Results of a second season of Paleolithic survey in the Agig area: the Red Sea region of the Sudan

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Introduction

One of the contentious issues in paleoanthropology today concerns the geographic route/routes through which hominins (early humans) left Africa. The Nile corridor and the Strait of Bab al-Mandab (the southern Red Sea) are commonly cited as the likely routes by which hominins dispersed out of East Africa (Van Peer 1998; Derricourt 2005; Beyin 2006). However, the extent to which hominin movements remained confined to these regions is unclear. The western periphery of the Red Sea (WPRS) occupies a critical geographic location to be considered as an ideal region to assess the role of coastal habitats in hominin survival, and the facilitation of important transitions in human evolution, as well as the possibility of hominin dispersal out of Africa through a coastal corridor. As a coast-bound corridor linking the fossil-rich East African Rift system with Southwest Asia, the region may have hosted multiple hominin settlement episodes, and some of the inhabitants may have easily dispersed toward Eurasia from there (Beyin in press). Unfortunately, the region had seen little Stone-Age focused research in the past, hindering an informed assessment of its contribution to hominin survival and dispersal.

With these questions and ecological scenarios in mind, in 2017, members of the current project launched 'The Red Sea Paleolithic Project' aimed at investigating the role of the WPRS in hominin survival and their movement out of Africa through documenting and studying Stone Age sites in the Red Sea coastal region of the Sudan. To this end, in the summer of 2017, the team carried out a three-week pilot exploration in the Agig and Khor Baraka districts of the Sudanese Red Sea region, which resulted in the documentation of five sites and numerous low-density lithic scatters on diverse landscape settings (Beyin *et al.* 2019). The most conspicuous artefact class documented at the surveyed localities were what archaeologists commonly identify as bifaces or large cutting tools (mainly of the handaxe type) that are characteristic of the Acheulean technocomplex, dating to *c.* 1.7–0.3Ma (Ma = million years ago) in Africa (de la Torre 2016). Other encountered artefact types included points, scrapers, and prepared core products referable to the African Middle Stone Age (MSA, dating roughly to 300–50ka (ka = 1000 years ago) (Barham and Mitchell 2008). The finds suggest that the region hosted multiple hominin occupation episodes since the Acheulean and MSA technocomplexes are generally thought to have appeared at different times alongside the appearance of distinct hominin lineages.

A noteworthy observation from the pilot work (also upheld by the recent visit in 2019-2020) was that most of the documented sites lie inland (outside of the coastal zone) despite the team's effort to explore targeted localities in the coastal areas. This find seems to imply that the terrestrial niche hosted resources that were effectively exploited using the Achuelean and MSA technologies. This could mean that the area mirrored the interior wooded-grassland habitat where the inhabitants and such technologies may have originated. The extent to which aquatic resources played a role in hominin survival in the study area remains less well understood, as we have not located any site near the coast or aquatic faunal remains at the inland sites. Much of the area near the coast is covered by recent dune activity, which, coupled with wave erosion, may have obscured sites associated with coastal resource use. The presence of coral reef shelves a few meters above the present sea level reflects the episodic rise of the sea level in the past. However, it is not clear how low/high the sea level was during the documented Acheulean and MSA settlement episodes. Much of the reef shelves along the Red Sea are known to have been formed during the Last Interglacial phase (128–73ka) at which point the global sea level rose *c.* 8-15m higher than today (Hoang *et al.* 1996; Walter *et al.* 2000). Even if we try to infer the general water level history of the Red Sea from the global eustatic record, since we do not know the precise ages of the sites, it will not be possible to establish their position with respect to the shoreline. Such a task will have to wait until we establish the chronological placement of the sites.

Although the pilot exploration achieved its intended objectives, it has also raised many questions regarding the temporal placement (age) and environmental contexts of hominin settlement history in the focal areas. Thus, the project needed to continue collecting more field data with which to address these and other relevant questions about the nature of hominin adaptive behaviors (e.g. technological and land-use strategies) in the region. With these

research issues as a backdrop, and building on the success of the pilot study, the team set out to run another survey round, this time restricted to the Agig study area (Figure 1), from late December 2019 to mid-January 2020. This report presents the major finds of this recent field season.

The Study

Environmental setting

The study area comprises three major landscape settings (Kassas 1957):

1. The coastal peripheries, featuring reef shelves, inlets and sandy beaches.
2. High-rising mountain ranges called the Red Sea Hills that form the western flank of the coastal plains.
3. Channelised alluvial plains dotted with fan outcrops extending several kilometres landward between the coast and the footwalls of the Red Sea Hills.

Much of the landscape adjacent to the shoreline is covered by undifferentiated alluvial deposits and sand dunes of the Holocene age. For this reason, it was designated as a low priority area in this project. We decided to focus on the Agig area due to logistical convenience and the fact that the area exhibits landscape settings that appear to be ideal for human habitation, such as the low relief fields between the mountain fronts and coastal margins. Wet phases in particular would have recharged the coast-bound channels emanating from the hills, making the intermediary plains conducive to people and their prey species. Our brief visits to limited quarters of the inland zone during the pilot survey had revealed one of the most artefact-rich sites, Hayna 01 (HY01) (Beyin *et al.* 2019). Given this, our recent field season sought to investigate more of such landscape settings to determine their archaeological potential.

Objectives and methods

The pilot exploration covered only small areas in the Agig and Khor Baraka districts due to difficult weather conditions that limited the team's ability to survey for longer hours during the day. Even for those documented sites, we could only make a swift assessment of the archaeology there. Thus, additional survey was deemed necessary at the outset, in order not only to find new, informative sites that the team may have missed in the previous season, but also to refine our account of the already recorded sites in terms of their geological contexts and spatial extents, artefact contents and subsurface potential. Ultimately, increasing the sample size of sites in the study area would allow an informed assessment of hominin land-use strategies and technological behaviors across various settlement episodes. Hence, the principal objective of the recent field season was to generate new archaeological information by surveying localities that the team did not visit during the pilot study and by re-examining some of the already documented sites.

As was the case with the pilot exploration, in selecting target areas, the team employed a judgmental sampling strategy focusing on plain fields and stable outcrops near drainage channels, as well as channel terraces that bear well-exposed profiles. The fieldwork involved vehicle assisted foot-survey using systematic and unsystematic approaches. When visiting a locality for the first time, surveyors would walk the area in an unsystematic way, sometimes in a radial manner for a quick reconnaissance to determine the presence of archaeology. Once artefacts were encountered by anyone of the surveyors, the area would be subject to a transect-guided systematic survey with each surveyor covering 5-15m wide transects, depending on the landform. While most of the targeted areas were accessible by vehicle, occasionally the team had to walk up to 5km away from vehicle-accessible spots. The geographic proveniences of the artefact find-spots and important landmarks were recorded using a Global Positioning System (GPS), which was often operating at an accuracy of 3m. Our basic criterion for classifying a find-spot as a 'site' was the occurrence of more than 20 stone artefacts (tools or distinctive cores) within a $100m^2$ area (Beyin *et al.* 2019). An exception to this criterion was when fewer than this number but mostly diagnostic artefacts (again tools and cores) were found in a broadly dispersed manner in a discrete part of the landscape, such as an outcrop or a flat field bordered by a channel or elevated ground, in which case the find-spot would be identified as a site. Find-spots containing fewer than 20 artefacts, and comprising mostly non-diagnostic types were registered as off-sites.

Representative artefacts were collected from find-spots in a judgmental manner to aid assessment of hominin technological behavior through laboratory analysis of the collected specimens. GPS points were taken for all the

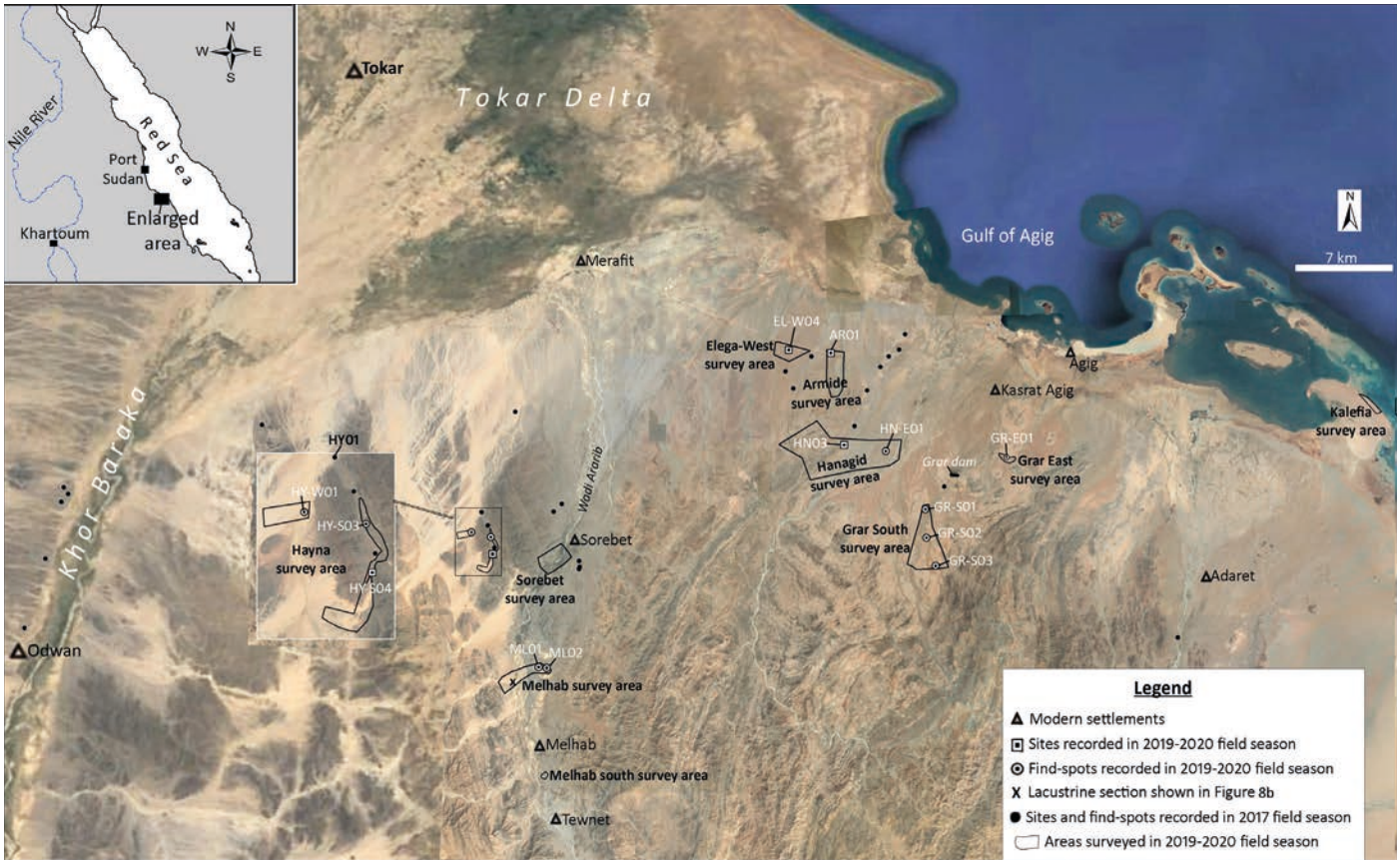

Figure 1. Location of the study area, surveyed localities and archaeological find-spots.

collected artefacts and each tool was assigned a field catalogue number consisting of the find-spot's first consonant letters and the serial number of its GPS point. When possible, the survey areas were named after local toponyms for the nearest prominent river or a hill range. Such information was provided by our local guides.

Results

This section describes the localities the team surveyed and the main archaeological finds in each survey area. Figure 2 shows the documented sites and off-sites, their proveniences and nature of their archaeological content. The find-spots registered as sites are Elega-West 04 (EL-W04), Armide 01 (AR01), Hanagid 03 (HN03) and Hayna-South 04 (HY-S04), whereas those identified as off-sites include Hanagid-East 01 (HN-E01), Grar-East 01 (GR-E01), Grar-South 01-03 (GR-S01-03), Hayna-South 03 (HY-S03), Hayna-West 01 (HY-W01) and Melhab 01-02 (ML01-02). The documented archaeological occurrences lie in varied landscape settings, which makes them useful for examining hominin activities across different landscapes.

Elega-West 04 (EL-W04)

Located just west of the Elega channel (Figure 1), this site produced broadly dispersed but some of the most impressive Acheulean handaxes so far discovered in the Agig study area (Figure 3a). The landform is nearly plain field, characterized by deflated lag gravel surface. Initially, the sight of numerous bulldozed trenches dug up for extracting gravel for the construction of the Suakin–Karora main road brought the area to our attention (Figure 3b). The road lies immediately north of the artefact-bearing area. A three-day intensive survey in the area revealed artefacts on the deflated lag surfaces, as well as on the floors and in profiles of the stripped grounds (Figure 3c). The inspected area extends 1.3kmx0.5km (the longest side runs in an east-west direction), and it is possible that numerous artefact-bearing sections may exist in the unsurveyed vicinity. Some of the most diagnostic aspects of the Acheulean tools found there include convergent-semiconvergent tip, thick butt, large and deep flake scars suggesting use of hard-hammer percussion, and use of local volcanic raw material, mainly rhyolite and basalt. The assemblage bears close resemblance to the HY01 finds from the previous field season. The occurrence of artefacts in subsurface profiles of the stripped zones will allow investigation of site formation history, and paleoenvironmental and temporal contexts of hominin activity. With this goal in mind, our next field season at the site will focus on the

		Provenience			Cores				Shaped tools						Debitage					Raw material	Period	
Name	Site/off-site	East	North	Elevation	Pebble, chopper and alike forms	Prepared - Nubian	Prepared - other	Prismatic/tabular	Other	Handaxe (>8 cm)	Other large cutting tools (cleaver, pick)	Point (triangular)	"Other Point forms: foliate or lanceolate	Scraper	Other- retouched	Triangular form	Blade form	Bearing signs of Levallois method	Other blanks/shatter	Volcanic (excluding obsidian)	Cultural Attribution	Hominin (h), Fauna (f) Fossil
Elega-West 04 (EL-W04)		396333	2015691	33					"											x	Acheulean	
Armide 01 (AR01)	Site	398853	2015281	25	x	x				x	x							x		x	Acheulean	
Hanagid 03 (HN03)	Site	399610	2008915	79						x	x	x	x		x	x		x	x			
Hayna-South 04 (HY-S04)	Site	375944	2002135	185								x		x								
Hanagid-East (HN-E01)	Site	402428	2008440	69																		
Grar-South 01 (GR-S01)	off-site	404963	2004483	93			x									x		x	x	x	MSA	
Grar-South 02 (GR-S02)	off-site	404952	2002611	117					x		x					x		x	x	x	MSA	
Grar-South 03 (GR-S03)	off-site	405487	2000762	144	x								x			x		x	x	x	?	
Grar-East 01 (GR-E01)	off-site	410623	2007878	43																		
Melhab 01 (ML01)	off-site	379261	1994838	202																		
Melhab 02 (ML02)	off-site	379786	1994769	204															x		Indet	f
Hayna-South 03 (HY-S03)	off-site	375791	2003251	168										x								
Hayna-West 01 (HY-W01)	off-site	374466	2003600	156																		

Figure 2. Sites and off-sites documented by the winter 2019/2020 field season of the Red Sea Paleolithic Project.

Figure 3. The Elega-West 04 survey area. Top: Acheulean artefacts found at the site (laboratory analysis of these finds is pending). Left: Artefact-bearing bulldozed area. Right: A handaxe cropping out of the profile of the bulldozed spot.

geoarchaeological examination of the artefact-bearing deposit. While most of the artefacts found on the surface were collected, we left several of the specimens seen in the wall-profiles in place to serve as reference points for the planned geoarchaeological examination.

The artefact-bearing deposit in this locality is composed primarily of channel-laid gravel and cobble material overlying a weathered Basement bed (Figure 3b). Due to this, fluvial activity had likely displaced many of the encountered tools from their primary context. But several of them do not appear to have been derived from far localities because they exhibit sharp edges, which would be unexpected if they were brought from afar. The tools may represent hominin activities in a paleo-riparian setting that may have existed nearby, which were subsequently moved to their present location by fluvial action. A noteworthy aspect of the EL-W04 site is that, it is located *c.* 13km from the current shoreline, making it the closest Acheulean-bearing site to the seashore. It may have been much closer to the sea during humid phases when the shoreline is expected to have risen. In light of the discovery of the HY01 Acheulean occurrence far inland, it is safe to say that Pleistocene hominins equipped with handaxes exploited diverse terrestrial landscapes in the region, potentially by moving seasonally between different settings. Such a land-use strategy may have afforded them access to diverse resources (Beyin in press).

Figure 4. Finds in the Armide survey area: a-b) classic bifaces, c-d) diminutive bifaces, e) lanceolate, f-h) Nubian Levallois flakes, i) foliate point.

Figure 5. Lithic finds in the Hanagid survey area: a, c, g, j) classic points, b) perforator, d-f) flakes, f) semi-convergent form, h) bipolar blade core, i) scraper (a-g are from HN03 and h-j from HN-E01).

Armide 01 (AR01)

To the east of the Elega channel lies a shallow local wadi (wadi = ephemerally drained riverbed) called Armide. A brief survey around its banks has revealed sparsely spread handaxes, points shaped through bifacial retouch and Levallois cores (Figure 4). Relative to the small size of the surveyed area (approximately 100x50m) and the sparse nature of the artefact density, the overall diversity of stone tools at this site is notable. Firstly the Acheulean entity comprises both large and diminutive entities (diminutive = smaller than 80mm in length), and secondly artefacts referable to the MSA, such as points and Levallois cores, are present. While MSA-affiliated entities are not uncommon at other Acheulean-bearing sites, their proportion is slightly higher here. Potentially, the presence of small bifaces together with MSA-affiliated entities at the site signifies a settlement episode associated with a younger/terminal Acheulean phase, which is known to have seen an overlap with the MSA Industry (Clark 1994). A few representative artefacts were collected from the encountered varieties.

Hanagid (HN03, HN-E01)

This survey area lies southeast of a locality by the same name that the team briefly explored in the previous season. It constitutes a series of barren ridges gently descending to shallow depressions that give rise to a network of local drainage channels. While the immediate peripheries of those channels host reworked sand and silt deposits, the ridges and associated slopes are covered by coarse gravel and rubble material that frequently form stony desert pavement surfaces. Most of the archaeological occurrences lie around the lower peripheries of the windswept ridges. In the recent field season, the team recorded one site in this survey area (HN03), where broadly dispersed stone tools referable to the MSA, such as retouched points and Levallois flakes were found (Figure 5a-g). Likewise, an off-site (HN-E01) lies to the east of HN03, and has revealed a low-scatter of lithics, comprising flakes, scrapers, points and a bipolar blade core (Figure 5h-j).

Grar (GR-S01-03, GR-E01)

The Grar survey area extends from the Grar dam southward to the foothills of the Hadaraba mountain. It constitutes a plain field bisected by tributary channels and the Wadi Grar, through which flash floods flow toward the coast during rainy seasons. The area between the channels features alluvial outcrops and windswept rocky hillocks that create a modest topographic relief within the expansive basin. Modern nomadic pastoralists place their camps at the base of those hills, and prehistoric people may have found them convenient for monitoring game movement around the basin. In addition to encountering numerous isolated artefacts all over the landscape, three off-sites,

Figure 6. Lithic finds in the Grar survey area: a) Lineal Levallois core, b-d) flakes referable to prepared core method, e) large foliate tool, f) triangular Levallois flake (a-d from GR-S01, and e-f from GR-S02).

Figure 7. a) HY-S04 site setting (looking south), b-e) finds at the site, f-g) isolated finds in the Hayna South survey area, h-i) stone tools embedded in a breccia bed at the HY01 site. All the finds belong to the biface (large cutting tools) class.

namely GR-S01-03 were recorded in this survey area, all located south of the GR01 MSA site that the team documented just west of the Grar dam in the previous season. The find-spots bear low-density scatters of wide varieties of stone artefacts. At GR-S01, the team documented a classic lineal Levallois core (Figure 6a), and at GR-S02 a large foliate point (Figure 6e). Flakes referable to the Levallois reduction method (Figure 6b-d, f) were found at both GR-S01 and GR-S02. Most of the artefacts in this survey area were heavily weathered. The large foliate form resembles the Lupemban MSA types associated with forest adaption (involving woodworking) in sub-Saharan Africa. At GR-E01 (northeast of the Grar dam), the team recorded a thin scatter of mostly non-diagnostic lithics.

Figure 8. Lithic finds in the HY-W01 survey area, all bifaces (large cutting tools).

Hayna (HY-S03-04, HY-W01)

The Hayna valley is the find-spot of the artefact-rich HY01 Acheulean site in the previous season. However, since our time in the area was all devoted to this site at that time, the archaeological potential of the surrounding landscape had not been assessed. Thus, in the recent field season, the team explored selected localities in the southern extension of the valley that hosts the HY01 site, as well as a small area adjacent to a wide wadi immediately west of HY01. The brief survey documented an off-site (HY-S03) and a site (HY-S04) in the main Hayna basin - the latter located in the southernmost vicinity of the valley. Likewise, the survey around the western wadi has located an off-site (HY-W01) where isolated artefacts were found on semi-level deflated surfaces. As is the case at HY01, the most diagnostic tools at the find-spots are large cutting tools (handaxe type), some finely made and others crude in design (Figures 7 and 8).

The HY-S04 finds appear to be *in situ* space-wise, such that the artefacts may have undergone intra-site dispersion but it is unlikely that they were transported from other high ground locations, because the site lies at the base of a sheared hill slope where hominin activity could not have occurred (Figure 7a). Isolated artefacts were encountered at numerous spots in the Hayna basin in addition to the cited find-spots (e.g., Figure 7f-g). Most importantly, a half-day visit to the HY01 site itself has revealed several artefacts embedded in the host breccia bed there (Figure 7h-i). By dating the depositional event that placed the artefacts in the breccia bed, we plan to establish the minimum age of the archaeological occurrence at the site.

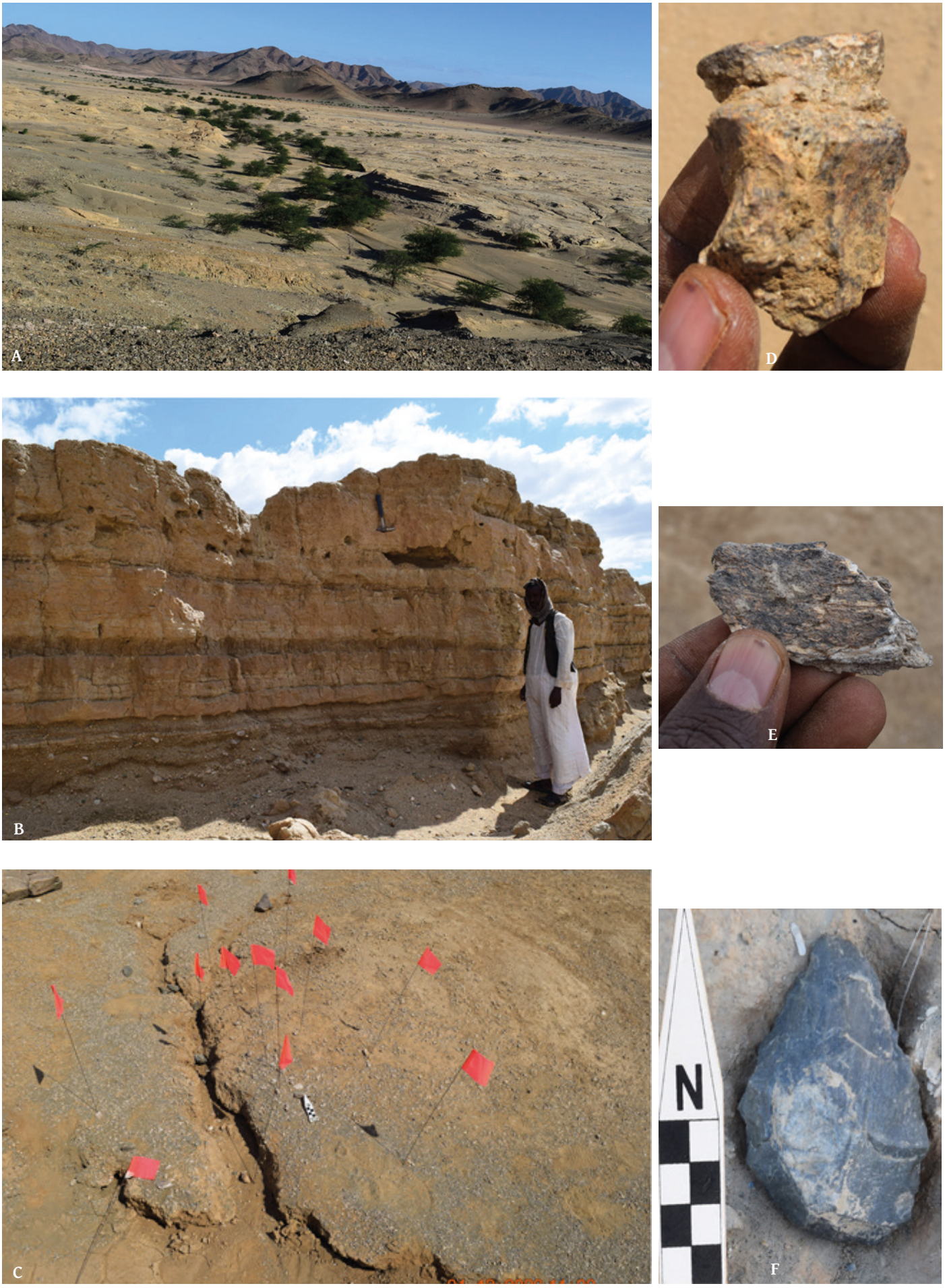

Figure 9. Melhab basin, lacustrine-looking deposit and representative finds: a) basin-view looking southeast, b) the deposit exposed along a channel bank at the lowest area of the basin, c-e) faunal bone concentration spot and representative specimens (ML02), f) classic point (ML01).

Figure 10. Reef limestone bed on the Kalefia coast, Red Sea coast of Sudan. Where the waves have washed away the underlying sediments, overhanging reef-shelves are common in this coastal zone.

Melhab

South of the Hayna valley lies a wide basin, called Melhab, which is traversed by a prominent channel called Wadi Ararib. Dotted with perennial springs, the wadi carries coast-bound drainage from numerous tributary channels originating from the mountain front. Not much information has been gathered about the archaeological potential of this area because the team only visited it for a short time toward the end of the field season. However, a day and a half reconnaissance has allowed us to discern the presence in the area of a lacustrine-looking deposit (Figure 9a-b), where isolated lithic remains and a faunal-bone cluster-spot were encountered at two places, registered as ML01 and ML02, respectively (Figure 9c-f). The rare lacustrine deposit holds considerable promise for future archaeological and paleoenvironmental investigations.

Sorebet and Kalefia

A half-day exploration of thick alluvial outcrops west of the Sorebet village (on the proximity of the Wadi Ararib) did not result in the discovery of any archaeological material, although the team has located several off-sites south and north of the village in the previous season. Likewise, a few hours visit to the Kalefia coast, where there is a well-exposed reef limestone bed (Figure 10), did not reveal any finds referable to the Stone Age, although low-density scatters of pottery fragments were observed.

Midway through the season, the team held a public outreach meeting with the Kasrat Agig community, which was well attended (Figure 11). The meeting involved a short presentation about our research activities and the importance of the region, and a showcase of artefacts collected from the newly documented sites.

Conclusions and implications of the new finds

In its second field season, the project successfully documented several Stone Age sites in the Agig study area, which, coupled with the finds from the previous season, clearly confirm the important role the WPRS may have played

Figure 11. Presentation of research activities at the public outreach meeting with the Kasrat Agig community.

in hominin survival and dispersal. Moreover, the finds attest the potential of the Agig area for revealing stratified evidence that can be dated in the future radiometrically. The documented sites occur on varied topographic settings, and represent tool types referable to the Acheulean and MSA technocomplexes. The emerging evidence suggests that hominins increased their survival chances in the study area by exploiting diverse landscapes. Although most of the sites lie inland, the recent field season has recorded a characteristic Acheulean occurrence in the Elega-West survey area (EL-W04), which is only *c.* 13km from the coast at present. The EL-W04 Acheulean finds bear close resemblance to the HY01 finds, which in turn share close stylistic similarities with Acheulean sites dated to *c.* 1.2–0.8 Ma in eastern Africa, such as Buia in Eritrea (Martini *et al.* 2004), and Kesem-Kebena and Konso-Gardula in Ethiopia (WoldeGabriel *et al.* 1992; Beyene *et al.* 2013), suggesting cultural and demographic affiliations among hominin groups that once inhabited the interior habitats and the WPRS. The similarities also attest that the Acheulean technology afforded hominins survival benefits across broad geographic and ecological settings.

The MSA technocomplex in the study area is best represented by cores and blanks referable to the Levallois method, and retouched tools, including points and, occasionally, scrapers. In general, the MSA does not constitute a prevalent status in the study areas compared to the more conspicuous Acheulean entities, possibly due to taphonomic bias. Because most MSA entities constitute small and less durable artefacts compared to the bulky Acheulean tools, they

are susceptible to attritional loss due to erosion and other taphonomic processes in open-air sites. Alternatively, it may also indicate that the MSA-affiliated settlements existed only for brief periods, resulting in a sparse signature of hominin activity on the landscape belonging to this culture.

The major contribution of this project thus far is that it has revealed characteristic Acheulean occurrences on the African side of the Red Sea that were previously unknown to the Paleolithic community. At the outset, the prevalence of handaxes (which are the archetype of the Acheulean technocomplex) at several of the visited localities suggests *Homo erectus* and/or possibly *Homo heidelbergensis* inhabited this region. As is the case at other sites in Africa and Asia (Clark 1994; Ambrose 2001), the main inventor of the Acheulean technocomplex is believed to be *Homo erectus*, a hominin lineage known to have inhabited Africa and Asia roughly between 1.8 and 0.5Ma (the terminal date is much younger in some regions). The industry was also adopted by *Homo heidelbergensis,* a possible descendant of *Homo erectus* (Klein 2009). In fact, typotechnological elements of both earlier and later Acheulean technology preserved in the study area attest to a prolonged history of Acheulean occupations and/or multiple Acheulean dispersals through the region.

Against this backdrop, the discovery of Acheulean sites in Agig and Khor Baraka area is significant because some of the inhabitants could have used the region as a spring board to disperse directly northward up to the Sinai Land Bridge following the western littoral of the Red Sea, or to enter the Nile basin and traveling northwards from there. Testing either scenario will depend on finding comparable sites in northeastern Egypt. Similarly, the discovery of MSA entities in the study area suggests its possible role as an Out-of-Africa dispersal conduit for archaic or early modern *Homo sapiens*, because the MSA is generally thought to represent the cultural innovations of *Homo sapiens*. Alternatively, the documented evidence may represent episodic hominin settlements in the study area that did not result in Out-of-Africa dispersals. Either way, the spread of hominins toward the WPRS in and of itself signifies the region's contribution to hominin survival. The present work is an important step to bringing this understudied but vital region into the spotlight of human evolutionary research.

Future Directions

Encouraged by the finds of the first and second field seasons, the team will continue to develop the project into an interdisciplinary and international research programme, with collaborators in the fields of geology, paleontology and geochronology. The team has two major agendas in the near future: to continue surveying more localities in the Agig study area with an emphasis on promising deposits, such as the Melhab area, to locate well-preserved fossils and artefactual remains, and to carry out targeted excavations and geochronological investigations at artefact-rich sites (e.g. HY01 and EL-W04). Ultimately, the project seeks to generate high resolution Paleolithic data from this underexplored part of eastern Africa with which researchers will be able to examine broader questions regarding the role of coastal landscapes and nearby ecozones in promoting hominin evolution, adaptation and dispersal.

Acknowledgements

The project was funded by the US National Science Foundation (BCS-1400473), and National Geographic Society (NGS-64510R-19). We are grateful to Drs. Abdel Rahman Ali Mohamed, Al-Hassan Ahmed and Amel Hassan Gismallah at the National Corporation for Antiquities and Museums in Khartoum for assisting with research permit. Beyin thanks his institution for financial support and travel authorisation in the middle of an academic year. We thank the administrator of Kasrat Agig, Mohammed Haj Mohammed Noor, and the community at large for their kind hospitality.

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