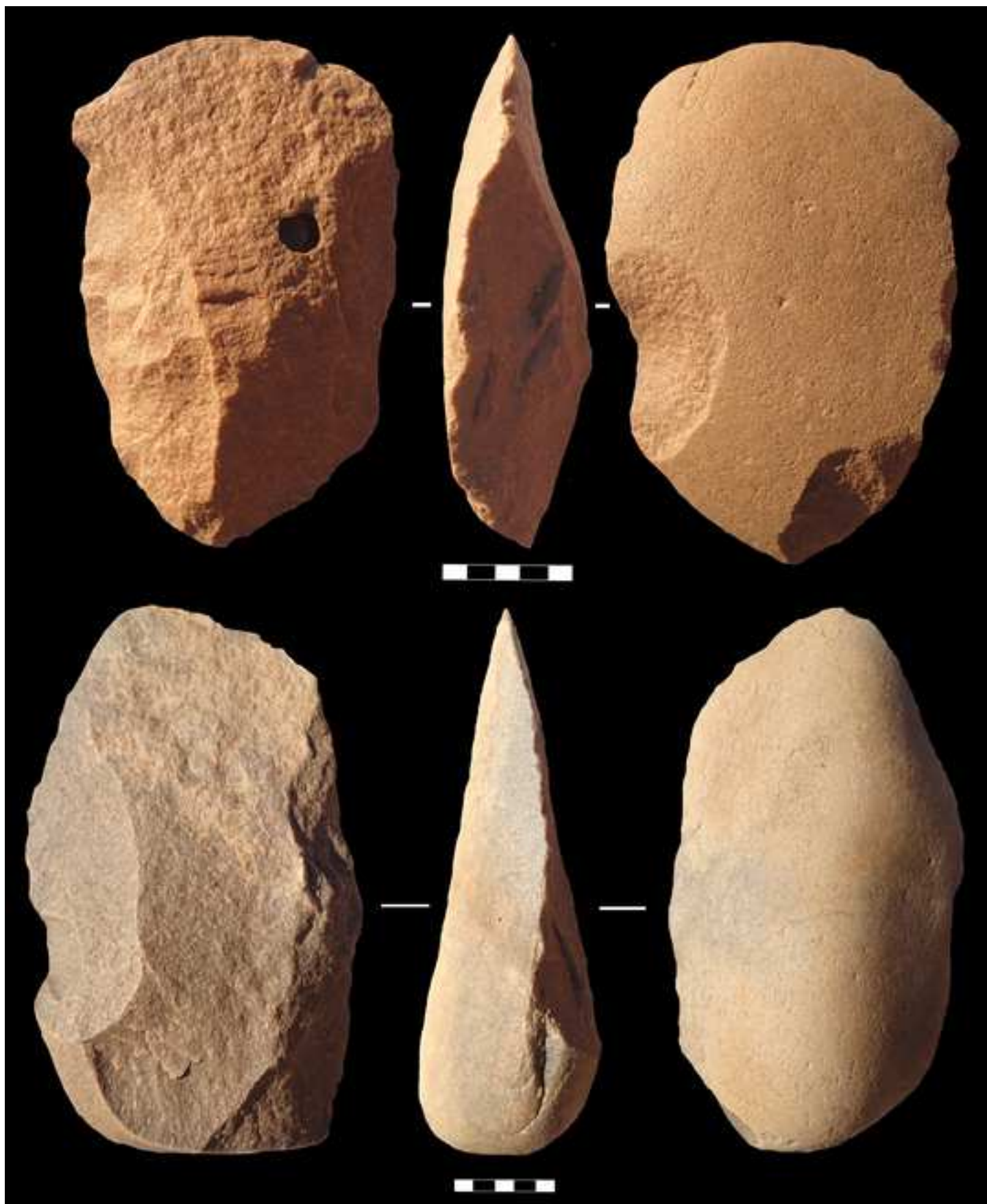


Fig 9

[Click here to access/download;Non-color figure;Fig 9.png](#)

