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Location and Research History

The Buia study area is located in the Dandiero basin (northernmost part of the Eritrean Danakil depression) and is named after the Buia village, 100 km SSE of Massawa (Fig. 1). The study area’s landmark (Buia) lies at 14.82 N, 39.84 E, and 155 m above sea level. The type locality for the human fossils is 12 km SE of Buia close to the Alad wells (Alad is the official name; in text and -gures can be found transliterated in Alat, Aalad, Aalat) and to the Alid volcano. The site was discovered in December 1995 following a preliminary prospection of the area in November 1994 (Abbate et al., 1998; Sagri et al., 1998). Afterwards, surveys were carried out by an international team with researchers from the departments of Earth Sciences and Antiquity Sciences “G. Pasquali” Paleontology, and Museum of Natural History of the University of Florence (Italy); CNR Institute of Geosciences and Resources, Pisa (Italy); the Eritrean Department of Mines, Ministry of Energy, Water and Mineral Resources; the Eritrean National Museum; and since 1997 in cooperation with Dipartimento di Biologia Animale e dell’Uomo of Rome University (Italy); the Dipartimento di Geoscienze of the Padua University, Padua (Italy); the Museo Etnografico “L. Pigorini,” Roma (Italy); the Laboratoire de Paléontologie Humaine, University of Poitiers (France), and the Institut Català de Paleoecologia Humana i Evolució Social (IPHES), Rovira i Virgili University, Tarragona (Spain).

Investigations in the Eritrean Danakil Depression are still ongoing. Recently, field explorations have extended to the Engel Ela-Ramud basin (south of the original focal localities) by IPHES and the Eritrean Commission of Culture and Sports, ECCS (Martínez-Navarro et al., 2016). The Buia site yielded a *Homo erectus/ergaster* cranium together with dental and postcranial elements (see

hereafter and Macchiarelli et al., 2004), rich mammalian faunal remains (Delfino et al., 2004, 2018; Martínez-Navarro et al., 2004, 2014; Fiore et al., 2004; Rook et al., 2013) as well as abundant artifacts, mainly from the left and right reaches of the Dandiero river (Martini et al., 2004). Moreover, 5 km south of the Buia site in the Dioli/Mulhuli Amo region, human cranial fragments (Coppa et al., 2014) were found in association with a remarkably high concentration of lithic materials dubbed the amygdale *esplanade* (study in progress).

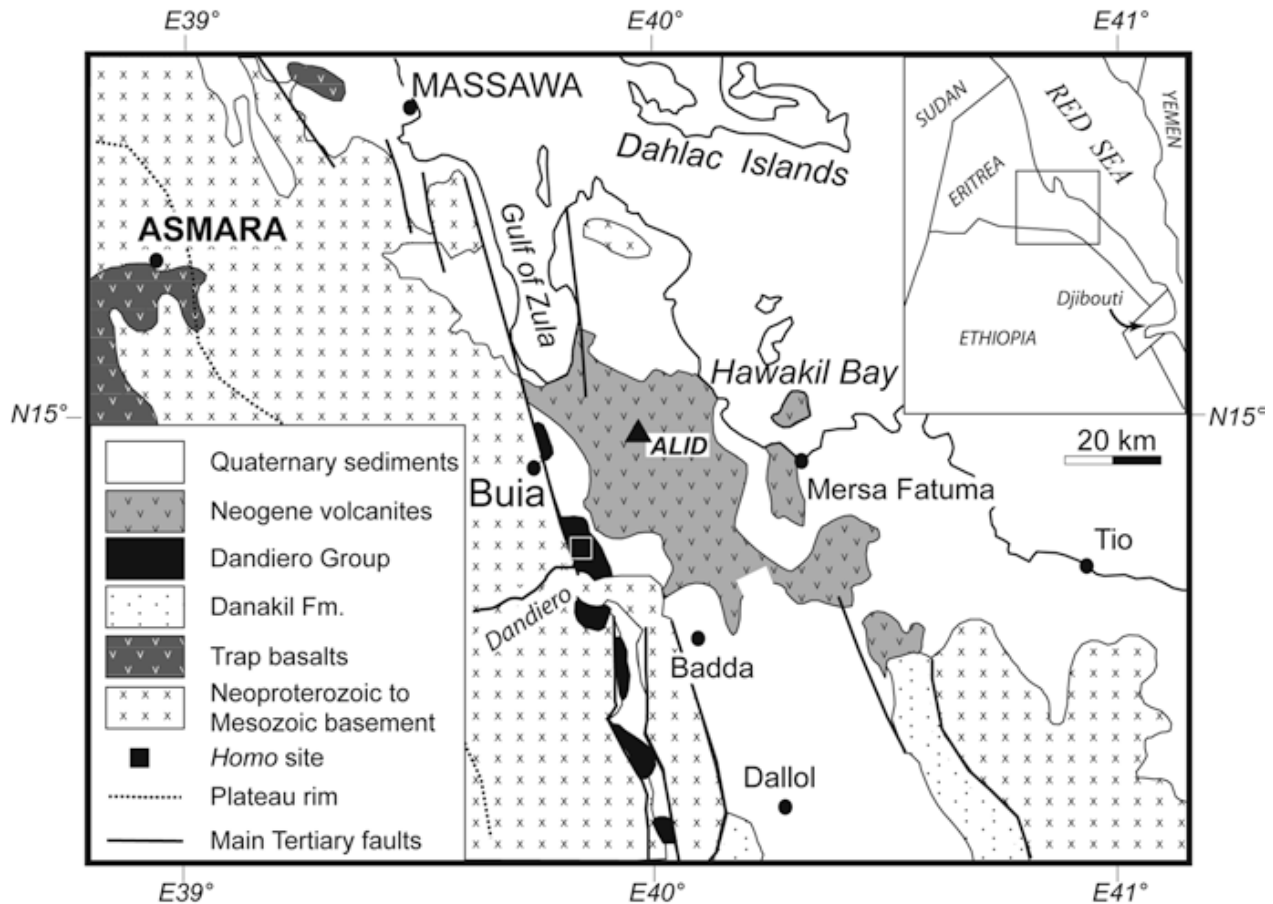


Fig. 1 Schematic geological map with the location of the Buia study area

Stratigraphy

The fossiliferous sites are located in the Dandiero basin succession, also known as the Maebele Synthem of the Dandiero Group (Fig. 2) (Abbate et al., 2004), Danakil Formation (Brinckmann & Kürsten, 1970), Danakil Series (Bannert et al., 1970), and Red Series (Barberi et al., 1970). This succession is the northernmost offshoot of the Neogene sedimentary filling of the Afar or Danakil depression, a belt of intense lithospheric extension at the intersection of the Red Sea-Gulf of Aden and East Africa Rift System. Deposition developed in a c. N-S elongated half-graben bound to the west by the faulted rim of the Eritrean plateau and to the east by a down-to-the-east major normal fault juxtaposing Dandiero sediments against recent Afar volcanics and sediments. The c. 450 m of the Dandiero deposits rest directly above the Neoproterozoic basement. From the base, the Dandiero succession includes six fluvial to lacustrine stratigraphic units (Abbate et al., 2004). The basal Bukra Sand and Gravel, entirely fluvial in origin, is at least 120 m thick and is capped by a lacustrine calcareous layer with peculiar fossil traces – “donut key bed” (Abbate et al., 2004;

Abbate et al., 2012), which represents a basin-scale key bed. The donut key bed marks the base of the Alad Fm. (in this text and figures often transliterated into Alat, Aalat, and Aalad), which consists of alternating fluvial, deltaic, and lacustrine deposits, and is up to 70 m thick. The overlying Wara Sand and Buia, Gravel Fm. is entirely fluvial in origin and ranges between 90 and 120 m in thickness.

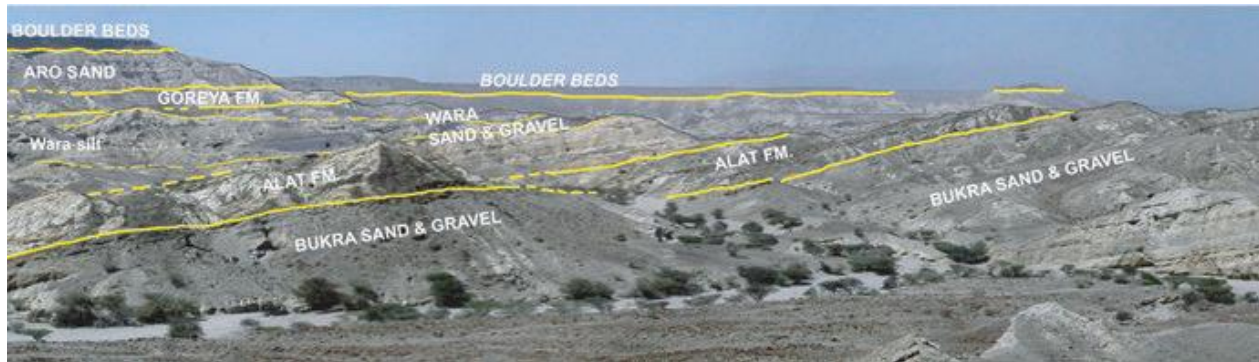


Fig. 2 The Dandiero Group on the right reach of the Dandiero river (Mt. Aro region)

The overlying Goreya Fm. is c. 65 m thick and consists of lacustrine deposits with subordinate fluvial facies. The Goreya Fm. is covered by the fluvial Aro sand, which is 60–80 m thick. In the Dandiero River area, the sand-rich fluvio-deltaic deposits grade to the west into conglomerates of the Addai Fm., which are mainly sourced from the rift margin. On the whole, this sedimentary succession records repeated shifts from fluvial to lacustrine environment, representing superposition of the local tectonic signal above climate-driven depositional changes (Scarciglia et al., 2018). North-South, abruptly east-dipping normal faults dissect the succession which is horizontally sealed by Late Pleistocene alluvial-fan gravels identified as “Boulder Beds” in Abbate et al. (2004), which are in turn dissected by modern alluvial drainage. Paleocurrent measurements from these deposits point to an overall transport toward the North (Abbate et al., 2004; Ghinassi et al., 2009, 2015; Sani et al., 2017). Occurrence of regional unconformities, mainly developed in connection with the hydroclimatic conditions of the Dandiero basin (Scarciglia et al., 2018; Sani et al., 2017), has been used to define unconformity-bounded units (Synthems) within the Dandiero succession (Abbate et al., 2004). On top of the metamorphic basement, the Mahabale Synthem includes the above described lithostratigraphic units up to the Addai Fm. conglomerates, while the overlying Boulder Beds make up the Curbelu Synthem, which is stratigraphically beneath the modern alluvial deposits of the Samoti Synthem. Four main depositional episodes are recorded within the Alad Formation. The first episode documents a rapid establishment of a lacustrine deposition, followed by a progressive lake shallowing. The second episode records fluvial aggradation above an erosive surface cut on lacustrine beds. Fluvial deposition occurs concurrently with the development and progressive infill of a second lake. The third episode points to a rapid lake formation followed by deposition of deltaic and fluvial sediments. The last episode was characterized by accumulation of fluvio-deltaic and fluvial deposits, which host vertebrate faunas, human remains, and stone tools recovered at the Aalat and Mulhuli Amu sites. The occurrence of ash-layers (Bigazzi et al., 2004) and the abovementioned basin-wide key beds – the “donuts” (Abbate et al., 2012) also make it important. Adjacent to the southeast of the Dandiero basin and separated by a slightly prominent sill lies a dissected area of Pleistocene sediments, which has been recently investigated by an Eritrean-Spanish team (Martínez-Navarro et al., 2016). *Tephrochronology*. An ash layer occurs interbedded at the base of the Alad Formation along the

Dandiero river. There, it has been stratigraphically traced 60 m below the *Homo* level. After an unsuccessful Ar39/Ar40 dating of biotite separates, the fission-track method was applied on glasses from the ash layer. They gave an age of 1.3 ± 0.3 Ma (Bigazzi et al., 2004).

Vertebrate Fauna, Biochronology, and Paleoecology In accordance with field procedures employed in other African Plio-Pleistocene study areas (Gilbert, 2008), all vertebrate fossils encountered on the surface during field survey were collected and no systematic excavations were carried out at the findspots. A preliminary inventory of the fossil remains of large vertebrates was published in Abbate et al. (1998). Since then, paleontological studies have documented the occurrence of a variety of reptiles and large mammals, and to a lesser extent, fish, birds, and small mammals (Delfino et al., 2004, 2018; Ferretti et al., 2003; Libsekal, 2010; Martínez-Navarro et al., 2004, 2014; Medin et al., 2015; Rook et al., 2010, 2013). Overall, the Buia faunal assemblage is representative of typical late Early Pleistocene East African faunas, such as the latest derived representative forms of *Theropithecus* cf. *T. oswaldi*, *Elephas recki*, *Hippopotamus gorgops*, *Kolpochoerus olduvaiensis*, *Kolpochoerus majus*, *Metridiochoerus* aff. *M. modestus*, and *Bos buiaensis* as well as representatives of extant taxa, such as *Ceratotherium simum*, *Equus* cf. *E. grevyi*, *Tragelaphus* cf. *T. spekei*, *Kobus* cf. *K. ellipsiprymnus*, and cf. *Crocota crocota* (based on the presence of a coprolite). The mammal biochronology points to the final phases of the Early Pleistocene, which is in agreement with the lithostratigraphical framework, paleomagnetism, and fission-track geochronology. Water-dependent taxa, such as hippopotamus, waterbuck, sitatunga, *Kolpochoerus*, a Thryonomyid rodent, crocodile, pelomedusid chelonian, Nile monitor lizard, and African rock python predominate (Martínez-Navarro et al., 2004; Rook et al., 2013). These faunal remains suggest a paleoenvironment characterized by moist grassland habitats adjacent to persistent water. The fossil bird taxa also suggest the occurrence of both open water with reedbeds and of dry areas nearby. The single fossil of *Ardeotis kori* could also indicate the local or distant presence of a savanna landscape with scattered trees (Rook et al., 2013; Delfino et al., 2018). The study of the faunal remains from the south Engal Ela-Ramud basin is still preliminary, but shows a representative Early Pleistocene record, which correlates with that of the Buia basin (Martínez-Navarro et al., 2016).

Magnetostratigraphy and Cyclostratigraphy Tephrochronology and biostratigraphy in the Dandiero basin provided good time constraints for calibrating the Geomagnetic Polarities (GPTS) of four magnetozones R1, N1, R2, and N2, which are correlated from bottom upward as follows: R1 pre-Jaramillo (C1r.2r), N1 Jaramillo (C1r.1n), R2 upper Matuyama (C1r.1r), and Brunhes (C1n) (Albianelli & Napoleone, 2004; Ghinassi et al., 2015) (Fig. 3). A complete chronological correspondence between the Jaramillo chron and the Alad Formation allows estimation of a sedimentation rate of c. 1m/ky in the Dandiero basin. The *Homo*-bearing level lies two meters below the Jaramillo/upper Matuyama boundary and has been dated at 0.992 Ma (Albianelli & Napoleone, 2004). A cyclostratigraphic approach based on detailed sampling and a good magnetic signal for the sediments was applied by Albianelli & Napoleone (2004) to the Alat, Wara, and Goreya units, and partially to the Aro Sand unit of the Aladaf section. This constitutes a thickness of 226 m covering a period of c. 215 ka. The cyclostratigraphic study showed that the magnetic remanence and susceptibility oscillations and the lithological variations could be plotted against the Milankovitch periods, pointing to climatic conditions of higher insolation for the coarse detrital Wara and Aro units and to periods of lower insolation for the fine-grained Alad and Goreya units deposited when the global climate was in a glacial phase.

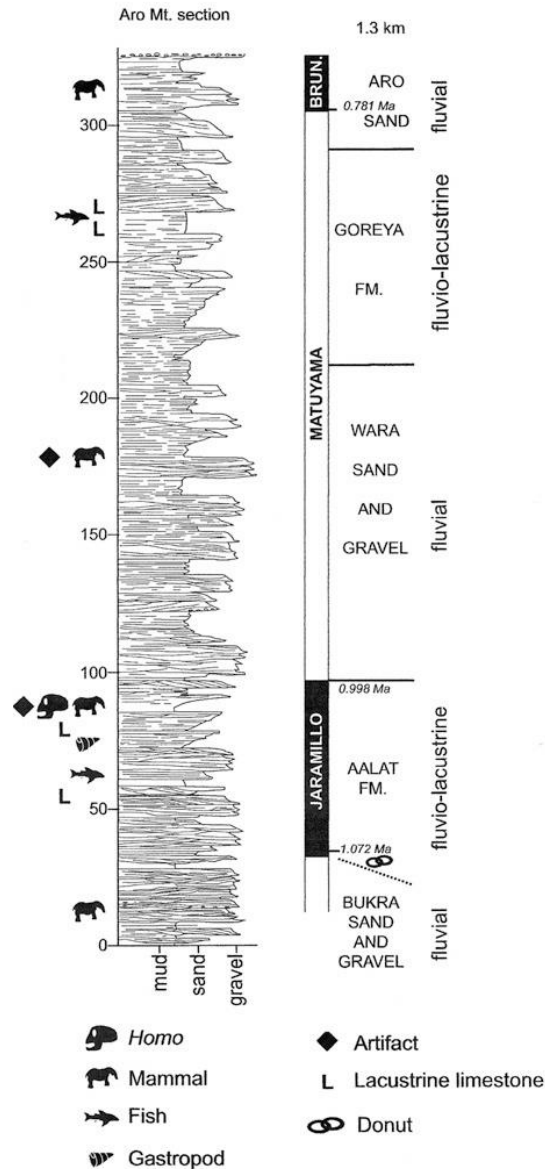


Fig. 3 Log of the Dandiero Group with lithostratigraphy, magnetostratigraphy, depositional environments, *Homo* bed, main faunal and lithics occurrences

Paleomagnetic data in Ghinassi et al. (2015) involved resampling to get direct paleomagnetic dating framed in a refined stratigraphy and sedimentology, which provided paleosol samples studied by Scarciglia et al. (2018). In Sani et al. (2017), new data from the Aro and Dandiero sections were used to affirm the lithostratigraphic correlations. Interestingly, these sections permitted the identification of the pre-Brunhes reverse interval older than 1.072 Ma (C1r.2r).

UA-31 Cranium and Other Human Remains A paleoanthropological landmark discovery in the Buia study area was made in December 1995 when a human cranium belonging to an adult individual (UA 31) was uncovered in the Alad Formation in the Uadi Alad area (Abbate et al., 1998; Macchiarelli et al., 2004; Bruner et al., 2016), Fig. 4. The nearly complete neurocranium (including the face) expresses a mix of typical *H. erectus/ergaster* characteristics (long braincase, opisthocranion coincident with inion, marked postorbital constriction, thick supraorbital torus) and

derived features more commonly found in Middle Pleistocene specimens, notably, a proportionally high braincase with high positioning of the maximum breadth, subvertical parietal walls, flexed base. The narrow cranial base is an autapomorphic trait of UA 31. The face, which is uniquely preserved in the penecontemporary African fossil record, displays a large zygomatic process and a high maxilla. Unlike any other Early Pleistocene African and Asian *Erectus*-like specimen, in UA 31, the orbits are especially high and the incisive canal opening is anteriorly placed (Macchiarelli et al., 2004). The paleoneurological study revealed a plesiomorphic phenotype (Bruner et al., 2016; Beaudet & Bruner, 2017), with features commonly found in *H. erectus s.l.* The UA 31 endocranial capacity (995 cm³) approximates the *H. erectus* average. The arterial network shows dominance of the posterior branches, i.e., a primitive condition, and comparative morphometrics indicate affinity with the Middle Pleistocene endocranial casts from Zhoukoudian, China (Bruner et al., 2016). The human fossil assemblage from the Aalad Formation at Uadi Aalad also includes two isolated permanent teeth (UA 222 and 369) and three pelvic portions (UA 173/405 and UA 466) collected between 1995 and 2003 (Abbate et al., 1998; Macchiarelli et al., 2004; Bondioli et al., 2006; Zanolli et al., 2014; Hammond et al., 2018) (Fig. 4). Based on the stratigraphic location of the remains, this assemblage is derived minimally from two adult individuals (Ghinassi et al., 2015). The teeth are an upper left lateral incisor (UA 222) and a lower left central incisor (UA 369). They preserve crown and root and show a comparable degree of occlusal wear. Their dimensions and overall outer and inner morphology are compatible with the wide variation expressed by *H. erectus s.l.* An analysis of UA 369 root completion timing using magnetic resonance microimaging (mMRI) indicates that apex closure compares with modern human standards (Zanolli et al., 2014). The pelvic portions are an incomplete right adult hip bone in two distinct but partially articulating portions (UA 173/405) and an isolated left pubic symphysis (UA 466), likely from the same individual. UA 173 is a posterior portion of an iliac blade, and UA 405 is a well-preserved right ischium. Geometric morphometric comparison of the specimens indicates affinity with anatomically modern human hip bone shape. At the same time, the analysis pointed to differences with specimens commonly assigned to *H. erectus* (Hammond et al., 2018). Estimated body mass in this individual, more likely male, is >65 kg. Based on extant human standards, the anatomy of the virtually intact UA 466 pubic symphysis seems to represent a <30 years old male individual (Bondioli et al., 2006). Overall, the individual *bauplan* indicated by the assemblage of cranial and postcranial remains from Buia is relatively more modern human-like than is commonly seen in the *H. erectus/ergaster* African hypodigm. The human discoveries in the Uadi Aalad prompted a further search for fossil remains in the nearby Alad Formation. The Mulhuli Amo area, which stratigraphically correlates with the Uadi Alad outcrop, 4.7 km apart, is over 630 m² in area and characterized by an exceptional abundance of lithic artifacts and faunal remains (Martini et al., 2004). The human remains collected here include one fragment of an isolated frontal bone with a thick supraorbital torus (MA 14), one permanent lower molar crown (MA 93), 10 fragments of parietal (MA 64a-b and 88a-g), sphenoid (MA 376), occipital (MA 933), and temporal (MA 89) bones, possibly belonging to a single juvenile individual. Eight parietal fragments articulate into an almost complete left parietal bone (MA 88) including the asterionic region, the structural (thickness distribution), and architectural features (proportions, curvature) of which closely fit the morphology anticipated by UA 31 (Coppa et al., 2014; Zanolli et al., 2016). Finally, MA 93 is a nearly fresh lower left first or second permanent molar crown from a juvenile individual (Zanolli et al., 2014). Its squat morphology and relatively large dimensions fit the range of variation in *H. erectus/ergaster*. One peculiar aspect, also shared with the permanent incisors UA 369 and 222, is relatively thin enamel, below the average condition found in most fossil human taxa, except the Neanderthals (Zanolli et al., 2014).

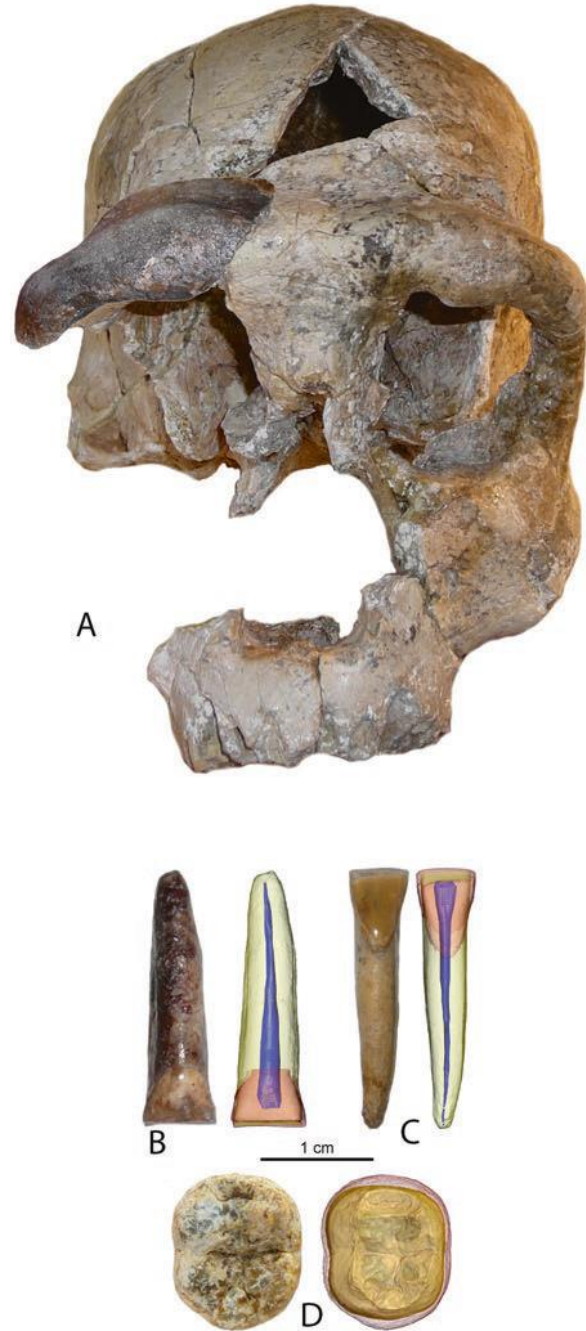


Fig. 4 (a) The human adult cranium UA 31 from the *Homo*-site at Buia is shown in anterior view with the right frontal fragment MA 14 from the penecontemporaneous site of Mulhuli-Amo (darker texture) superimposed to illustrate their dimensional and morphological similarities. Scale bar, 1 cm. Human dental remains from the Dandiero basin: Image of the original and virtual rendering (in semi-transparency to show tooth tissue proportions) of the upper left lateral permanent incisor UA 222 (b), and of the lower left central permanent incisor UA 369 (c), both from the *Homo*-site at Buia and projected here in lingual view, and of the lower left crown (in occlusal view) of the first or second permanent molar MA 93 from Mulhuli-Amo (d). In the virtual renderings, the enamel appears in rose, the dentine in yellow, the pulp cavity in blue. Scale bar, 1 cm.

The Lithic Industries More than 200 sites containing lithic artifacts and faunal remains have been documented in the Buia study area. The lithic finds are referable to the Acheulean Industry, which is expected given the chronostratigraphic contexts of the findspots. The sites with the richest stone artifact content in the Dandiero basin are shown in Fig. 3 of Abbate et al. (2004) and the results of our investigations of the finds from the left reach of the Dandiero are reported in Martini et al. (2004, 2005). Recent results from Uadi Aalad and Mulhuli Amo, two *Homo* sites in the Alat Formation, are described here.

Uadi Aalad Homo Site The exposed sections in the Uadi Aalad Homo Site (UAHS) produced not only 190 stone artifacts, composed of flakes and cores, but also of choppers, bifaces, hammerstones, and trihedral picks (Fig. 5). They were recovered in three different areas of the site related to three different depositional surfaces in the same stratigraphic sequence where the human fossil remains were found. The tools were primarily knapped from local raw materials. Comparison of the lithic assemblages from the different findspots shows many techno-typological similarities. Some obvious differences exist and are related to the frequency of choppers vs. bifaces. Specialized tools (trihedral picks and hammerstones) were only identified in one area. Bifacial tools are the most characteristic entities of the lithic finds and are generally homogeneous in form with elongated cordiform and oval shapes being the dominant types. Both large and small sizes are present. Some technological patterns are related to the imposition of design around the distal parts of the bifaces to create convergent to semi-convergent tips. Choppers were produced in a consistent manner. Similar proportions of unifacial/bifacial and transverse/lateral choppers are represented, and the manufacture is characterized by wide, unrefined, barely organized, and invasive scars. The flake production process shows similarities across the different areas although differences have also been noted in raw materials, dimensions, the presence of generic tools (such as truncations, notches, side-scrapers, endscrapers), and retouch patterns. The UAHS Acheulean finds express unique traits, while also bearing similarities to other assemblages in the Dandiero basin. The raw materials from which the artifacts were made are local and include quartz, basalt, marble, schist, and rarely quartzite. Generally, the assemblages suggest a poor reduction sequence as reflected in the crude design of the toolkits. The bifaces vary in length, elongation, thickness, symmetry, and shape (represented forms include elongate to oval limande and discoid). All the assemblages contain cleavers with the cutting edges made by very few transverse blows and only rarely refined by lateral retouches. The chopper elements include mainly squat morphologies and very few elongated specimens with varying size ranges. The lithic samples show a pattern of variability relatable to widespread presence of Acheulean-makers in the Dandiero basin. Three hypotheses can explain the observed technotypological variability. The first one links the various assemblages in the basin to different episodes of human occupation (thus variability emanating from temporal differences). The second hypothesis attributes the artifact variability to distinct hominin activities at the different sites (site function). Accordingly, similar technological strategies were used contemporaneously but distinct activities were performed at each site. The third hypothesis considers the sites broadly coeval and does not take into account the site function; instead, it attributes the variability to differences in cultural and technological traditions of human groups in the same general area. The Dandiero Acheulean assemblages bear resemblance to Modes 1 and 2 finds (of Early Pleistocene age) in the Middle Awash region of Ethiopia (de Heinzelin et al., 2000). There, Mode 2 elements dominate over Mode 1 artifacts. In most of the Acheulean-bearing assemblages (from the end of Early Pleistocene to the Early Middle Pleistocene), chopper-making and bifacial systems occur together. The biface typology of the Buia study area can be compared with East African sites, specifically those of the Early and Middle Pleistocene. Similarities include

artifact morphologies, such as the rare application of refining retouches on top of the original shaping scars, and the presence of cleavers. The fact that the Uadi Aalad site dates to c. 1.0 Ma makes it possible to compare the lithic finds with other assemblages dating around this time period, such as those from BOU-A6 and BOU-A14 (western Middle Awash), whose basal levels were dated to 1.042 Ma (de Heinzelin et al., 2000), the Olorgesailie deposits, Kenya (Isaac, 1977), and level J of the Garba XII site dated to 1.0–0.8 Ma (Chavaillon et al., 1979).

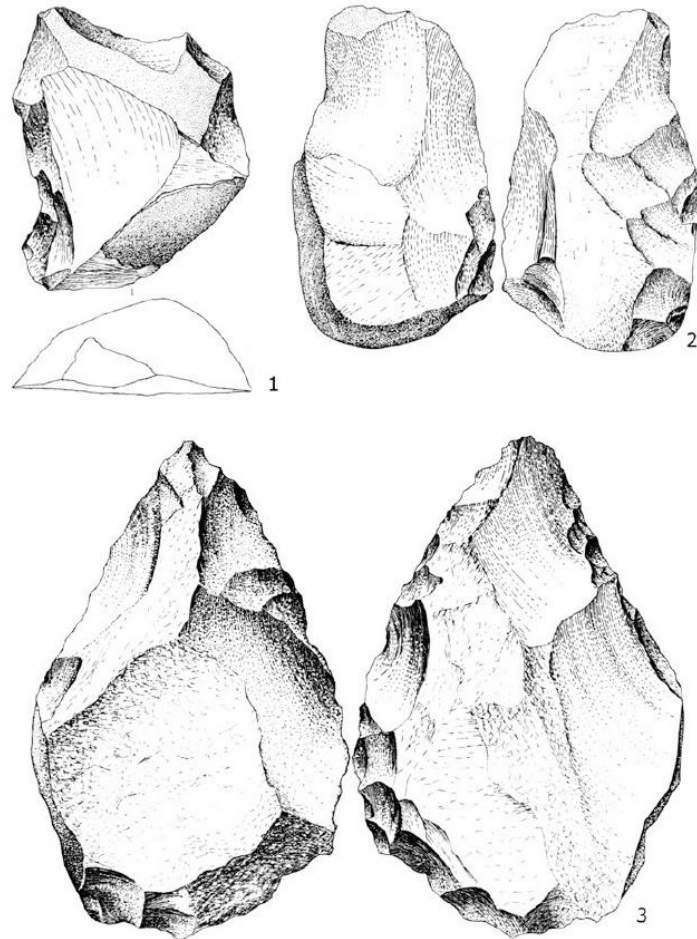


Fig. 5 (1–2) lithic finds from the UAHS area 2: (1) biface, (2) retouched flake; (3) biface (1/2 natural size) from UAHS area 3. (After Martini et al., 2004).

Mulhuli Amo Site Archaeological fieldwork at the Mulhuli Amo site, situated along the Dandiero valley (c. 1.5 km NE of the Aro Mt.), started in 2012 with the initial study focused on dense surface lithic scatters observed throughout the gentle slope (c. 630 m²) of the site. The lithic concentration at the highest point of the site is particularly impressive (Fig. 6), perhaps the densest Acheulean occurrence in Eastern Africa. Subsequent researches carried out in 2014, 2015, and 2016, involved systematic stratigraphical surveys in multiple particular key areas of the site. These activities permitted the identification of archeological levels with in situ lithics and paleontological remains. A 20 × 6 m area was selected for detailed survey around a findspot of human fossils. It was divided into two sectors: MA-1-South and MA-1-North.

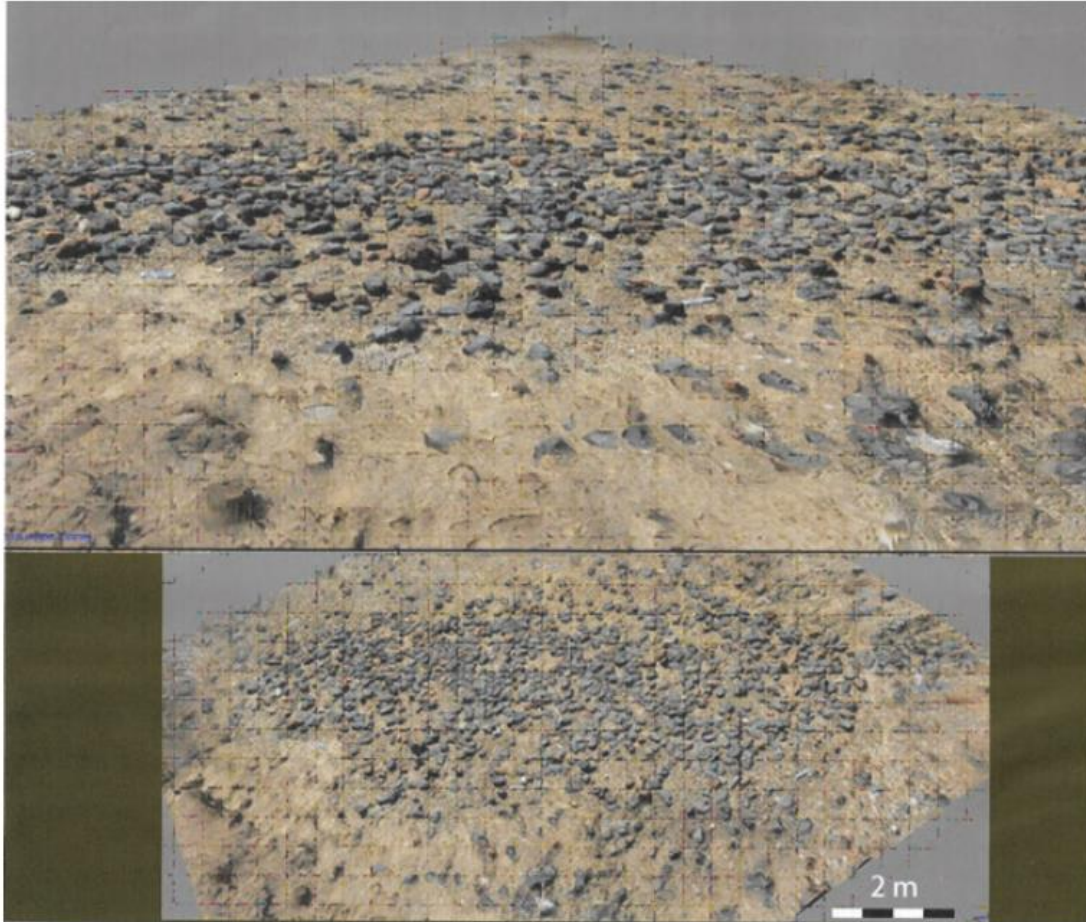


Fig. 6 3D photogrammetry of the high level of the handaxes *esplanade* at Mulhuli Amo, a concentration of hard rock tools (cleavers, bifaces, handaxes) at the bottom of an eroded channel.

The geoarchaeological sequence of MA-1 is composed of several archaeostratigraphic units. At the bottom there is a layer of fine sands and mud pebbles with Acheulean lithic artifacts and paleontological remains (Delfino et al., 2018). This level has been named Archaeostratigraphic Unit 4 and was dated by paleomagnetism to about 1.0 Ma. It was documented a lacustrine-deltaic environment within the Aalad Formation corresponding to a short site occupation. The AU 4 Acheulean level represents the only systematically surveyed archaeostratigraphic unit at Mulhuli Amo. Bifaces, flakes, chopper-cores, and a crocodile mandible were found and this shows the importance of riverine and lacustrine settings in supporting human lives in the Mulhuli Amo site. Stratigraphic investigations also occurred in an area called Mulhuli Amo 4 (MA-4), south-southeast of MA-1, where the team located a fine sand level yielding bifaces from extremely fresh raw materials. In the same area, a poorly cemented fine sand bed in a sequence of massive lacustrine sands revealed a well-defined archaeological level with bifaces and flakes made on schist (Fig. 7). Further research confirmed the presence of a well-preserved Acheulean level, named AU 2, with in situ schist bifaces and flakes englobed in multiple sequences of thin sands with ferruginous interface. This anthropic level represents the bottom of a small channel, which constitutes a filling phase of a lake basin. As with the AU 4 of MA-1, the AU 2 of MA-4 material is attributable to a phase of the Acheulean culture dated to c. 1.0 Ma. From a topographic and stratigraphic point of view, this level could belong to an Acheulean phase older than that of AU 4 in MA-1. The erosion

of archaeological levels, most notably at the AU 2 Acheulean, is responsible for the massive surface dispersion of faunal remains and lithic artifacts. The preliminary technological analysis of the finds from Mulhuli Amo, despite an apparent technical monotony of the lithics, witnesses the application of specific bifacial shaping strategies to specific raw materials and documents the tool-makers' ability to employ flexible technological approaches to maximize tool production efficiency.

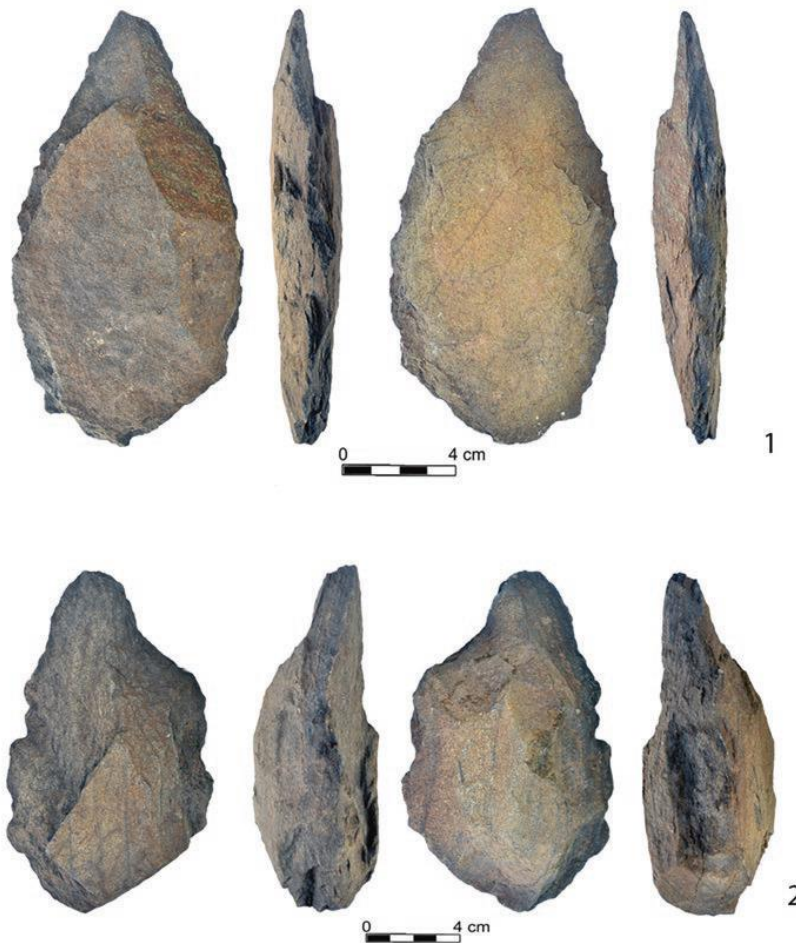


Fig. 7 Acheulean finds from Mulhuli Amo 4: (1) biface from schist angular slab; (2) biface from schist block.

Buia Archeo-Paleontological Records for the late Early Pleistocene in Africa The developed Acheulean assemblages recorded at the Buia sites (Martini et al., 2004), dated to c. 1.0 Ma, are also well represented in northern Africa and the Levantine Corridor. Northern African sites include Thomas Quarry in Casablanca, Tighennif in Algeria, c. 0.7 Ma (Geraads et al., 1986), and Oued Sarrat in Tunisia, c. 0.7 Ma (Martínez-Navarro et al., 2014). In the Levant, the sites include Geshen Benot Ya'akov in Israel, dated to 0.7–0.8 Ma (Goren-Inbar et al., 2000). Subsequently, the technology is believed to have dispersed to Europe, reaching Venosa-Notarchirico (Italy) c. 0.6–0.5 Ma (Piperno et al., 1999). A recent work on the Red Sea district of Sudan has also reported the presence of Acheulean occurrences that share close resemblance to the Buia finds (Beyin et al., 2019). The discovery signifies possible cultural connections between the inhabitants of the two regions, and potentially northward dispersal of the Buia inhabitants (toward the Levant) through the western periphery of the Red Sea basin. The large vertebrate assemblage from Buia is primarily

composed of ungulates and crocodiles. Some species, such as *Palaeoloxodon recki* (which evolved in Eurasia into *P. antiquus*), or *Bos buiaensis* (which evolved into *B. primigenius*), are believed to have dispersed into the Eurasian continent together with Acheulean-bearing humans (Martínez-Navarro et al., 2014). This dispersal is also correlated with the out-of-Africa expansion of some carnivores not recorded at Buia, such as *Panthera leo*, *P. pardus*, *Crocota crocuta* or *Hyaena hyaena* (Martínez-Navarro & Rabinovich, 2011). Other species recorded in Buia, such as the large gelada monkey *Theropithecus oswaldi* (Rook et al., 2010), have also been found at the c. 0.9 million years old site of Cueva Victoria, Iberian Peninsula (Gibert et al., 1995; Ferrández-Cañadell et al., 2014), and in the Siwaliks deposits, India (Delson, 1993; Pickford, 1993). **Significance** Because of its geographic location and its specific paleoenvironmental and paleo-ecological conditions, the Buia area represents a key site for the study of the Acheulean variability in Africa and for the assessment of the timing and modalities of the development of this lithic technocomplex in the NE Africa Rift region. As regards future archeological research in the Dandiero basin, the fossiliferous Alad Formation is of particular interest. It is c. 70 m thick at the type locality and records repeated shifts from fluvial to lacustrine conditions, which are controlled by localized tectonic depocenters and climatic fluctuations. Due to their temporal control through paleomagnetic and biostratigraphic analyses, the paleoenvironmental changes in the Buia section can be extrapolated to other sites with human fossils in the wide Danakil/Afar region. Some morphological features displayed by the well-preserved and varied human fossil remains from the area give a glimpse into important evolutionary transitions that paved the path to the emergence of our lineage in the subsequent periods.

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