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EDITORIAL
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Editorial: Early Human Colonization of Remote Indian Ocean Islands and Its Ecological Impacts

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Editorial on the Research Topic

Early Human Colonization of Remote Indian Ocean Islands and Its Ecological Impacts

The remote islands of the tropical Indian Ocean (Madagascar, Comoros, Mascarenes, Seychelles, Chagos, Maldives, Cocos, and Christmas Island) lie >250 km from continental shores. As a result, their systematic colonization required offshore seafaring that began 4,000 bp. Despite this capability, many islands remained uninhabited 500 years ago, and histories of habitation and environmental change upon others remain conspicuously uncertain among those of oceanic islands generally (Anderson et al., 2018a). Our topic considered the relationships of colonization timing and substantial ecological change. The conjunction of these highlights the fundamental issue of distinguishing natural from cultural causation in ancient sedimentary, ecological and taphonomic phenomena.

Insular distribution of commensal animals can elucidate sources of human migration. Rocha et al. used historical records and DNA from modern and museum samples to explore the distribution and dispersal patterns of house geckos. Their results demonstrate how animals can be used as proxies to identify possible pre-European migration routes. Thomson et al. found that black rats of historical age on Christmas Island were from Southeast Asia, while those on the Cocos Islands had widespread origins. Multiple and continuing introductions of rats and geckos, however, have obscured older patterns require additional research. Recurrent human colonization of Mauritius discussed by Seetah et al. showed how colonialism drove demographic and ecological processes of environmental degradation. Albert et al., compared historical vertebrate extinction between Mauritius and Reunion and found greater extinction on Reunion was associated with faster loss of lowland forest.

Most contributions focused upon Madagascar, where the age (or ages) of human colonization have profound implications for understanding trajectories of anthropogenic ecological change there, and for the timing of maritime migration and colonizing horizons elsewhere in the Indian Ocean. On the basis of archaeological evidence, human genetics and historical linguistics, habitation of Madagascar began around 1,400 bp with a predominantly Austronesian population of agriculturalists. In palaeoecological rainforest data extending to 3,000 bp in NW Madagascar, Reinhardt et al., found no evidence of cultural intervention before 1,350 bp (cf. Tofanelli et al.). Domic et al. showed that forest loss and megafaunal extinctions in SW Madagascar, 1,150–550 bp were associated with intensified burning that reflected a drying climate and pastoral activities. Hixon et al. dissected the pastoral impact with respect to introduced dogs that competed with endemic predators and were used in cultural hunting.

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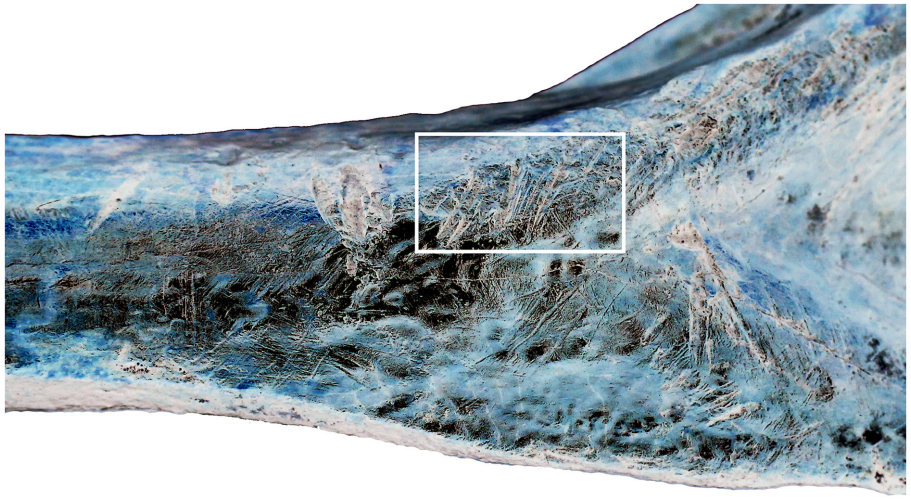

FIGURE 1 | OUM 14342A, *Palaeopropithecus ingens* distal humerus (L) adjusted in Adobe Photoshop to highlight areas with bone damage. Perez et al. (2005) "cut marks" enclosed by white rectangle, but note similar and extensive damage elsewhere that is probably non-cultural (Copyright Anderson and Clark).

An alternative scenario envisages early Holocene occupation of Madagascar by African foragers, as proposed by Godfrey et al., although they considered late Holocene megafaunal losses in the southwest to be drought-associated, and attributed the island-wide collapse of endemic vertebrates at 1,200–900 bp to the advent of agropastoralism. Possible areas of transient occupation in SW Madagascar, identified by remote sensing, were considered by Davis and Douglass as up to 3,000 years old, although they acknowledged the difficulty of identifying foraging in a scarcity of direct evidence (see also Reinhardt et al.). Madagascan colonization much earlier than 2,000 bp, was argued partly from landscape and ecological changes, but based most problematically upon radiocarbon-dated megafaunal bones exhibiting bone damage assumed as anthropogenic.

Potential cut-marks on *Aepyornis* (elephant bird) bones dated 10,000 bp (Hansford et al., 2018) were on facets almost inaccessible during articulation and it is unlikely that, after butchery, the bones were replaced in association as found. Moreover, the clearest marks cut through a surficial stain profile into cleaner bone beneath, indicating damage that could not have been perimortem and must have occurred much later. In this case, and others where local people were employed to excavate, their customary use of sharp implements was the most plausible explanation. Mitchell (2020) pointed to additional flaws in the ancient butchery hypothesis. In the largest systematic study of newly-excavated megafaunal bone in Madagascar, Anderson et al. (2018b) found abundant evidence of taphonomic damage by trampling, scavenging and other agencies but an extremely low incidence of possible butchery and no older than the late first millennium AD. Earlier analysis of Madagascan megafaunal samples (e.g., Perez et al., 2005) had seldom identified the full extent and variety of bone damage on specimens believed to be cut-marked (**Figure 1**). Better identification of bone-damage origins is an important problem in archaeology and paleontology and currently under technical review (e.g., Cifuentes-Alcobendas and Domíngez-Rodrigo, 2019).

Competing hypotheses of relatively early or late human colonization of islands, with premises based alternatively upon archaeological or palaeoenvironmental data, have arisen in the North Atlantic, Caribbean, and East Polynesia. Interdisciplinary research in those regions has substantially reduced chronological spans in dispute, and contributions included here form part of an analogous endeavor for the Indian Ocean.

AUTHOR CONTRIBUTIONS

AA conceived and led this publication. GC, SH, GL, and KS provided intellectual contributions and reviewed the manuscript. All authors approved it for publication.

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