Quaternary Science Reviews 186 (2018) 123–141

Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

A rhinocerotid-dominated megafauna at the MIS6-5 transition: The late Middle Pleistocene Coc Muoi assemblage, Lang Son province, Vietnam

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ARTICLE INFO

Article history:
Received 14 September 2017
Received in revised form
11 February 2018
Accepted 16 February 2018

Keywords:
Southeast Asia
Ecosystems
Rhinoceros sondaicus
Hypoplasia
Lida Ajer

ABSTRACT

Little is known about the ecosystems in the north of the Indochinese peninsula at the Middle-Late Pleistocene transition. In this paper, we analyzed the new fauna from Coc Muoi cave, Lang Son province, northeast Vietnam. In comparison with other well-documented faunas from the region, that of Coc Muoi is distinguished by the predominance of rhinoceroses among diverse large-bodied herbivores. The results of the OSL and pIR-IRSL dating of the cave sediments and U-series dating of flowstones indicate a potential age range of 148-117 ka for the fauna (MIS6-5). The analysis of age-at-death distributions of rhinoceroses, wild cattle, sambar deer, and wild pig, does not show any apparent selectivity of age classes. We also focused our study on rhinoceroses, tapirs, and wild cattle by analyzing the prevalence of hypoplastic defects on deciduous and permanent teeth, in an attempt to assess the health status of the taxa during their first years of growth. The health status of large-bodied herbivores (kouprey and rhinoceros) reveals the importance of stressors (biotic and abiotic) in the rainforest environment during a period of marked climatic transition (MIS6-5) in comparison with other MIS5-4 well-documented faunas from the region.

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https://doi.org/10.1016/j.quascirev.2018.02.017
0277-3791/

1. Introduction

Although widespread in the past environments of Southeast Asia, little is known about the foraging abilities of large predators, the solitary tiger and leopard, or the group-living dhole and hyena. What we know however, is that large predators from Pleistocene mammalian communities had access to a larger spectrum of large prey (van Valkenburg et al., 2016). In the north of Indochina (Corbet and Hill, 1992), the structure of the mammalian ecosystems was shaped by the presence of numerous large-bodied herbivores - at least five types of animals >250 kg (tapirs, wild cattle, and rhinoceroses) up to 5000 kg (elephant and stegodont) - which might have composed part of the predators' diets, among either juvenile or adult individuals.

In 2013, on an invitation from the Vietnamese authorities (Institute of Archaeology in Hanoi and Lang Son Museum), we undertook in a collaborative fieldwork the excavation of the Coc Muoi cave, in Lang Son province, north-east Vietnam. Since the 1960's, the Lang Son province has yielded major faunal assemblages (i.e. Tham Khuyen, Tham Hai, and Keo Leng), which have formed the foundation for the biochronology of the Middle to Late Pleistocene in the Indochinese region (Kha, 1976; Long and Du, 1981; Cuong, 1985, 1992; Olsen and Ciochon, 1990; Ciochon and Olsen, 1986, 1991; Schwartz et al., 1994, 1995; Ciochon et al., 1996; Tougard, 1998, 2001). More recently, the faunal assemblages were used as key-references in palaeoecological studies (Tougard and Montuire, 2006; Louys and Meijaard, 2010), and were also used to resolve diagnostic issues regarding the oldest hominines in Asia (Ciochon, 2009).

In this paper, we aim to increase our understanding of the Pleistocene megaherbivore-bearing ecosystems by analyzing the new fauna from Coc Muoi cave which produced an assemblage of several hundred isolated teeth. In comparison with other well-documented faunas from the region, that of Coc Muoi is distinguished by the predominance of rhinoceroses among megaherbivores (Long et al., 1996; Bacon et al., 2008a; Antoine, 2012). We applied single-grain optically stimulated luminescence (SG-OSL) and post-infrared infrared-stimulated luminescence (pIR-IRSL) to the sediment, and U-series dating to the overlying flowstones to provide a time frame for deposition of the faunal remains in the cave. Taxonomic diversity has been defined based on the teeth. Then, we conducted a taphonomic study of the assemblage, in order to assess factors that may have contributed to the composition and preservation of the mammalian assemblage. We used age-at-death distributions of rhinoceroses, wild cattle, sambar deer, and wild pig in an attempt to emphasize potential prey preferences of large predators. We focused our palaeoecological study on rhinoceroses, tapirs, and wild cattle by analyzing the prevalence of hypoplastic defects on teeth. Considering its composition and age, the fauna has the potential to shed light on a guild of megaherbivores in terms of diversity, relative abundance, and health status around the Middle-Late Pleistocene transition.

2. Description of the site

2.1. Location and geological context

The Coc Muoi cave is close to the Chinese border 155 km NNE from Hanoi in the Lang Son province (Fig. 1). The site is located 10 km north from the main town That Khê.

The landscape is composed of limestone hills and tower karsts dated to the "Anthracolitique" (Fromaget, 1931; Deprat et al., 1963) corresponding to Permo-Carboniferous deposits. The local geology is a massive sparitic limestone with low metamorphic processes. The cave is situated in a small isolated hill, around 150 m in diameter and 30 m high that emerges from the cultivated fields 361 m above the sea level. The precise location is N22° 21′ 21.54", E106° 26′ 6.12" (Fig. 2A). The entrance of the cave, hidden in the forest, is situated 10 m above the cultivated plain (Fig. 2B and C).

The chambers within the cave have a total length of 40 m with a NE-SW orientation (Figs. 3 and 4). The narrow cave entrance (≤1 by 1 m) opens out to 4 m long passageway leading to a first chamber of ~12 m (referred to as "upper hall" in Figs. 3B and 4B). A second chamber, named "lower hall", is situated 1.45 m below the upper level (Figs. 3B and 4B). From the lower hall, a small passageway runs below the upper hall partly blocked by clay (Fig. 4B).

The upper hall is characterized by massive concretions, flowstones, stalactites, stalagmites and various other speleothems that overly light brown argillaceous sediment but with minimal fossils. This part has not been exploited. Several trenches were opened in the fossils-rich lower hall which displays two types of deposits (Fig. 5). The center of the cavity is almost entirely filled with moist yellow silty clay. The upper part of this clay (up to 30 cm) is completely reworked by modern digging (clays are exploited by farmers). Some angular limestone clasts from the substratum of the hill are scattered on the surface. Otherwise, large mud cracks cover the greatest part of the surface suggesting episodic cave flooding. These deposits do not contain fossils.

At the periphery of the cave, plastered on the wall, a solid brown to light brown sandy/clayey breccia unit is characterized by a progressive enrichment in calcite from the base to the top of the section with some limestone clasts and quartz pebbles (Fig. 5). A flowstone overlies this breccia section and is composed of two different phases of deposits. The upper part in made by modern stalactites (light green on Fig. 5) which overlies an older flowstone (dark green on Fig. 5) that in turn overlies the breccia. All fossils were discovered in the sediment below this older flowstone (brown color on Figs. 3–5). The stratigraphic relationship between the soft clayey sediment on the surface of the cave and that plastered on the wall at the periphery indicates an erosion surface (Fig. 5). In the passageway that runs below the upper hall (Fig. 4B), the sediment is almost the same as that plastered at the periphery of the cave but with less calcitic cementations, and contains similar fossils.

2.2. Cave history

The history of the filling of the cave is summarized in Fig. 5 with four phases (from old to young). The cave was filled by the sandy/clayey breccia at least half way up the cave wall (phase 1). The water and sediment entered the cave, bringing the sediment and vertebrate remains studied in this paper. Several flowstones were precipitated progressively more frequently and with increasing thickness during this phase. A large section of the deposits from phases 1 and 2 deposition are removed by erosion, and new sediments are deposited via cut and fill processes (phase 3). An obvious erosional surface separates phases 1 and 2 from phase 3. The last deposit in the cave consists of stalactites and plastic clayey sediment (phase 4).

3. Methods and material

3.1. Dating strategy

To constrain the fossil deposition within Coc Muoi cave two sediment samples for luminescence dating (VCOCMU5 and 6) were collected from two areas of the cave within the unconsolidated breccia sediment that is capped by an overlying flowstone. One was sampled from directly below the capping flowstone by the south cave wall (VCOCMU5) and the other from the opposite cave wall at