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Paleoecology of the Serengeti during the Oldowan-Acheulean transition at Olduvai Gorge, Tanzania: The mammal and fish evidence

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ABSTRACT

Eight years of excavation work by the Olduvai Geochronology and Archaeology Project (OGAP) has produced a rich vertebrate fauna from several sites within Bed II, Olduvai Gorge, Tanzania. Study of these as well as recently re-organized collections from Mary Leakey's 1972 HWK EE excavations here provides a synthetic view of the faunal community of Olduvai during Middle Bed II at ~1.7–1.4 Ma, an interval that captures the local transition from Oldowan to Acheulean technology. We expand the faunal list for this interval, name a new bovid species, clarify the evolution of several mammalian lineages, and record new local first and last appearances. Compositions of the fish and large mammal assemblages support previous indications for the dominance of open and seasonal grassland habitats at the margins of an alkaline lake. Fish diversity is low and dominated by cichlids, which indicates strongly saline conditions. The taphonomy of the fish assemblages supports reconstructions of fluctuating lake levels with mass die-offs in evaporating pools. The mammals are dominated by grazing bovids and equids. Habitats remained consistently dry and open throughout the entire Bed II sequence, with no major turnover or paleoecological changes taking place. Rather, wooded and wet habitats had already given way to drier and more open habitats by the top of Bed I, at 1.85–1.80 Ma. This ecological change is close to the age of the Oldowan-Acheulean transition in Kenya and Ethiopia, but precedes the local transition in Middle Bed II.

The Middle Bed II large mammal community is much richer in species and includes a much larger number of large-bodied species (>300 kg) than the modern Serengeti. This reflects the severity of Pleistocene extinctions on African large mammals, with the loss of large species fitting a pattern typical of defaunation or 'downsizing' by human disturbance. However, trophic network (food web) analyses show that the Middle Bed II community was robust, and comparisons with the Serengeti community indicate that the fundamental structure of food webs remained intact despite Pleistocene extinctions. The presence of a generalized meat-eating hominin in the Middle Bed II community would have increased competition among carnivores and vulnerability among herbivores, but the high generality and interconnectedness of the Middle Bed II food web suggests this community was buffered against extinctions caused by trophic interactions.

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1. Introduction

Fieldwork by the Olduvai Geochronology and Archaeology Project (OGAP) since 2008 has produced a large collection of vertebrate fauna from Middle Bed II at Olduvai Gorge, Tanzania. Most paleontological studies of the last 100 years at Olduvai have focused on Bed I and Lower Bed II, and comparatively little attention has been paid to the Middle and Upper parts of Bed II, which document the transition from Oldowan to Acheulean stone tool technologies (Stanistreet et al., submitted for publication; de la Torre et al., 2012).

The main fossiliferous beds at Olduvai are numbered from Bed I to IV (Fig. 1), from oldest to youngest, following the original stratigraphy developed by the Berlin expedition of 1913 (Reck, 1914). Geological work over the last 100 years (Leakey, 1978) has clarified

the chronostratigraphy at Olduvai. Bed I is well dated to 2.0–1.8 Ma (Deino, 2012). Bed II is divided into Lower, Middle, and Upper units (Leakey, 1971) that together span some 600,000 years (1.8–1.2 Ma; McHenry et al., 2016). We take Middle Bed II to include all levels from the base of the Lower Augitic Sandstone up to Tuff IIC (Stanistreet et al., submitted for publication). The age of Middle Bed II is constrained to 1.76–1.3 Ma or 1.76–1.5 Ma based on the ages of Tuffs IIA (Curtis and Hay, 1972) and IID (Manega, 1993; Domínguez-Rodrigo et al., 2013). Our estimate for the undated Tuff IIC, which defines the top of Middle Bed II, is ~1.6–1.4 Ma. Tuff IIB bisects the sequence and is located just below a tuff dated to 1.66 Ma (Uribelarrea et al., in press) that itself underlies the Bird Print Tuff (BPT; McHenry, submitted for publication; Diez-Martín et al., 2015). In this paper, we follow the stratigraphic model of Stanistreet et al. (submitted for publication) and McHenry (submitted for

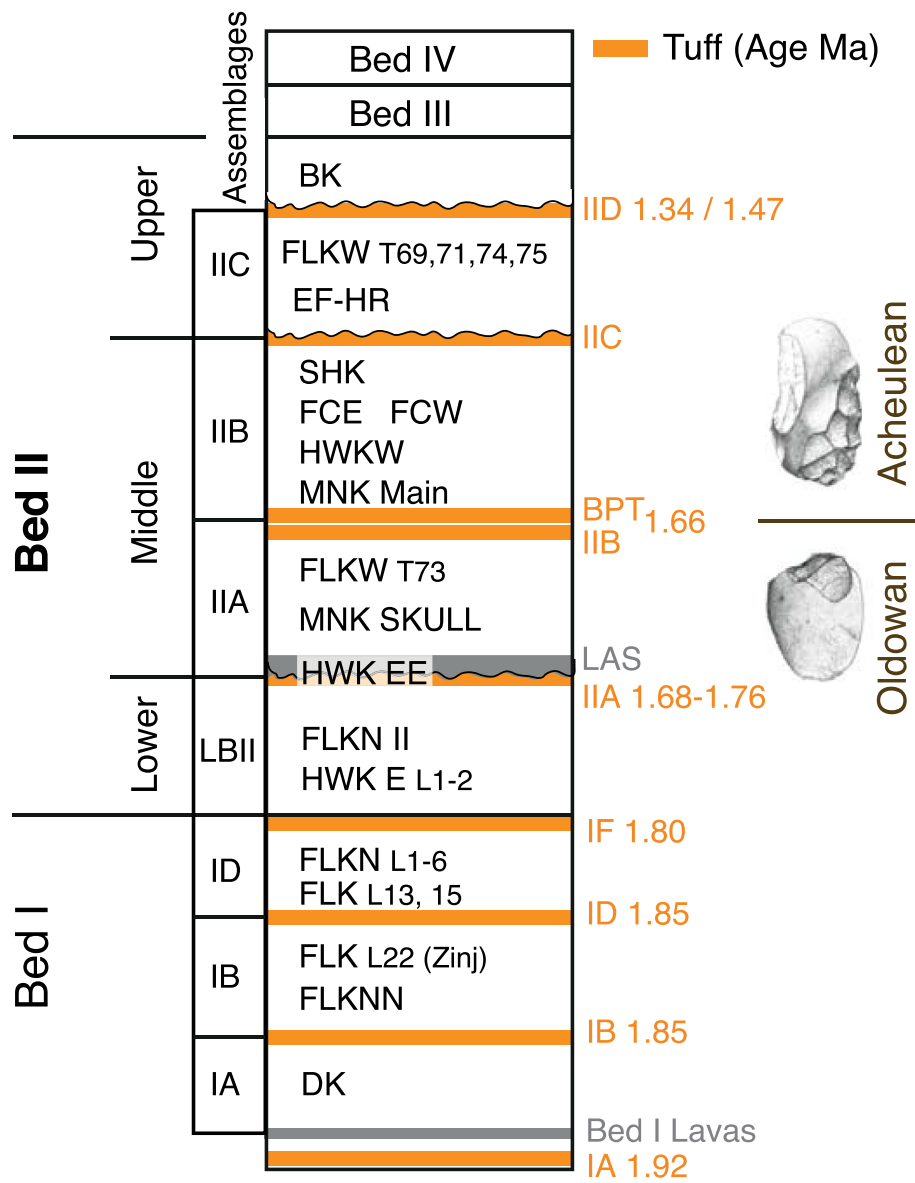


Figure 1. Simplified stratigraphy of Olduvai Gorge. This mainly follows previous stratigraphic schemes, though Bed II tuff ages and the placement of EF-HR above Tuff IIC are updated following OGAP findings. Site names within bracketing tuffs are alphabetical, not stratigraphic. Assemblage IIA comprises specimens from sites between Tuffs IIA and IIB and represents the Oldowan component of Middle Bed II. Assemblage IIB encompasses sites between Tuffs IIB and IIC and represents the Acheulean component of Middle Bed II. BPT = Bird Print Tuff, LAS = Lower Augitic Sandstone. Undulating lines represent disconformities. Geochronological ages follow Deino (2012), McHenry (submitted for publication), and references therein.

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