Quaternary International xxx (2015) 1–18

Contents lists available at ScienceDirect

Quaternary International

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

Subsistence strategies and environment in Late Pleistocene–Early Holocene Eastern Java: Evidence from Braholo Cave

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Southeast Asia
Subsistence
Pleistocene–Holocene transition
Zooarchaeology
Java

ABSTRACT

The climatic shifts during the Pleistocene–Holocene transition in Island Southeast Asia resulted in dramatic changes in landscape configurations which are presumed to have had greatly impacted vertebrate community composition and in turn human subsistence economies. Zooarcheological investigations in the region have provided information on how ancient foraging communities responded to these changes. However the complete picture remains to be elucidated. In this paper we present preliminary results of an ongoing analysis of faunal remains recovered from Braholo Cave in Eastern Java. We observed an overwhelming predominance of arboreal and semi-arboreal fauna, most notably the Javan langur, in the Late Pleistocene and Early-Mid Holocene deposits of the cave. In contrast earlier cave deposits were dominated by animal taxa generally associated with open environments such as bovids and cervids. This reflects forest expansion at the onset of the Holocene, albeit it also suggests deliberate targeting of specific taxa. The wide range of terrestrial, arboreal and aquatic species from various ecological niches suggests that the humans that inhabited the site subsisted on a mosaic of environments. It also hints on their intimate knowledge of these environments and the presence of different hunting technologies. Zooarchaeological parameters such as mortality profiles and body part representation allowed us to describe certain aspects of these hunting technologies. Our results provide unique insights on subsistence strategies of prehistoric foraging communities and the environment they encountered in Java during a key period in human history.

1. Introduction

The transition from the Late Pleistocene to the Holocene, which was accompanied by significant climatic fluctuations and drastic sea level changes, is a suitable period to study the relationships between environmental changes and human ecological and behavioral adaptations. Perhaps one of the most dramatic landscape changes during the period was the inundation of the Sunda Shelf which resulted in the modern configuration of Island Southeast Asia (ISEA). At height of the Last Glacial Maximum (LGM), with the sea level approximately 116 m lower than today, the islands of Bali, Java, Sumatra and Borneo were linked to mainland Southeast Asia forming a massive equatorial continent that covered an area of approximately 1.8×10^6 km^2 (Verstappen, 1975; Fairbanks, 1989; Hanebuth et al., 2000; Voris, 2000). The changes in the environments and local climatic patterns consequent of the flooding of the Sunda shelf would have been felt most significantly in the resulting islands in Southeast Asia, especially with regard to the flooding of the coasts and the subsequent changes in rainfall and wind patterns.

Numerous studies, including sedimentological, limnological and palynological analyses (e.g. van der Kaars and Dam, 1995; van der Kaars et al., 2001; Sémah et al., 2004a,b; Sémah and Sémah, 2012) have elucidated how the onset of Holocene in ISEA coincided with a change to a more humid climatic condition and the development of a closed rainforest vegetation type. Interestingly there is an abundance of archaeological evidences in ISEA dating to

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http://dx.doi.org/10.1016/j.quaint.2015.09.072
1040-6182/

this period, perhaps indicative of an intensification in the occupation of sites or an increase in human population size (Sémah et al., 2004b; Simanjuntak and Asikin, 2004; Barker, 2005; Barker et al., 2007; Lewis et al., 2008; Rabett, 2012; Pawlik et al., 2014). The most common archaeological evidence is faunal remains (e.g. Piper et al., 2008, 2011; Piper and Rabett, 2009, 2014). Animal remains from Late Pleistocene-Early Holocene sites in ISEA provide not only direct information on human subsistence economies but can also be used as additional proxy evidence for paleoenvironmental reconstruction.

Studies of faunal assemblages from archaeological sites in ISEA have a long history starting with paleontological research in Trinil (e.g. Dubois, 1891, 1907). Several studies have detailed the faunal succession sequences in the islands and how they had been influenced by climatic and environmental changes, including detailed analyses of migration routes and patterns of regional endemism (e.g. Badoux, 1959; van den Brink, 1982; de Vos, 1983; Sondaar, 1984; de Vos and Sondaar, 1994; van den Bergh et al., 1996, 2001; Westaway et al., 2007; Morwood et al., 2008).

During the past decade there has been a burgeoning research in the region looking at faunal remains to provide information on changes in human behavior during the Pleistocene–Holocene transition, including changes in their subsistence economies, strategies employed to exploit animal resources and the cultural perceptions of these resources (e.g. Barker, 2005; Barker et al., 2007, 2009; O'Connor, 2007; Morwood et al., 2008; Piper et al., 2008; Barton et al., 2009; Piper and Rabett, 2009; O'Connor et al., 2011; Ingicco, 2012; Pawlik et al., 2014). The resulting picture, which is proving to be rather complex, suggests that one has to be cautious in giving generalized, sweeping interpretations of the foraging behaviors of early hunter gatherer communities. The zooarchaeological studies conducted in the Niah Caves in Borneo (Barker et al., 2007; Piper et al., 2008; Piper and Rabett, 2009) and Song Gupuh (Morwood et al., 2008) and Song Terus (Sémah et al., 2004b; Ingicco, 2012) in Eastern Java for example showed how human foraging behavior is adapted to take full advantage of specific local environmental conditions. These results highlight the importance of conducting more research aimed at looking at the regional variability in the resource importance of different animal taxa. Any new research on the topic will add to the knowledge of the diverse ways that hunter gatherer groups adapted to the changes in the environment during the onset of the Holocene in Island Southeast Asia.

In this paper, we present the preliminary results of an ongoing research on the faunal remains of Braholo Cave in Eastern Java. Braholo Cave offers a deep temporal dataset and a huge faunal assemblage that allows for the study of the interactions of past human and animal populations. The current study focuses on the enumeration and description of the taxa present in the assemblage and the discussion of their implications on the paleoenvironment of Eastern Java and the foraging behaviors of the people that lived in the site during the Late Pleistocene and Early to Mid-Holocene.

2. Archaeological background

Braholo Cave is located on the western part of the Gunung Sewu ('Thousand Mountains') region of Central Java in the regency of Gunung Kidul close to the village of Semugih at 8° 4′ 52.1″ S, 110° 45′ 18.5″ E (Fig. 1). Braholo is a local term meaning 'statue' based on beliefs that statues are to be found inside the cave (Simanjuntak, 2002). The cave is on the western slope of a ca. 45 m high limestone hill, 15 m above the modern village road. It has a 35 m wide and 15 m high northwest entrance, a high, domed ceiling reaching ca. 12 m and a floor area of ca. 600 m^2. The cave is orientated along a northeast–southwest axis and the eastern and the southern areas of the cave floor are covered with huge boulders and debris from roof falls as well as some stalagmites.

The local area, situated on the fringe of the Wonosari plateau (ca. 5 km East) around 13 km away from the present-day southern Javanese coast, is dominated by the hills of the Gunung Sewu and is currently covered by rice paddies, vegetable terraces, occasional swidden fields and secondary forests. Braholo is one of the thirty or so caves in the western Gunung Sewu region surveyed by the Pusat Penelitian Arkeologi Nasional (Indonesian Center for Archaeological Research) starting from 1995 (Simanjuntak, 2002; Simanjuntak and Asikin, 2004). It is approximately 30 km away from the group of caves of the eastern Gunung Sewu region, known for their rich and well-studied archaeological deposits, which includes Song Terus (Sémah et al., 2004b; Hameau et al., 2007), Goa Tabuhan (Simanjuntak, 2004), Song Gupuh (Morwood et al., 2008) and Song Keplek (Simanjuntak, 2001, 2002, 2004; Simanjuntak and Asikin, 2004; Forestier, 2007). The Gunung Sewu region is situated along the southern Javanese coast and current climatic conditions are strongly influenced by the Northeast and Southwest Monsoons. These produce a distinct dry season, which could be very arid, between May and September and a wet season from October to April with an average annual precipitation of 2230 mm (Haryono and Day, 2004). These conditions are quite different from those in Western Java where there is higher annual precipitation and a relatively longer wet season. Interestingly Braholo Cave is located in the westernmost part of the Gunung Sewu region at the border with Central Java. Currently, there exists a significant difference in vegetation cover between the western and eastern regions of Gunung Sewu, with the western region characterized by the predominance of secondary forests and the eastern region dominated by an open, dry vegetation type.

Excavations in Braholo Cave were undertaken between 1997 and 2001 (by Truman Simanjuntak) and these yielded archaeological deposits of more than 7 m deep. A total of 17 pits (9 2 × 2 m and 8 1 × 1 m pits) were opened during the excavations. The archaeological investigations were limited to the northwest region of the cave because of the huge limestone boulders and collapsed stalactites in the southern portion of the cave. The deepest squares (O8 and G6) reached a maximum depth of 7.3 m. The basal occupation layers were presumed to have not been reached since excavations in most squares were halted due of the presence of huge limestone boulders (Fig. 2).

A total of 17 radiocarbon dates mostly from charcoal anchor the stratigraphy of the site to a numerical chronology (Simanjuntak, 2002). For the purpose of this paper we will rely on these dates which ranged from 33,100 ± 1260 cal BP (burnt bone fragment from O8 found 7.2 m below the surface) to 3050 ± 100 cal BP (charcoal fragment from L8 recovered 64 cm below surface) (Simanjuntak, 2002).

Braholo Cave produced numerous archaeological materials ranging from polished stone adzes and pottery in the first 50 cm of deposits to more than 50,000 flakes and stone tool fragments from the lower stratigraphical levels. Most notable is the amount of faunal remains recovered from the site. A total of approximately 425,000 bone fragments were recovered. Most of the faunal remains were from squares O8, G8 and G7, all yielding more than 50,000 bone fragments. O8 alone yielded 75,520 fragments, representing 17.8% of the total vertebrate faunal assemblage from the site. Of these, approximately 30,000 bone fragments have been sorted and identified to taxon (by Rokus Due Awe). Artifacts traditionally associated with the Southeast Asian Neolithic (i.e. Bellwood, 1997, 2013) such as pottery, clay ornaments and quadrangular stone adzes and other polished stone tools were restricted to the first 30–50 cm deposit (Simanjuntak, 2002). A series of prehistoric burials truncated the lower sedimentary

Please cite this article in press as: Amano, N., et al., Subsistence strategies and environment in Late Pleistocene–Early Holocene Eastern Java: Evidence from Braholo Cave, Quaternary International (2015), http://dx.doi.org/10.1016/j.quaint.2015.09.072