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## Preliminary study of the rodent assemblages of Goda Buticha: New insights on Late Quaternary environmental and cultural changes in southeastern Ethiopia

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### ABSTRACT

Given its proximity to the Strait of Bab el Mandeb and the Red Sea, the Horn of Africa is particularly important for understanding human and faunal migration events to and from Africa. Towards the end of the Pleistocene, the Middle/Later Stone Age (MSA/LSA) transition represents a critical step in human cultural evolution. However, in the Horn of Africa, the environmental conditions associated with this transition remain poorly understood. The Goda Buticha (Buticha cave) sequence, located in southeastern Ethiopia, and dated from ca. 63 ka cal BP to ca. 1 ka cal BP, provides a rare opportunity to examine the environmental contexts associated with major cultural sequences documented in the region during this time period. A preliminary analysis of the rich microvertebrate (and especially rodent) remains recovered from the levels dated between 43 and 4 ka BP identified fourteen different rodent genera, including two species that are locally extinct in southeastern Ethiopia today. While the taphonomic signature is similar throughout the sequence, indicating an *in situ* accumulation by an owl without major perturbation, the palaeoecological analysis showed environmental change through time, characterized by open-dry setting during the Late Pleistocene, shifting to wetter and more wooded conditions heading to the Holocene. These results are generally consistent with other diverse records which include the large mammals, speleothems and lake basins records, and allow a better understanding of the dynamics of environmental contexts associated with observed cultural change and continuity in eastern Africa from the Late Pleistocene to Late Holocene.

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### 1. Introduction

The eastern African region, and particularly the Eastern African Rift System, is considered as a locus to the emergence of anatomically modern humans and Late Pleistocene human and faunal migrations in and out of Africa (McDougall et al., 2005; Beyin, 2006, 2011; Behar et al., 2008; Klein, 2008; Tishkoff et al., 2009; Rose

et al., 2011; Delagnes et al., 2012). The Horn of Africa in particular could have alternately played the role of pathway (along the Nile Valley or through the Bab el Mandeb) or refuge area in mountains and high plateaus (Van Peer, 1998; Kleindienst, 2000; Basell, 2008). Many genetic and phylogeographic studies in the region indicate that climate changes and volcanic activity have led to habitat fragmentation and the emergence of numerous endemic species, especially among small mammals (e.g., Yalden et al., 1976, 1996; Yalden and Largen, 1992; Huhndorf et al., 2007; Meheretu et al., 2014; Lavrenchenko et al., 2016). However, few Quaternary palaeontological and archaeological fossil records exist in the region, especially from the Pleistocene-Holocene boundary, a period marked by significant environmental and human cultural changes

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(e.g., Foerster et al., 2015). A clear understanding of the changes in species diversity and landscapes through time, as well as the possible link between environmental and cultural changes is hindered by lack of such records. A large sample of microvertebrate remains (Assefa et al., 2014; Pleurdeau et al., 2014) derived from recent archaeological excavations at Goda Buticha (Buticha cave), in southeastern Ethiopia, sheds light on the environmental and climatic record and renders better understanding of the technological changes at the Pleistocene-Holocene boundary in the Horn of Africa. For palaeoenvironmental reconstructions, the study of microvertebrates, especially rodents, have shown great potential (e.g., Chaline, 1972, 1973; Avery, 1982; Andrews, 1990; Fernandez-Jalvo et al., 1998; Stoetzel et al., 2011). In this preliminary study of the Goda Buticha microvertebrate accumulations, we employed systematic taphonomic investigations of the faunal remains, which allowed a reliable reconstruction of the accumulating agent(s), as well as the profile of the palaeoenvironment, as represented by different taxa of the fossil faunal record.

## 2. Regional settings

### 2.1. The Goda Buticha sequence

Goda Buticha, located in the Dire Dawa region near the Porc-Epic cave (Clark et al., 1984; Pleurdeau, 2005; Assefa, 2006; Leplongeon, 2014), is a relatively small cave carved into Jurassic limestone beds at the foothills of the structurally controlled escarpment between the southeastern Ethiopian Plateau and the Ethiopian rift at an altitude of 1382 m a.s.l. (Fig. 1). The site was discovered in 2007, and was subsequently excavated in 2008 and 2011 (Assefa et al., 2014; Pleurdeau et al., 2014). In its main chamber, the cave contains more than 2 m thick sedimentary sequences.

As discussed in detail by Pleurdeau et al. (2014) the stratigraphy of the excavated sequence at Goda Buticha is divided into two main sedimentological complexes (Fig. 2): (i) the Upper Complex, which is composed of mainly anthropogenic deposits such as ashes, and one level that is particularly rich in microvertebrate bones, hence called 'micromammal layer'; and (ii) the Lower Complex, which is of 'natural' origin and is mainly composed of aeolian sediments with some contribution from stream in-wash deposits.

Combined  $^{14}\text{C}$  and OSL dating of the Goda Buticha sequence has shown that the sediments were deposited between 63 ka BP and 1 ka BP (Tribolo et al., 2017). Tribolo et al. (2017) also confirmed that there is a clear chronological and sedimentological hiatus between Late Pleistocene and Holocene levels (from ca. 25 to 7.5 kcal BP), roughly corresponding to the arid period of MIS 2 and early Holocene, regionally marked by wetter condition of the African Humid Period (AHP). The sedimentological analyses suggested a hiatus in actual sedimentation rather than erosion to be responsible for the sedimentological gap in the sequence.

From its stratified layers, Goda Buticha has yielded a large number of Middle Stone Age (MSA) and Later Stone Age (LSA) tools, Ostrich eggshell fragments and beads, human skeletal remains, a good number of faunal remains of larger mammals and abundant microvertebrate remains (Pleurdeau et al., 2014; Sime, 2014). Figurative rock art has also been observed at the wall of a small gallery branching off the main sediment filled chamber.

The lithic industries in the Goda Buticha sequence are marked by lack of clear technological shift from Late Pleistocene to Middle Holocene occupations (Pleurdeau et al., 2014; Leplongeon et al., 2017). The lower sub-unit of the Lower Complex (Layers IId and Ile) is composed of typical MSA industries (Levallois debitage, uni- and bi-facial points, etc.) with few LSA components. On the other hand, while elongated and microlith components are more clearly apparent in the upper sub-unit (Layer IIc), MSA features like

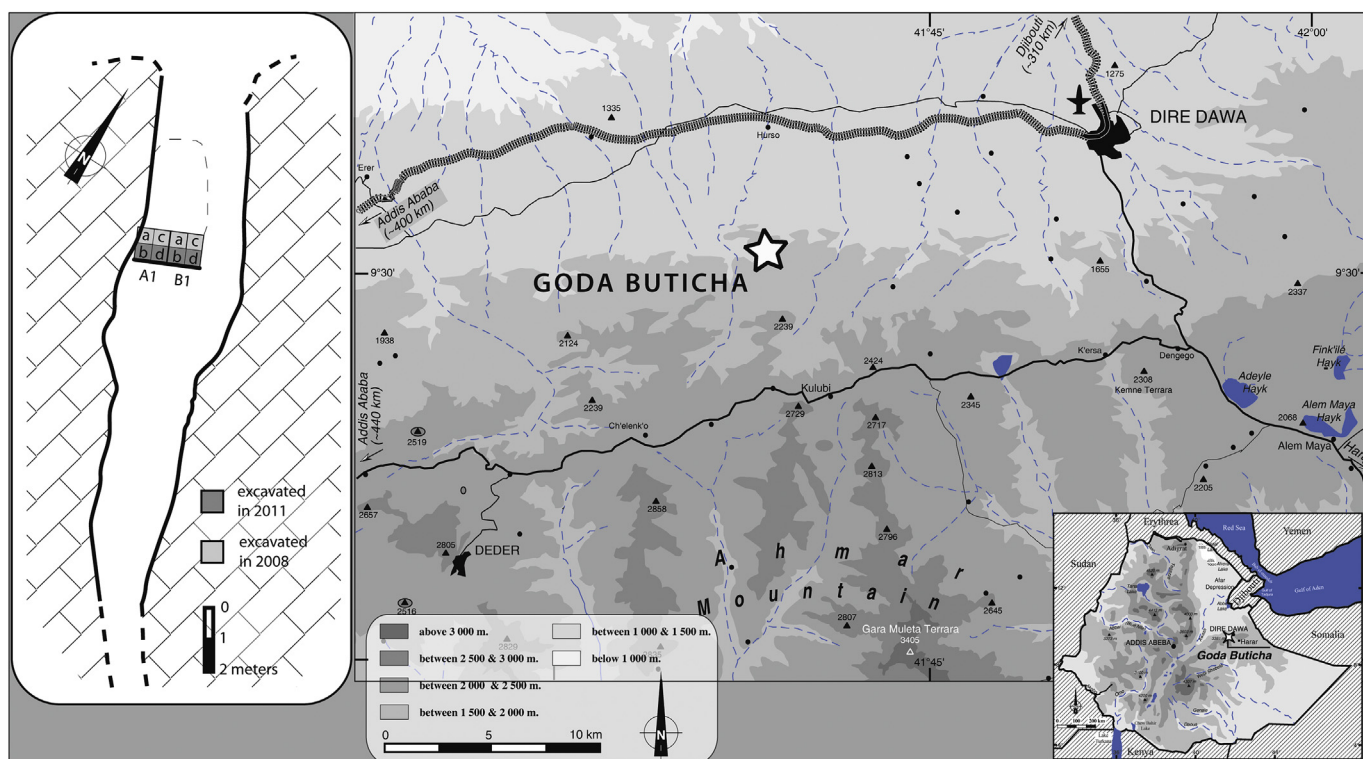


Fig. 1. Location of Goda Buticha; inset, picture shows the excavated area (modified after Pleurdeau et al., 2014).

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