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The contexts and early Acheulean archaeology of the EF-HR paleo-landscape (Olduvai Gorge, Tanzania)

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ABSTRACT

Renewed fieldwork at the early Acheulean site of EF-HR (Olduvai Gorge, Tanzania) has included detailed stratigraphic studies of the sequence, extended excavations in the main site, and has placed eleven additional trenches within an area of nearly 1 km^2, to sample the same stratigraphic interval as in the main trench across the broader paleo-landscape. Our new stratigraphic work suggests that EF-HR is positioned higher in the Bed II sequence than previously proposed, which has implications for the age of the site and its stratigraphic correlation to other Olduvai Middle Bed II sites. Geological research shows that the main EF-HR site was situated at the deepest part of an incised valley formed through river erosion. Archaeological excavations at the main site and nearby trenches have unearthed a large new assemblage, with more than 3000 fossils and artefacts, including a hundred handaxes in stratigraphic position. In addition, our test-trenching approach has detected conspicuous differences in the density of artefacts across the landscape, with a large cluster of archaeological material in and around the main trench, and less intense human activity at the same level in the more distant satellite trenches. All of these aspects are discussed in this paper in the light of site formation processes, behavioral contexts, and their implications for our understanding of the early Acheulean at Olduvai Gorge.

1. Introduction

EF-HR is one of the most emblematic archaeological sites in Olduvai Gorge, Tanzania. Discovered by Evelyn Fuchs and Hans Reck (hence EF-HR) in 1931, the site was originally excavated by Mary Leakey in 1963 (Leakey, 1971), and became the prime example of the early Acheulean at Olduvai. Although the estimated age of the site varied between 0.7 and 1.0 Ma (Leakey, 1971) and 1.4 Ma (Leakey, 1975), EF-HR was soon considered as paradigmatic in discussions on the emergence of handaxe technology (e.g., Gowlett, 1979; Stiles, 1979), also attracting research interest in recent years (e.g., Kimura, 2002; de la Torre and Mora, 2005). Nonetheless, despite frequent references to EF-HR in the literature on early Acheulean origins, no fieldwork was conducted at the site for over four decades.

In 2009, the Olduvai Geochronology Archaeology Project (OGAP) renewed excavations at EF-HR, which continued until 2013. Objectives of the new fieldwork program included refining the chronostratigraphic position of the site, investigating contexts and site formation processes, exploring the lateral extent of deposits and the wider paleo-landscape, and retrieving fresh archaeological data to characterise the technological and subsistence strategies of Olduvai Gorge Early Acheulean hominins.

While Leakey (1971) positioned EF-HR as the earliest assemblage in Middle Bed II, Hay (1976) located the site higher up in the sequence, just below Tuff IIC. Revisiting the stratigraphic position of EF-HR was thus deemed essential to contextualise it better among

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other relevant Middle and Upper Bed II sites; our new results, which contradict earlier reconstructions, will be discussed in this paper. The archaeological context of EF-HR was only briefly touched upon by Leakey (1971), who assumed the site constituted a living floor largely in primary position; this and an accompanying study (de la Torre and Wehr, submitted) will discuss formation processes of EF-HR in the light of renewed excavations, highlighting the complexity of the site's history. Inspired by leading efforts to produce paleo-landscape data in major paleoanthropological localities (e.g., Rogers et al., 1994; Potts et al., 1999; Blumenschine et al., 2012a, 2012b), we combined large-scale excavations (sited to extend Leakey's trench at the main EF-HR trench) with test trenches across the same stratigraphic interval. While the large size and relevance of the lithic assemblage warrants a separate account (de la Torre and Mora, submitted), the main features of the fossil and stone tool collection unearthed by OGAP at EF-HR, and the meaning of their distribution, will be another major aspect discussed in this paper.

In summary, trench stratigraphic correlations, landscape reconstructions and a study of site formation processes based on spatial analysis, taphonomic signatures, and sedimentological features are presented in order to understand the dynamics that led to the accumulation of a large assemblage with some of the earliest Acheulean handaxes at Olduvai. Our aim in the present study is to provide a detailed account of the stratigraphic, contextual, and behavioral features of the wider landscape occupied by hominins during early Acheulean times at Olduvai Gorge.

2. Methods

2.1. Archaeological excavation

Based upon relative coordinates, a virtual grid was set up in the area of the main outcrop at EF-HR, and cemented reference stations were placed across the korongos of DK EE, EF-HR and MK W. This coordinate system was aligned with Leakey's trench at the main exposure of EF-HR, and therefore the northing (Y-axis) is at 320°, rather than geographic North. Although the relative coordinate system was used during the excavations, cemented reference stations were positioned with differential GNSS, and then the grid was transformed into absolute coordinates (WGS84), which is the reference for all maps shown here, apart from Figure 9A–C, where a UTM Zone 36S projection is used.

Excavation methodology included three-dimensional (3D) plotting with a total station of all artefacts unearthed and relevant geological features (e.g., lithological contacts and hence lithofacies geometries, claystone paleo-surface topography, paleo-environmental samples) and followed protocols detailed by de la Torre et al. (2015). Definition of archaeological levels was based on both the lithofacies context and vertical clustering of artefacts. Thus, some lithological units contained more than one archaeological level because of vertical gaps between artefact aggregations, while lateral changes of facies led on occasions to the inclusion of materials embedded in more than one lithological unit within the same archaeological level.

2.2. Stratigraphy and sedimentology

Stratigraphic sections in the vicinity of EF-HR were measured from the Lemuta Member to the base of Bed III where possible. These were initially measured to help identify the target interval so that satellite trenches could be sited. This means that the measured sections made use of natural exposures with minimal scraping, and that they pre-date the excavations. They are thus not always directly associated with a trench, and lack the sedimentological detail later achieved during the measurement of the trench backwalls. They are, however, sufficient to identify the major lithological units and their relative stratigraphic positions, and help to place the EF-HR land surface within the context of Bed II stratigraphy. A rock hammer was used to clear exposures, measurements were made using a Jacob's staff (with level) and meter stick, and sedimentological observations were made using a hand lens.

Following excavation, the detailed stratigraphy of all trenches excavated in the EF-HR area was mapped on the backwalls and/or sidewalls of each archaeological trench, and lithological contacts were measured at cm-accuracy with a total station and positioned in the same reference system as the archaeological material.

Particular facies types were defined on the basis of grain size, sorting, fabrics, bedding, compositional, and grain characteristics, providing the basis for their process-related sedimentological interpretation. Lithostratigraphic units and facies associations were also classified by whether they were bounded by conformable or incisional surfaces. Incisional surfaces were differentiated into Type I (pronouncedly incisional) or Type 2 (hiatal or slightly incisional). Time-rock units were then delimited according to the criteria employed by Stanistreet (2012), Blumenschine et al. (2012a, 2012b), and Stanistreet et al. (submitted), who have named such time-slices lake-parasequences.

2.3. Micromorphology

Sediment blocks and carbonates encrusted on artefacts were impregnated with a clear polyester resin-acetone mixture; samples were then topped up with resin, ahead of curing and slabbing for 75 × 50 mm thin sections (Murphy, 1986; Goldberg and Macphail, 2006). These were further polished with 1000 grit papers and analysed using a petrological microscope under plane polarised light (PPL), crossed polarised light (XPL), oblique incident light (OIL) and using fluorescence microscopy (blue light – BL), at magnifications ranging from ×1 to ×200/400. Thin sections were described, ascribed soil microfabric types (MFTs), and counted according to established methods (Bullock et al., 1985; Courty et al., 1989; Courty, 2001; Macphail and Cruise, 2001; Stoops, 2003; Stoops et al., 2010).

2.4. Phytolith analysis

Eighteen phytolith samples were analysed, following the rapid extraction procedure developed by Katz et al. (2010). Quantitative analysis and morphological identification used an Olympus BX41 optical microscope with magnification of 200× and 400×, respectively. Morphological identification was based on our own reference collection (Albert et al., 2016; www.phytcore.org), as well as on relevant published literature from Africa (Alexandre et al., 1997; Runge, 1999; Bamford et al., 2006; Barboni et al., 2007; Barboni and Bremond, 2009; Mercader et al., 2009).

2.5. Artefact and fossil analysis

Bone taphonomy was mostly limited to inspection of cortical surfaces with the naked eye under a 60 W light source due to the overall poor condition of the fossils. However, following Blumenschine et al.'s (1996) methods, a more conventional technique of using a hand lens was employed when bone surfaces were well preserved enough to reveal surface modifications. Taphonomic data collected include bone weathering based on Behrensmeyer's (1978) criteria, the type of breakage – either green (indicated by spiral or feathered breaks), or dry (indicated by transverse breaks)— and a general account of the condition of cortical surfaces

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