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New excavations at the HWK EE site: Archaeology, paleoenvironment and site formation processes during late Oldowan times at Olduvai Gorge, Tanzania

Ignacio de la Torre [a, *], Rosa M. Albert [b, c], Adrián Arroyo [a], Richard Macphail [a], Lindsay J. McHenry [d], Rafael Mora [e], Jackson K. Njau [f, g], Michael C. Pante [h], Carlos A. Rivera-Rondón [i], Ágata Rodríguez-Cintas [c], Ian G. Stanistreet [j, g], Harald Stollhofen [k], Karol Wehr [a]

[a] Institute of Archaeology, University College London, 31-34 Gordon Square, WC1H 0PY London, United Kingdom
[b] ICREA, Pg. Lluís Companys 23, 08010 Barcelona, Spain
[c] ERAAUB/Departament de Historia i Arqueologia, Universitat de Barcelona, Montalegre 6-8, 08001 Barcelona, Spain
[d] Department of Geosciences, University of Wisconsin- Milwaukee, 3209 N. Maryland Ave., Milwaukee, WI 53211, USA
[e] Centre D'Estudis Del Patrimoni Arqueologic de La Prehistoria, Facultat de Lletres, Universitat Autonoma de Barcelona, 08193 Bellaterra, Spain
[f] Department of Geological Sciences, Indiana University, 1001 East 10th Street, Bloomington, IN 47405-1405, USA
[g] Stone Age Institute, 1392 W Dittemore Road, Gosport, Indiana 47433, USA
[h] Department of Anthropology, Colorado State University, 1787 Campus Delivery, Fort Collins, CO 80523, USA
[i] Unidad de Ecología y Sistemática, Departamento de Biología, Pontificia Universidad Javeriana, Cra. 7 # 40-82, 110231 Bogotá, Colombia
[j] Department of Earth, Ocean and Ecological Sciences, University of Liverpool, Brownlow Street, Liverpool L69 3GP, United Kingdom
[k] GeoZentrum Nordbayern, Friedrich-Alexander-University (FAU) Erlangen-Nürnberg, Schloßgarten 5, 91054 Erlangen, Germany

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ABSTRACT

This paper reports the results of renewed fieldwork at the HWK EE site (Olduvai Gorge, Tanzania). HWK EE is positioned across the boundary between Lower and Middle Bed II, a crucial interval for studying the emergence of the Acheulean at Olduvai Gorge. Our excavations at HWK EE have produced one of the largest collections of fossils and artefacts from any Oldowan site, distributed across several archaeological units and a large excavation surface in four separate trenches that can be stratigraphically correlated. Here we present the main stratigraphic and archaeological units and discuss site formation processes. Results show a great density of fossils and stone tools vertically through two stratigraphic intervals (Lemuta and Lower Augitic Sandstone) and laterally across an area of around 300 m^2, and highlight the confluence of biotic and abiotic agents in the formation of the assemblage. The large size and diversity of the assemblage, as well as its good preservation, qualify HWK EE as a reference site for the study of the late Oldowan at Olduvai Gorge and elsewhere in Africa. In addition, the description of the stratigraphic and archaeological sequence of HWK EE presented in this paper constitutes the foundation for further studies on hominin behavior and paleoecology in Lower and Middle Bed II.

1. Introduction

Olduvai Gorge (Tanzania) is one of the world's most important paleoanthropological areas for the study of the Oldowan to Acheulean transition, due to the presence of archaeological sites in a relatively continuous stratigraphic sequence where a predominance of core and flake assemblages is replaced by handaxe-bearing sites (Leakey, 1951). Thanks to pioneering work by Mary Leakey (1971), the tempo of such technological change was narrowed down to Middle Bed II. In this stratigraphic interval, Leakey (1971) excavated a number of assemblages – now classic in the literature – where she observed a technological evolution within the Oldowan (which she attributed to *Homo habilis*), and an eventual replacement by the Acheulean (which she linked to *Homo erectus*). One of those sites was HWK EE, the subject of this paper.

* Corresponding author.
E-mail address: i.torre@ucl.ac.uk (I. de la Torre).

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The outcrop of HWK EE (Henrietta Wilfrida Korongo East East) is located in the southeast part of the Junction Area at Olduvai Gorge (see Fig. 1) and a few hundred meters from HWK E, one of the sites published in Leakey's (1971) classic monograph. Middle Bed II deposits were excavated at HWK EE by Mary Leakey in the early 1970s, but she never published her work at the site. HWK EE remains poorly known, and referenced almost exclusively for its stratigraphic sequence (Hay, 1976), the discovery of a tooth of cf. *H. habilis*, and the evolution of Olduvai bovids (Gentry and Gentry, 1978). As a result, the site has been rarely included in any discussions about Beds I and II of the Olduvai sequence from the 1980s until the present.

The large size and good preservation of the HWK EE Leakey collection, along with its stratigraphic position in the basal part of Middle Bed II (which is essential for the discussion of the Oldowan–Acheulean transition) at ~1.7 million years ago, indicated the potential of the site to provide information about hominin behavior and technology during this crucial period of human evolution. In 2008, the Olduvai Geochronology Archaeology Project (OGAP) began a re-study of the unpublished Leakey assemblage (see Pante and de la Torre, submitted), and in 2009 renewed excavations at the site.

Excavations at HWK EE between 2009 and 2015 became one of the major fieldwork undertakings by OGAP and, as a result, a substantially large (one of the largest at Olduvai and elsewhere in Africa) bone and lithic assemblage has been recovered. Abundance, diversity and overall importance of the HWK EE archaeological record allows detailed studies of the zooarchaeology (Pante et al., submitted), lithic technology (de la Torre and Mora, submitted), and mammal isotopic and tooth wear patterns (Rivals et al., submitted). The HWK EE record also constitutes the main dataset for several other studies on the Olduvai battered tools (Arroyo and de la Torre, submitted), raw materials (McHenry and de la Torre, submitted), and paleoecology (Bibi et al., this volume; Uno et al., this volume; Prassack et al., this volume) of Bed II.

The present paper aims to introduce the archaeological sequence of HWK EE to provide the foundation for all the aforementioned studies. Based on a cross-disciplinary approach, this paper presents a full and extensive account of the archaeo-stratigraphic sequence, site formation processes and paleoenvironment of HWK EE, drawing from detailed studies of tephrostratigraphy, sedimentology, micromorphology, diatoms, phytoliths, taphonomy and spatial analysis of the assemblage. While paleoecological patterns and an interpretation of hominin behavior/s involved in the formation of HWK EE will be discussed in accompanying papers, this paper will provide the necessary picture to contextualise hominin activities and their environment during late Oldowan times at Olduvai Gorge.

2. Materials and methods

2.1. Archaeological excavation

A virtual grid with a local coordinate system was created in the area of the HWK EE outcrop. Cemented reference stations were placed around the main excavation and satellite trenches. This relative coordinate grid was aligned with Mary Leakey's trench at HWK EE, so that the OGAP trench could be extended from Leakey's trench walls. Such alignment does not correspond to geographic North, and thus the northing (Y-axis) of the HWK EE relative system is at 38°. The local coordinate system was used during excavations,

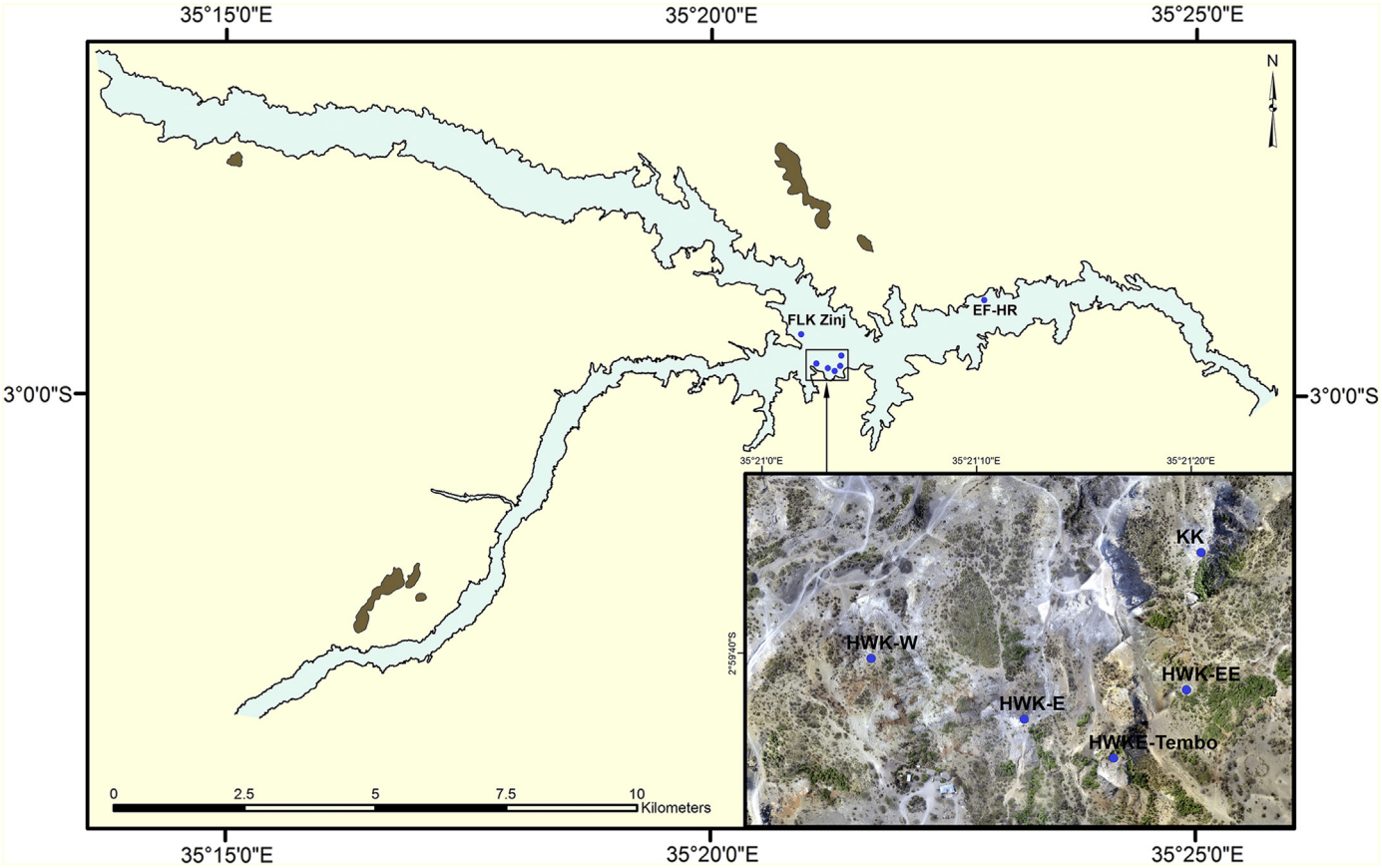

Figure 1. Location of Olduvai Gorge with localities mentioned in the text. Map outline and aerial view after Jorayev et al. (2016).

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