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Abstract: n/a

**From the Oldowan to the Acheulean at Olduvai Gorge, Tanzania– An introduction to the special issue**

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## Introduction

Even before setting foot at Olduvai Gorge, Louis Leakey was certain that he would find handaxes there (Leakey, 1951: 3). Apparently, he did so on the very first day of the 1931 expedition, the first that Louis Leakey ever conducted at Olduvai. More unexpectedly, Louis Leakey also found an archaic, handaxe-free industry in the lower beds of Olduvai (Leakey et al., 1931), which then he formally termed Oldowan (Leakey, 1936). In one way or another, all studies on the transition from the Oldowan to the Acheulean in East Africa and elsewhere, stem from Louis Leakey's (e.g., 1936, 1951) initial reports at Olduvai, the first site where a stratigraphic sequence showed that handaxes emerged after a core-and-flake technology.

And such studies are many, among which Mary Leakey's (1971) *'Olduvai Gorge. Volume 3'* stands out as the pivotal work that shaped the empirical, methodological and conceptual frameworks of the Oldowan-Acheulean transition. Leakey (1971) reported on excavations that were methodologically exemplary, and produced painstaking descriptions of lithic assemblages to characterise the Oldowan, the Acheulean and the transitional industries between the two cultures (i.e., Developed Oldowan A and B), within well-constrained geological contexts. The superb quality of Leakey's (1971) analysis and publication, combined with the wealth of the archaeological record in Beds I and II (with abundant, well-preserved, high-density, stratified assemblages), and the radiometric control over the age of the sites (which placed the earliest handaxes in Middle Bed II at around 1.4 ma), made Olduvai Gorge the world's reference for the emergence of the Acheulean in the following decades (see review by de la Torre and Mora, 2014).

1 Although the relevance of Leakey's (1971) monograph can never be stressed enough, most  
2 subsequent discussions of the Oldowan-Acheulean transition did not involve first-hand reanalysis of  
3 the Olduvai collections, and some which did include a study of the original materials (e.g., de la Torre  
4 and Mora, 2005), highlighted problems that were unsolvable without renewed archaeological  
5 excavations at Olduvai. In this context, the Olduvai Geochronology Archaeology Project (OGAP)  
6 commenced fieldwork at Olduvai in 2008, and over the past decade has focused most of its efforts  
7 on gaining a better understanding of the geology, chronology, paleoecology and archaeology of  
8 Olduvai Bed II. During this phase of the project, OGAP's overarching aims (see details in de la Torre  
9 et al., 2012) have included an investigation of the ecological adaptations of late Oldowan and early  
10 Acheulean hominins, their technological skills and subsistence strategies, and a refinement of the  
11 chrono-stratigraphic framework in which such patterns unravelled.  
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14 As one of the major transitions in human evolution, it is exciting times for those interested in the  
15 origins of the Acheulean and the evolutionary and cognitive patterns associated with the emergence  
16 of this technology (de la Torre, 2016). Recent findings suggest that handaxes may have appeared  
17 elsewhere in East Africa at around 1.76 ma (Lepre et al., 2011; Beyene et al., 2013), and thus the  
18 Olduvai Acheulean is not the earliest. Nevertheless, the quality and quantity of its archaeological  
19 record, and the existence of Oldowan sites that are stratigraphically succeeded by Acheulean  
20 assemblages, still guarantee a pivotal role for Olduvai in the discussion of the transition. Proof of this  
21 is the renewed fieldwork interest in the Middle and Upper Bed II archaeological sequence (e.g.,  
22 Dominguez-Rodrigo et al., 2014, 2017) which, in addition to the data presented in this special issue  
23 by OGAP, should contribute to shape a modern view of the origins of the Acheulean at Olduvai  
24 Gorge.  
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### 29 **Materials and methods**

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31 This special issue compiles results of fieldwork by OGAP between 2008 and 2016, in which we  
32 conducted at least one field season annually and, in some years (2014 and 2015), two field seasons.  
33 Most of these eleven fieldwork seasons focused on a specific stratigraphic interval of the Olduvai  
34 Pleistocene sequence, that which captures the local transition from the Oldowan to the Acheulean  
35 between Lower and Upper Bed II, and involved the excavation of 57 trenches. OGAP's field strategy  
36 has combined the excavation of large trenches in some sites with high density of material –following  
37 Leakey's (1971) approach–, with the landscape perspective inaugurated at Olduvai in 1989 by the  
38 Olduvai Landscape Paleoanthropology Project (OLAPP) (Blumenschine and Masao, 1991), and based  
39 on the excavation of randomly-placed trenches that sample targeted stratigraphic intervals.  
40 However, while Bed I and Lowermost Bed II contain stratigraphic layers that can be laterally followed  
41 across large extensions of Olduvai Gorge (Hay, 1976), the overlying stratigraphic units are more  
42 locally restricted, therefore limiting the paleogeographic range available for OGAP's random  
43 trenching, which is often limited to sampling within each of the outcrop localities defined by the  
44 Leakeys. Excavations between 2009-2016 focused on the eastern shoreline of the Olduvai paleolake,  
45 particularly at archaeological localities EF-HR, HWK EE, HWK E, FLK, FC (East and West) and MNK  
46 (Figure 1A), and sampled the top of Lower Bed II, throughout Middle Bed II, and the lower part of  
47 Upper Bed II (Figure 1B).  
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54 Apart from an overview of OGAP's research aims (de la Torre et al., 2012), digital mapping initiatives  
55 of the gorge (Jorayev et al., 2016) and geochemical correlations (McHenry et al., 2016), this special  
56 issue is the first publication that presents a systematic account of OGAP's investigations. With the  
57 exception of two papers based on assemblages excavated by Mary Leakey (Proffitt, 2018; Pante and  
58 de la Torre, 2018), all articles in this volume use OGAP's materials as the main data source. Papers  
59 on the stratigraphy and geochronology of Bed II (McHenry and Stanistreet, 2018; Stanistreet et al.,  
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1 2018) compile data obtained from all trenches excavated, plus additional information from natural  
2 outcrop logging and surveys. Papers on the paleoecological reconstruction of Bed II (Prassack et al.,  
3 2018; Bibi et al., 2018; Uno et al., 2018) also use all OGAP's materials (i.e., all fossils from 57  
4 trenches through Bed II) as the main dataset, which in this case deserves special mention as they are  
5 almost exclusively assemblages derived from excavation, rather than surface collection. One of the  
6 papers on the archaeological record (McHenry and de la Torre, 2018) also includes materials from  
7 several of the localities sampled by OGAP, but the rest (de la Torre and Mora, 2018a, b; de la Torre  
8 et al., 2018a, b; Pante et al., 2018; Rivals et al., 2018; Arroyo and de la Torre, 2018) focus on two of  
9 the archaeological sites excavated by OGAP, namely HWK EE and EF-HR.

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12 The rationale behind this variable selection of materials lies on the scale of analysis for each of the  
13 research questions discussed in this special issue. The geochronological and stratigraphic studies  
14 seek to clarify site correlations and present sedimentary and erosive dynamics through the  
15 sequence, and the papers on paleoecology investigate stability versus change of the  
16 paleoenvironmental context in which the Oldowan-Acheulean transition took place. Diachronic  
17 patterns are consubstantial to these lines of enquiry and therefore the entire OGAP Bed II dataset up  
18 to 2016 was considered.

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21 Concerning the archaeological study, OGAP's current strategy is to report on full assemblages, rather  
22 than presenting preliminary accounts of unfinished excavations or a partial analysis of selected  
23 elements of some particular archaeological collections. This perspective precludes presenting here  
24 the archaeological results for the entire OGAP dataset, and we chose instead to focus on two key  
25 Olduvai paleoanthropological localities and their surroundings. The HWK EE site is stratigraphically  
26 located in the transition between Lower and Middle Bed II, and is one of the latest Oldowan sites at  
27 Olduvai, at ~1.7 ma. EF-HR sits in Upper Bed II at ~1.4 ma, and the abundance of handaxes at the site  
28 points at an unequivocally Acheulean character for the assemblage. These two sites were selected  
29 for large-scale excavations and publication in this special issue because they are in the stratigraphic  
30 endpoints of the interval under study and, in addition, they are some of the most productive  
31 assemblages in the entire Olduvai sequence. This provides the unique opportunity to develop a  
32 comparative framework to interpret changes in faunas, paleoenvironments, and stone tools, and to  
33 contextualise such framework within a detailed chronostratigraphic background provided by the  
34 tephrostratigraphic and high-resolution sedimentary studies presented in this volume.

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37 The 16 papers that follow cover a wide range of disciplines and expertise, including  
38 tephrostratigraphy, sedimentology, micromorphology, diatoms, stable isotopes, phytoliths,  
39 vertebrate systematics, tooth wear, archaeological conservation, taphonomy, zooarchaeology, stone  
40 tool technology, lithic use wear, spatial analysis and geostatistics. They involve 29 different  
41 contributors from research centres in 11 countries. While all papers aim to present discussions  
42 relevant to broad paleoanthropological questions, there is also a deliberate emphasis on the  
43 production of data-rich articles, where pictures, illustrations, diagrams and supplementary online  
44 material (interactive models of excavations in HWK EE and EF-HR, and 3D reconstructions of  
45 outcrops, archaeological units and artefacts) play an essential role.

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48 In summary, the substantial sample excavated across one very specific stratigraphic interval, the  
49 wide range of expertise dedicated to investigate one particular research problem, and the  
50 importance given to the presentation of raw data from entire assemblages, construct a piece of  
51 reference for the study of the Oldowan-Acheulean transition at Olduvai, and produce an empirical  
52 corpus and a methodological framework that can now be used by other researchers.

## 53 54 55 56 57 58 59 60 **Results**

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### *The chrono-stratigraphic framework*

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2 Bed II records a more complicated depositional and erosive history than Bed I (Hay, 1976), and the  
3 use of tuffs as stratigraphic markers is hindered by lateral discontinuities and the reworking and  
4 alteration of volcanic glass, which also makes dating of Bed II less precise than that of Bed I (Deino,  
5 2012). McHenry and Stanistreet (2018) recalibrate previous radiometric dates for Bed II, and use  
6 mineralogical and geochemical fingerprints of tuffs to constrain the Bed II stratigraphy.  
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9 Their results are particularly relevant to pin down the appearance of first handaxes at Olduvai, as  
10 they position new Acheulean findings at FLK West (Diez-Martin et al., 2015) in Middle Bed II rather  
11 than in Lower Bed II (Uribelarrea et al., 2017). McHenry and Stanistreet (2018) also report that EF-HR  
12 sits above the level of Tuff IIC instead of below (Hay, 1976), which therefore locates the site in Upper  
13 Bed II, rather than in Middle Bed II (Leakey, 1971). A revised stratigraphic framework for Bed II is  
14 presented by Stanistreet et al. (2018), who use a sequence stratigraphy approach to distinguish five  
15 major sequences bounded by deeply incised discontinuities. This perspective justifies the  
16 redefinition of the Lower to Middle Bed II boundary above the Lemuta Member (McHenry et al.,  
17 2016) instead of in Tuff IIA (Leakey, 1971), enables the identification of lake para-sequences  
18 throughout Bed II, and describes the significant erosive processes that have led to previous  
19 misplacements of early Acheulean occurrences (Stanistreet et al., 2018).  
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### *Paleoecology of Bed II*

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25 Whether or not the technological transition between the Oldowan and the Acheulean can be  
26 associated with paleoecological changes across the Olduvai basin is one of the key questions  
27 investigated in this special issue. Papers on bird (Prassack et al., 2018), fish and large mammal (Bibi  
28 et al., 2018) communities, and on isotope and wear of mammal teeth (Uno et al., 2018), use the  
29 same scale of analysis (i.e., three fossil assemblages that include all materials from the 57 excavated  
30 trenches separated by stratigraphic intervals: see Figure 1B) to address this question, so that results  
31 from each proxy can be consistently compared.  
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36 Variation in bird communities from Oldowan (Assemblage IIA) to Acheulean (Assemblages IIB and  
37 IIC) units suggests an increasing expansion of grasslands and open woodlands, and a more open and  
38 drier environment than in Lowermost Bed II (Prassack et al., 2018). Fish and large mammal  
39 communities (Bibi et al., 2018) support that open and seasonal grassland habitats dominated in the  
40 three assemblages, but do not record any major turnover across the sequence; the Olduvai  
41 paleoenvironmental settings remained open and dry throughout Bed II (Bibi et al., 2018).  
42 Assemblage IIB sees a decrease in the number of C<sub>3</sub> and mixed feeders, and an increase on the  
43 abrasiveness of the diet (Uno et al., 2018). Nonetheless, both stable isotopes and tooth wear  
44 analyses report no major changes in hydrology and vegetation across the sequence (Uno et al.,  
45 2018), and thus support results by Bibi et al. (2018) on the structural continuity of large mammal  
46 communities.  
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### *Archaeological contexts*

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52 The Oldowan site of HWK EE was discovered and originally excavated by Mary Leakey, but she never  
53 published her work at this locality. Pante and de la Torre (2018) analyse the rich fossil and stone tool  
54 assemblage excavated by Leakey, and contextualise it within recent fieldwork at HWK EE. New  
55 excavations at the site are detailed by de la Torre et al. (2018a), who describe the stratigraphic and  
56 paleoecological settings of HWK EE, and discuss formation processes of the assemblage. With a large  
57 fossil and lithic assemblage straddling the Lower to Middle Bed II boundary, HWK EE was deposited  
58 in a river and marshy wetland freshwater environment, with both grass and trees nearby. The fossil  
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1 and lithic deposit contains a multi-layered stack of archaeological units that show variable degrees of  
2 human activity and disturbance by water, which contributed to the formation of the assemblage  
3 alongside other agents such as hominins, crocodiles and mammal carnivores (de la Torre et al.,  
4 2018a).

5 Fieldwork in the EF-HR complex (de la Torre et al., 2018b) included excavations in twelve trenches  
6 that covered around 1 km<sup>2</sup> across which the same handaxe-bearing stratigraphic unit can be traced.  
7 Early Acheulean activity is pervasive within the sampled area, but conspicuous differences in the  
8 density of archaeological materials are observed across the paleolandscape. Stone artefacts are  
9 highly clustered around the main EF-HR trench, which was situated in the deepest part of an incised  
10 valley and which contained a stable water source with trees probably adjacent to it, in a generally  
11 open environment with grasses (de la Torre et al., 2018b). Possible scenarios explaining the large  
12 stone tool accumulation around the main trench are explored by de la Torre and Wehr (2018), who  
13 discuss the role of post-depositional processes and conclude that fluvial erosion and re-deposition  
14 played a significant part in shaping the configuration of the archaeological assemblage.  
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### 19 *Carnivore- hominin interactions*

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21 HWK EE may represent one of the last appearances of *Homo habilis* at Olduvai, and the large fossil  
22 assemblage recovered from the site enables discussions on seasonality (Rivals et al., 2018) and the  
23 feeding behaviour of hominins and carnivores (Pante and de la Torre, 2018; Pante et al., 2018).  
24 Tooth wear and stable isotope data indicate that, while there are no significant changes in bulk diet  
25 or hydroclimate between the lower (Lemuta) and upper (Lower Auginic Sandstone; LAS) deposits,  
26 differences exist in the vegetation consumed by HWK EE ungulates (Rivals et al., 2018). These  
27 authors thus suggest that the LAS deposits were accumulated mostly during relatively dry periods, in  
28 which grasses were less readily available than in Lemuta, and grazing animals may have been more  
29 stressed nutritionally.  
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33 Hominins are inferred to have broken most of the limb bones at HWK EE, although both hominins  
34 and carnivores had some access to flesh (Pante and de la Torre, 2018). Hominins obtained  
35 substantial amounts of flesh and marrow from smaller mammals, but they scavenged much of their  
36 animal foods from carnivores (Pante et al., 2018). The contribution of both hominins and carnivores  
37 to the formation of the bone assemblage at EF-HR is also attested (de la Torre et al., 2018b),  
38 although in this case the fragmentary condition of fossils does not allow for discussions on the  
39 character of such interaction.  
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### 43 *Technological strategies*

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45 Potential diachronic patterns within the Oldowan at Olduvai Gorge are discussed by Proffitt (2018),  
46 who studies lithic assemblages excavated by Leakey (1971) from Bed I and the lower part of Bed II.  
47 According to Proffitt (2018), technological differences between the classic Oldowan and the  
48 Developed Oldowan A are not significant enough to warrant the separation proposed by Leakey  
49 (1971) between the two facies, and he attributes the perceived differences to raw material  
50 availability and use. De la Torre and Mora (2018a) study the large lithic assemblage unearthed by  
51 OGAP at HWK EE, and are less confident than Proffitt (2018) about the absence of marked techno-  
52 typological differences between the classic and the late Oldowan, although the expediency and low  
53 skill shown in core-reduction methods shared in both periods is also emphasized (de la Torre and  
54 Mora, 2018a; Pante and de la Torre, 2018).  
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58 While Proffitt (2018), de la Torre and Mora (2018a) and Pante and de la Torre (2018) deal with  
59 assemblages placed stratigraphically before the first Large Cutting Tools (LCTs) are found in the  
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1 Olduvai sequence (McHenry and Stanistreet, 2018; Stanistreet et al., 2018), the technological  
2 analysis of EF-HR (de la Torre and Mora, 2018b) presents a snapshot of what an uncontested early  
3 Acheulean assemblage was like after Tuff IIC, i.e., once LCTs had appeared at Olduvai in post-Tuff IIB  
4 contexts. De la Torre and Mora (2018b) highlight the shortness and discontinuity of shaping  
5 processes and the lack of planform and biconvex symmetry in the LCT production. However, they  
6 also emphasize the existence of standardized procedural patterns, fixed technical rules and  
7 particular mental templates that indicate a structured technological behaviour during the early  
8 Acheulean.  
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10 Apart from the obvious differences in tool-types and flaking/ shaping techniques between Oldowan  
11 (HWK EE) and Acheulean (EF-HR) assemblages (de la Torre and Mora, 2018a, b), further comparisons  
12 can be made in other technological categories such as percussive artefacts (Arroyo and de la Torre,  
13 2018), and in raw material procurement (McHenry and de la Torre, 2018). Arroyo and de la Torre  
14 (2018) describe techno-typological macroscopic features and microscopic use-wear of pounding  
15 tools at EF-HR and HWK EE, and conclude that the Oldowan battered assemblage reflects a wider  
16 range of tasks than in the Acheulean site. McHenry and de la Torre (2018) discuss raw material  
17 sourcing and use collections from several of the localities sampled by OGAP to propose a  
18 classification protocol of Olduvai Bed II rock types, which is then applied to the entire assemblages  
19 of HWK EE and EF-HR. They conclude that late Oldowan hominins from HWK EE selected  
20 preferentially raw materials according to blank shape and suitability of natural angles for flaking,  
21 rather than based on rock texture. In contrast, early Acheulean hominins at EF-HR showed no clear  
22 selectivity in blanks for small core debitage, but preferred high-quality raw materials for LCT  
23 production.  
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### 31 **From the Oldowan to the Acheulean at Olduvai Gorge**

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33 The breadth of papers in this special issue attempts to attain an updated, comprehensive view of  
34 geochronological, paleoenvironmental and behavioural patterns associated with the transition from  
35 the Oldowan into the Acheulean at Olduvai. According to the results presented in this special issue,  
36 the earliest Acheulean appeared at Olduvai after Tuff IIB in Middle Bed II, at around  $\sim 1.66$  ma, and  
37 core-and-flake assemblages devoid of handaxes are confined to the pre-Tuff IIB sequence (McHenry  
38 and Stanistreet, 2018; Stanistreet et al., 2018). Similarity of core reduction methods across Bed I and  
39 pre-Tuff IIB assemblages indicate continuity of flaking techniques in classic and late Oldowan sites,  
40 although raw material (Proffitt, 2018) and tool-type differences (de la Torre and Mora, 2018) are  
41 observed between the pre-Lemuta (i.e. Bed I and Lowermost Bed II) and those assemblages  
42 originally termed Developed Oldowan A by Leakey (1971).  
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47 While the composition of bird assemblages seems to change after Lowermost Bed II (Prassack et al.,  
48 2018), substantial changes in large mammal communities are only detected between Middle Bed I  
49 and the sequence above (Bibi et al., 2018). Hydrology and vegetation remained similar between the  
50 top of lower Bed II and Upper Bed II (Uno et al., 2018), and large-mammal communities underwent  
51 no substantial changes during this period (Bibi et al., 2018), although seasonal paleoecological  
52 variations are detected locally (Rivals et al., 2018). Therefore, neither variations observed between  
53 classic and late Oldowan assemblages, nor the major technological change from the Oldowan to the  
54 Acheulean, can be readily associated with major faunal turnovers at Olduvai. Environments were  
55 open across the area sampled by OGAP in the eastern side of the Olduvai paleolake (Bibi et al., 2018;  
56 Prassack et al., 2018; Uno et al., 2018), with archaeological sites such as HWK EE (de la Torre et al.,  
57 2018a) and EF-HR (de la Torre et al., 2018b) near watercourses with some tree cover.  
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1 HWK EE hominins acquired meat and marrow mainly through scavenging (Pante and de la Torre,  
2 2018; Pante et al., 2018) and sourced raw materials locally (McHenry and de la Torre, 2018), which  
3 they used in flaking (de la Torre and Mora, 2018a) and pounding (Arroyo and de la Torre, 2018)  
4 activities. At ~1.7 ma, HWK EE is one of the latest Oldowan sites at Olduvai, but the distinctiveness of  
5 its technology with respect to previous Oldowan assemblages (de la Torre and Mora, 2018a) does  
6 not herald the technological change brought about with the Acheulean. Approximately 300,000  
7 years apart, EF-HR suggests that by ~1.4 ma LCT production was a usual technical behaviour which  
8 followed well-established procedural patterns (de la Torre and Mora, 2018b), using high-quality raw  
9 materials (McHenry and de la Torre, 2018) that led to substantial concentrations of stone tools in  
10 particular areas of the landscape (de la Torre et al., 2018b; de la Torre and Wehr, 2018).

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13 HWK EE and EF-HR represent the endpoints of the stratigraphic interval that capture the Oldowan-  
14 Acheulean transition at Olduvai, and potentially also the emergence of *Homo erectus* and the  
15 disappearance of *Homo habilis* (Leakey, 1975). By describing these sites in detail here, and  
16 presenting the geochronological and paleoecological setting of this transition, we aim to establish  
17 the features that define each technocomplex, and their paleoenvironmental background. OGAP has  
18 also conducted substantial excavations in the stratigraphic interval between those two endpoints,  
19 and archaeological results of such fieldwork will be presented in future years.  
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## 50 **References**

51  
52 Arroyo, A., de la Torre, I., 2018. Pounding tools in HWK EE and EF-HR (Olduvai Gorge, Tanzania).  
53 Percussive activities in the Oldowan-Acheulean transition. *J. Hum. Evol.*  
54  
55 Beyene, Y., Katoh, S., WoldeGabriel, G., Hart, W.K., Uto, K., Sudo, M., Kondo, M., Hyodo, M., Renne,  
56 P.R., Suwa, G., Asfaw, B., 2013. The characteristics and chronology of the earliest Acheulean at  
57 Konso, Ethiopia. *PNAS* 110, 1584-1591.  
58  
59  
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61  
62  
63  
64  
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1 Bibi, F., Pante, M., Souron, A., Stewart, K., Varela, S., Werdelin, L., Boisserie, J.-R., Fortelius, M.,  
2 Hlusko, L., Njau, J., de la Torre, I., 2018. Paleoecology of the Serengeti during the Oldowan-  
3 Acheulean transition at Olduvai Gorge, Tanzania: The mammal and fish evidence. *J. Hum. Evol.*

4 Blumenschine, R.J., Masao, F.T., 1991. Living sites at Olduvai Gorge, Tanzania? Preliminary landscape  
5 archaeology results in the basal Bed II lake margin zone. *J. Hum. Evol.* 21, 451-462.

6  
7 Curtis, G.H., Hay, R.L., 1972. Further geological studies and potassium-argon dating at Olduvai Gorge  
8 and Ngorongoro Crater. In: Bishop, W.W. and Miller, J.A. (eds) *Calibration of Hominoid Evolution*  
9 Recent advances in isotopic and other dating methods as applicable to the origin of man. Scottish  
10 Academic Press, Edinburgh, pp 289-301.

11  
12  
13 de la Torre, I., 2016. The origins of the Acheulean: past and present perspectives on a major  
14 transition in human evolution. *Phil. Trans. R. Soc. Lon. B* 371, 20150245.

15  
16  
17 de la Torre, I., Albert, R.M., Arroyo, A., Macphail, R., McHenry, L.J., Mora, R., Njau, J.K., Pante, M.C.,  
18 Rivera-Rondón, C.A., Rodríguez-Cintas, Á., Stanistreet, I.G., Stollhofen, H., Wehr, K., 2018. New  
19 excavations at the HWK EE site: Archaeology, paleoenvironment and site formation processes during  
20 late Oldowan times at Olduvai Gorge, Tanzania. *J. Hum. Evol.*

21  
22  
23 de la Torre, I., Albert, R.M., Macphail, R., McHenry, L.J., Pante, M.C., Rodríguez-Cintas, Á.,  
24 Stanistreet, I.G., Stollhofen, H., 2018. The contexts and early Acheulean archaeology of the EF-HR  
25 paleo-landscape (Olduvai Gorge, Tanzania). *J. Hum. Evol.*

26  
27 de la Torre, I., McHenry, L.J., Njau, J.K., Pante, M.C., 2012. The Origins of the Acheulean at Olduvai  
28 Gorge (Tanzania): A New Paleoanthropological Project in East Africa. *Archaeology International* 15,  
29 89-98.

30  
31 de la Torre, I., Mora, R., 2005. Technological Strategies in the Lower Pleistocene at Olduvai Beds I &  
32 II. ERAUL 112, Liege.

33  
34  
35 de la Torre, I., Mora, R., 2014. The Transition to the Acheulean in East Africa: an Assessment of  
36 Paradigms and Evidence from Olduvai Gorge (Tanzania). *J. Arch. Met. Theo.* 21, 781-823.

37  
38 de la Torre, I., Mora, R., 2018. Oldowan technological behaviour at Olduvai Gorge, Tanzania: The  
39 HWK EE stone tool assemblage. *J. Hum. Evol.*

40  
41 de la Torre, I., Mora, R. 2018. Technological behaviour in the early Acheulean of EF-HR (Olduvai  
42 Gorge, Tanzania). *J. Hum. Evol.*

43  
44 de la Torre, I., Wehr, K., 2018. Site formation processes of the early Acheulean assemblage at EF-HR  
45 (Olduvai Gorge, Tanzania). *J. Hum. Evol.*

46  
47  
48 Deino, A.L., 2012.  $^{40}\text{Ar}/^{39}\text{Ar}$  dating of Bed I, Olduvai Gorge, Tanzania, and the chronology of early  
49 Pleistocene climate change. *J. Hum. Evol.* 63, 251-273.

50  
51 Diez-Martín, F., Sánchez Yustos, P., Uribelarrea, D., Baquedano, E., Mark, D.F., Mabulla, A., Fraile, C.,  
52 Duque, J., Díaz, I., Pérez-González, A., Yravedra, J., Egeland, C.P., Organista, E., Domínguez-Rodrigo,  
53 M., 2015. The Origin of The Acheulean: The 1.7 Million-Year-Old Site of FLK West, Olduvai Gorge  
54 (Tanzania). *Scientific Reports* 5, 17839.

55  
56  
57 Domínguez-Rodrigo, M., Pickering, T.R., Baquedano, E., Mabulla, A., Mark, D.F., et al., 2013. First  
58 partial skeleton of a 1.34-million-year-old *Paranthropus boisei* from Bed II, Olduvai Gorge, Tanzania.  
59 *PLoS ONE* 8 (e80347).

60  
61  
62  
63  
64  
65

1 Domínguez-Rodrigo, M., Díez-Martín, F., Mabulla, A., Baquedano, E., Bunn, H.T., Musiba, C., 2014.  
2 The evolution of hominin behavior during the Oldowan–Acheulean transition: Recent Evidence from  
3 Olduvai Gorge and Peninj (Tanzania). *Quat. Int.*, 322-323: 1-314.

4 Domínguez-Rodrigo, M., Baquedano, E., Mabulla, A., Díez-Martín, F., Egeland, C.P., 2017. Oldowan  
5 and Acheulian archaeology of Olduvai Gorge. *Boreas*, 46: 605–936.

6 Hay, R.L., 1976. *Geology of the Olduvai Gorge*. University of California Press, Berkeley.

7  
8  
9  
10 Jorayev, G., Wehr, K., Benito-Calvo, A., Njau, J., de la Torre, 2016. Imaging and photogrammetry  
11 models of Olduvai Gorge (Tanzania) by Unmanned Aerial Vehicles: A high-resolution digital database  
12 for research and conservation of Early Stone Age sites. *J. Archaeol. Sci.* 75, 40–56.

13  
14 Leakey, L.S.B., 1936. *Stone Age Africa. An outline of Prehistory in Africa*. Oxford University Press,  
15 London.

16  
17 Leakey, L.S.B., 1951. *Olduvai Gorge. A Report On The Evolution Of The Hand-Axe Culture In Beds I-IV*.  
18 Cambridge University Press, Cambridge.

19  
20 Leakey, L.S.B., Hopwood, A.T., Reck, H., 1931. New Yields from the Oldoway Bone Beds, Tanganyika  
21 Territory. *Nature* 128, 1075.

22  
23 Leakey, M.D., 1971. *Olduvai Gorge. Vol 3. Excavations in Beds I and II, 1960-1963*. Cambridge  
24 University Press, Cambridge.

25  
26 Leakey, M.D., 1975. Cultural Patterns in the Olduvai Sequence, in: Butzer, K.W., Isaac, G.L. (Eds.),  
27 *After the Australopithecines. Stratigraphy, Ecology, and Cultural Change in the Middle Pleistocene*.  
28 Mouton, Chicago, pp. 477-493.

29  
30 Lepre, C.J., Roche, H., Kent, D.V., Harmand, S., Quinn, R.L., Brugal, J.-P., Texier, P.-J., Lenoble, A.,  
31 Feibel, C.S., 2011. An earlier origin for the Acheulian. *Nature* 477, 82-85.

32  
33 Manega, P.C., 1993. *Geochronology, geochemistry and isotopic study of the Plio-Pleistocene*  
34 *Hominid sites and the Ngorongoro volcanic highland in Northern Tanzania*. Ph.D. Dissertation,  
35 University of Colorado, Boulder, 382 p.

36  
37 McHenry, L.J., Njau, J.K., de la Torre, I., Pante, M.C., 2016. Geochemical “fingerprints” for Olduvai  
38 Gorge Bed II tuffs and implications for the Oldowan–Acheulean transition. *Quat. Res.* 85, 147-158.

39  
40 McHenry, L., de la Torre, I., 2018. Hominin raw material procurement in the Oldowan-Acheulean  
41 transition at Olduvai Gorge. *J. Hum. Evol.*

42  
43 McHenry, L., Stanistreet, I., 2018. Tephrochronology of Bed II, Olduvai Gorge, Tanzania, and the  
44 chronology of the Oldowan-Acheulean transition. *J. Hum. Evol.*

45  
46 Pante, M.C., de la Torre, I., 2018. A hidden treasure of the Lower Pleistocene at Olduvai Gorge,  
47 Tanzania: The Leakey HWK EE assemblage. *J. Hum. Evol.*

48  
49 Pante, M.C., Njau, J.K., Hensley-Marschand, B., Keevil, T.L., Martín-Ramos, C., Peters, R.F., de la  
50 Torre, I., 2018. The carnivorous feeding behavior of early Homo at HWK EE, Bed II, Olduvai Gorge,  
51 Tanzania. *J. Hum. Evol.*

52  
53 Prassack, K., Pante, M.C., Njau, J.K., de la Torre, I., 2018. The Paleoecology of Fossil Birds from  
54 Middle Bed II, at Olduvai Gorge, Tanzania *J. Hum. Evol.*

1 Proffitt, T. 2018. Diachronic changes in Oldowan technology in Beds I and Lower Bed II. *J. Hum. Evol.*

2 Rivals, F., Uno, K.T., Bibi, F., Pante, M.C., Njau, J., de la Torre, I., 2018. Dietary traits of the ungulates  
3 from the HWK EE site at Olduvai Gorge (Tanzania): Diachronic changes and seasonality. *J. Hum. Evol.*

4 Stanistreet, I., Stollhofen, H., McHenry, L.J., de la Torre, I., 2018. Bed II Sequence Stratigraphic  
5 context of EF-HR and HWK EE archaeological sites, and the Oldowan/ Acheulean succession at  
6 Olduvai Gorge, Tanzania. *J. Hum. Evol.*

7 Uno, K.T., Rivals, F., Bibi, F., Pante, M., Njau, J.K., de la Torre, I., 2018. Large mammal diets and  
8 paleoecology across the Oldowan-Acheulean transition at Olduvai Gorge, Tanzania from stable  
9 isotope and tooth wear analyses. *J. Hum. Evol.*

10 Uribelarrea, D., Martín-Perea, D., Díez-Martín, F., Sánchez-Yustos, P., Domínguez-Rodrigo, M.,  
11 Baquedano, E., Mabulla, A., 2017. A reconstruction of the paleolandscape during the earliest  
12 Acheulian of FLK West: The co-existence of Oldowan and Acheulian industries during lowermost Bed  
13 II (Olduvai Gorge, Tanzania). *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 488, 50-58.

## 14 15 16 17 18 19 20 21 22 **Legends**

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26 Figure 1. A) Map with localities excavated by OGAP at Olduvai Gorge (base map after Jorayev et al.,  
27 2016). B) Simplified stratigraphy of Bed II (composite section), with the stratigraphic position of  
28 localities investigated by OGAP. \* Dates from: (1) Deino, 2012; (2) Curtis and Hay, 1972, updated in  
29 McHenry and Stanistreet, 2018; (3) Manega, 1993, updated in McHenry and Stanistreet, 2018; (4)  
30 Díez-Martín et al., 2015; (5) Domínguez-Rodrigo et al., 2013. \*\* Archaeological sites within each  
31 assemblage are not plotted in stratigraphic order.  
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