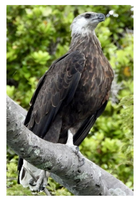

SUBFOSSIL BIRDS AT VINTANY CAVE: A KEY TO UNDERSTANDING THE PAST ECOLOGY AND RECENT HISTORY OF TSIMANAMPESOTSE NATIONAL PARK

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INTRODUCTION

Madagascar, an island renowned for its rich biodiversity, is home to an impressive variety of bird species. The island's Quaternary subfossil sites have yielded the remains of birds that bear testimony to an even richer avifauna during the recent past (Figure 1). These species are also excellent indicators of past habitats, due to habitat-specific adaptations (Behrensmeyer et al., 2003; Carrera et al., 2021). We studied the subfossil avifauna from Vintany Cave at Tsimanampesotse, SW Madagascar, to reconstruct the habitats of this region prior to human population expansion. The bird fossils were found in deposits alongside remains of other vertebrate species including large-bodied frugivorous lemurs, browsing elephant birds, and carnivorans such as *Fossa fossana* and *Cryptoprocta spelea*, the latter an extinct euplerid that preyed on large-bodied lemurs such as *Pachylemur* and *Megaladapis*. Radiocarbon dates establish an age range between 2000 and 3000 yr BP.

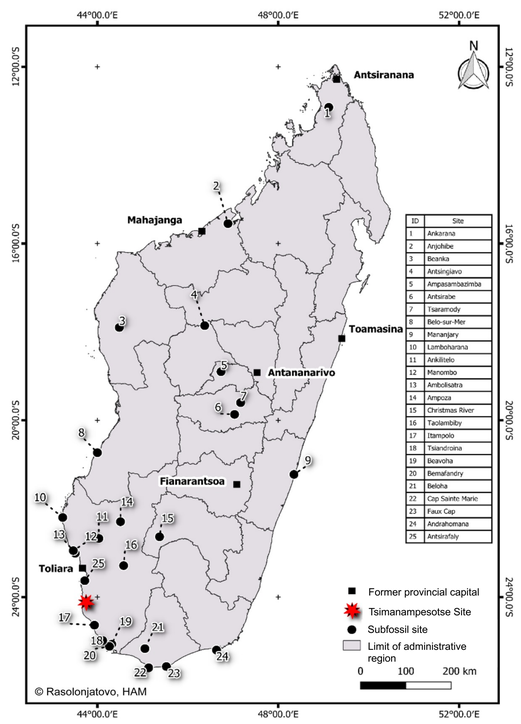

Figure 1. Subfossil bird sites in Madagascar

METHODS

We used Ascending Hierarchical Classification (AHC) cluster analysis to compare the ecological attributes of 35 subfossil bird species from Vintany to those of modern birds from 27 protected-area avifaunal communities across Madagascar (Rasolonjatovo et al., 2021).

RESULTS

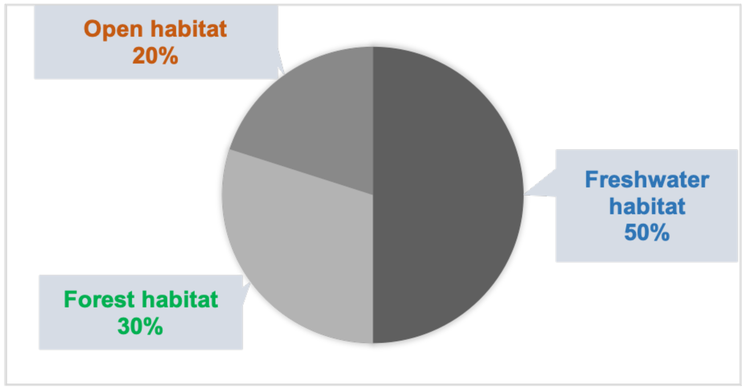

Figure 2. Ecological distribution of extinct and extant species found at Vintany cave, Tsimanampesotse region

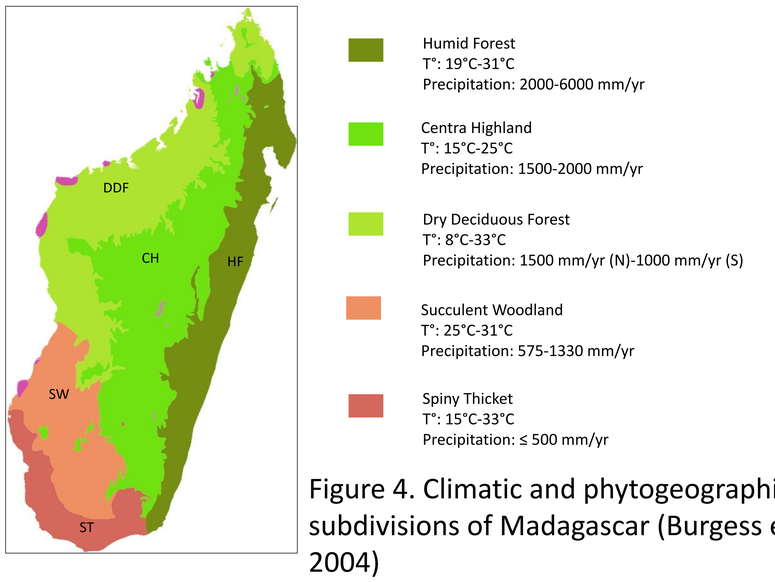

Figure 4. Climatic and phytogeographical subdivisions of Madagascar (Burgess et al., 2004)

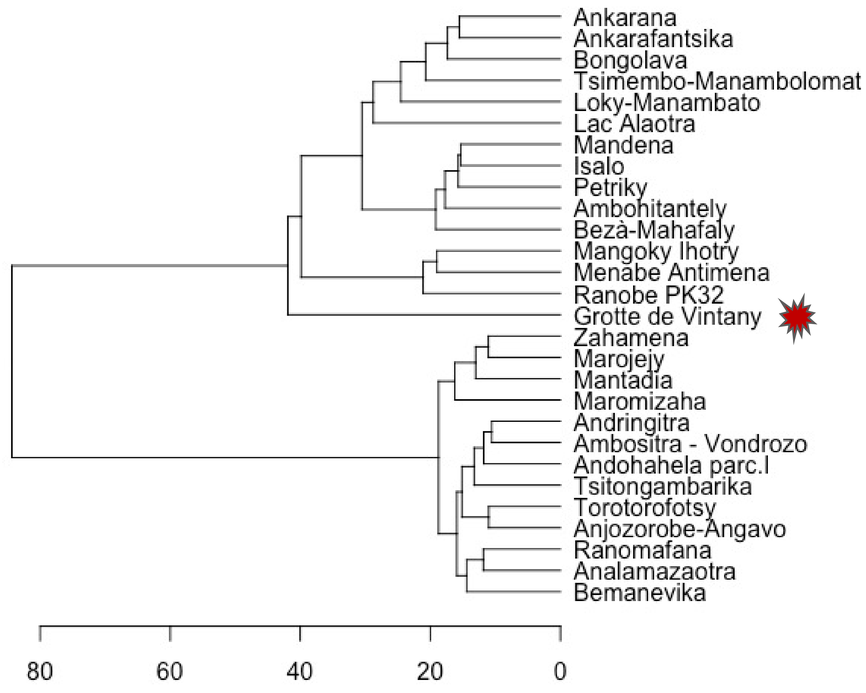

Figure 3. **Ascending hierarchical classification (AHC)** cluster analysis of the subfossil avifauna of Vintany cave and 27 modern protected areas.

DISCUSSION

- Our paleoecological analysis shows that a variety of habitats existed at Tsimanampesotse between 2,000 and 3,000 years ago. Our floristic reconstruction has implications for the availability of fresh water, prior to the salinization of Lake Tsimanampesotse (likely ~1,600 years ago) on the coastal plain.
- Open canopy forest existed along the coastal plain, supported by soil able to retain water, and fed by groundwater flowing from the Mahafaly plateau into the ocean. Open habitat accommodated some bird species, as did a large, freshwater lake (where today a brackish water wetland exists). On the plateau, the vegetation was similar to that of today, with xeric thickets and bushes, and emergent trees at the entrances to the humid caves.
- Aquatic birds, especially *Haliaeetus vociferoides* (the Malagascar fish eagle), required clear, fresh water to locate their fish prey from the tops of branches. We know, therefore, that the now-saline lake was bordered by riparian forests, and that, only a couple of thousand years ago, Lake Tsimanampesotse supported fish, today replaced by shrimp.
- Our Ascending Hierarchical Classification cluster analysis demonstrates that the subfossil bird community at Vintany resembles those that exist today in other parts of western Madagascar. The climate between 2000 and 3000 years ago was hot and dry, and all of the extant birds that lived 2000-3000 years ago at Tsimanampesotse occur today at two modern protected sites: Tsimembo-manambolomaty and Menabe-Antimena, where the presence of fresh water is critical to the birds' survival.

CONCLUSIONS

By studying the subfossil birds of Tsimanampesotse, we were able to reconstruct the diverse habitats that existed in the southwest over 2,000 years ago. It helps us to understand why the freshwater birds, large fruit-eating lemurs (especially *Pachylemur*), horned crocodiles, large mammalian carnivorans, elephant birds, and more, disappeared from this part of Madagascar.

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