

3D models related to the publication: An unpredicted ancient colonization of the West Indies by North American rodents: dental evidence of a geomorph from the early Oligocene of Puerto Rico

Laurent Marivaux^{1*}, Jorge Vélez-Juarbe², Pierre-Olivier Antoine¹

¹Laboratoire de Paléontologie, Institut des Sciences de l'Évolution de Montpellier (ISEM, UMR 5554, CNRS/UM/IRD/EPHE), c.c. 064, Université de Montpellier, place Eugène Bataillon, 34095 Montpellier Cedex 05, France

²Department of Mammalogy, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, CA 90007, USA

*Corresponding author: Laurent.Marivaux@UMontpellier.fr

Abstract

This contribution provides the raw files for the μ CT-scan data and renderings of the three-dimensional digital models of two fossil teeth of a geomyin geomorph rodent (*Caribeomys merzeraudi*), discovered from lower Oligocene deposits of Puerto Rico, San Sebastian Formation (locality LACM Loc. 8060). These fossils were described, figured and discussed in the following publication: Marivaux et al. (2021), An unpredicted ancient colonization of the West Indies by North American rodents: dental evidence of a geomorph from the early Oligocene of Puerto Rico. Papers in Palaeontology. <https://doi.org/10.1002/spp2.1388>

Keywords: Caribbean islands, Geomorpha, Paleobiogeography, Paleogene, Rodentia

Submitted:2021-05-28, published online:2021-07-16. <https://doi.org/10.18563/journal.m3.128>

INTRODUCTION

We present here the 3D digital models of two dental remains of a fossil rodent (Fig. 1; Table 1) that were recently unearthed in shallow marine Oligocene deposits (\sim 29.5 Ma; San Sebastian Formation) at locality LACM Loc. 8060, situated on the west bank of Río Guatemala, San Sebastián, Puerto Rico (Vélez-Juarbe et al., 2007, 2014; Vélez-Juarbe and Domning, 2014; Ortega-Ariza et al., 2015; Marivaux et al., 2020). These two specimens (a worn lower molar [LACM 162449; Fig. 1A-C] and a pristine deciduous lower premolar [LACM 162478; Fig. 1D-F]) have allowed the description of a new small-bodied geomyin geomorph (*Caribeomys merzeraudi* Marivaux et al., 2021). This discovery is the only evidence of the presence of this rodent group in the West Indies in the past. The same locality LACM Loc. 8060 had recently yielded dental remains of two distinct fossil species of chinchilloid caviomorphs of South American origin. The discovery of additional isolated teeth of a new rodent species documenting an ancient relative of North/Central American geomyoids (modern kangaroo rats, pocket mice, and pocket gophers; see e.g., Hafner, 1993; Korth, 1994; Hafner et al., 2007) reveals that the past Caribbean rodent diversity (at least during the Paleogene) also derived from North American source, and not exclusively from South America. These rodents (Geomyina and Chinchilloidea) from the early Oligocene of Puerto Rico are the oldest rodents to be found on the Caribbean archipelago thus far.

Caribeomys displays a suite of morphological specializations (e.g., very thick enamel layer, cuspids and stylids not well differentiated and interconnected) that makes this insular taxon distinct from known Paleogene mainland representatives of all

Inv nr. (model Id)

LACM162478(M3#712)

Description

Surface model of a right lower dp4

LACM162478(M3#714)

5 μ m μ CT data set

LACM162449(M3#713)

Surface model of a right lower molar (m1 or m2)

LACM162449(M3#715)

4.5 μ CT data set

Table 1. List of 3D surface and μ CT scans of *Caribeomys merzeraudi*. Collection: Natural History Museum of Los Angeles County (LACM), Los Angeles, USA

so far recognized Geomyina families (Heliscomyidae, Florentiomyidae, Heteromyidae, Geomyidae, and Geomyoidea *incertae sedis*; see e.g., Flynn et al., 2008). As such, the possibility exists that *Caribeomys* is the representative of a separate insular geomyin geomorph lineage (i.e., a distinct West Indian branch). Morphological comparisons indicate that this island lineage diverged for some time from its coeval mainland geomyin counterparts, and likely dispersed toward the West Indies long before its appearance in the Puerto Rican fossil record (during the late Eocene/earliest Oligocene interval). This unexpected rodent adds to the few cases of Antillean terrestrial vertebrates of North American origins. Without clear subaerial land connections between both landmasses, an overwater dispersal probably occurred to explain the mid-Paleogene colonization of the West Indies by geomorph rodents (see Marivaux et al., 2021).

METHODS

The LACM 162449 molar and LACM 162478 dp4 were scanned with a resolution of 4.5 μ m and 5 μ m, respectively, using a μ CT-scanning station EasyTom 150 / Rx Solutions (Montpellier RIO

Imaging, ISEM, Montpellier, France). AVIZO 7.1 (Visualization Sciences Group) software was used for visualization, segmentation, and three-dimensional (3D) rendering. The isolated teeth were prepared within a “labelfield” module of AVIZO, using the segmentation threshold selection tool. The 3D models are provided in “.ply” format, and thus can be opened with a wide range of softwares (e.g., MorphoDig 1.5.3., an open-source 3D freeware; Lebrun, 2018; <https://morphomuseum.com/morphodig>).

ACKNOWLEDGEMENTS

The 3D data presented in this work were produced through the technical facilities of the Montpellier RIO Imaging (MRI) platform (ISEM, Université de Montpellier) and of the LabEx CeMEB. We particularly thank Renaud Lebrun (ISEM, Université de Montpellier) for μ CT-scan acquisitions, treatments, and reconstructions. This research was supported by the French “Agence Nationale de la Recherche” (ANR) in the framework of the GAARAnti program (ANR-17-CE31-0009) and of the LabEx CEBA (ANR-10-LABX-25-01). ISEM publication n° 2021-035.

BIBLIOGRAPHY

Flynn, L. J., Lindsay, E. H., Martin, R. A., 2008. Geomorpha. In Janis, C. M., Gunnell, G. F., Uhen, M. D. (Eds), *Evolution of Tertiary Mammals of North America*. Cambridge: Cambridge University Press. pp. 428–455. <https://doi.org/10.1017/CBO9780511541438.027>

Hafner, J. C., 1993. Macroevolutionary diversification in heteromyid rodents: heterochrony and adaptation in phylogeny. In Genoways, H. H., Brown, J. H. (Eds), *Biology of the Heteromyidae*. The American Society of Mammalogists. pp. 291–318.

Hafner, J. C., Light, J. E., Hafner, D. J., Hafner, M. S., Reddington, E., Rogers, D. S., Riddle, B. R., 2007. Basal clades and molecular systematics of heteromyid rodents. *Journal of Mammalogy*, 88, 1129–1145. <https://doi.org/10.1644/06-MAMM-A-413R1.1>

Lebrun, R., 2018. MorphoDig, an open-source 3D freeware dedicated to biology. 5th International Paleontological Congress (IPC5) – *The Fossil Week*, July 9–13th, 2018 (Paris, France). Abstract volume, 399.

Marivaux, L., Vélez-Juarbe, J., Merzeraud, G., Pujos, F., Viñola López, L. W., Boivin, M., Santos-Mercado, H., Cruz, E. J., Grajales, A., Padilla, J., Vélez-Rosado, K. I., Philippon, M., Léticée, J.-L., Münch, P., Antoine, P.-O., 2020. Early Oligocene chinchilloid caviomorphs from Puerto Rico and the initial rodent colonization of the West Indies. *Proceedings of the Royal Society B* 287, 20192806. <https://doi.org/10.1098/rspb.2019.2806>

Marivaux, L., Vélez-Juarbe, J., Viñola López, L.W., Fabre, P.-H., Pujos, F., Santos-Mercado, H., Cruz, E.J., Grajales Pérez, A. M., Padilla, J., Vélez-Rosado, K.I., Cornée, J.-J., Philippon, M., Münch, P., Antoine, P.-O., 2021. An unpredicted ancient

colonization of the West Indies by North American rodents: dental evidence of a geomorph from the early Oligocene of Puerto Rico. *Papers in Palaeontology*, in press. <https://doi.org/10.1002/spp2.1388>

Ortega-Ariza, D., Franseen, E. K., Santos-Mercado, H., Ramirez, W. R., Core-Suarez, E. E., 2015. Strontium isotope stratigraphy for Oligocene-Miocene carbonate systems in Puerto Rico and the Dominican Republic: implications for Caribbean processes affecting depositional history. *The Journal of Geology* 123, 539–560. <https://doi.org/10.1086/683335>

Vélez-Juarbe, J., Domning, D. P., 2014. Fossil Sirenia of the West Atlantic and Caribbean region: X. *Priscosiren atlantica*, gen. et sp. nov. *Journal of Vertebrate Paleontology* 34, 951–964. <https://doi.org/10.1080/02724634.2013.815192>

Vélez-Juarbe, J., Brochu, C. A., Santos, H., 2007. A gharial from the Oligocene of Puerto Rico: transoceanic dispersal in the history of a non-marine reptile. *Proceedings of the Royal Society B* 274, 1245–1254. <https://doi.org/10.1098/rspb.2006.0455>

Vélez-Juarbe, J., Martin, T., MacPhee, R. D. E., Ortega-Ariza, D., 2014. The earliest Caribbean rodents: Oligocene caviomorphs from Puerto Rico. *Journal of Vertebrate Paleontology* 34, 157–163. <https://doi.org/10.1080/02724634.2013.789039>

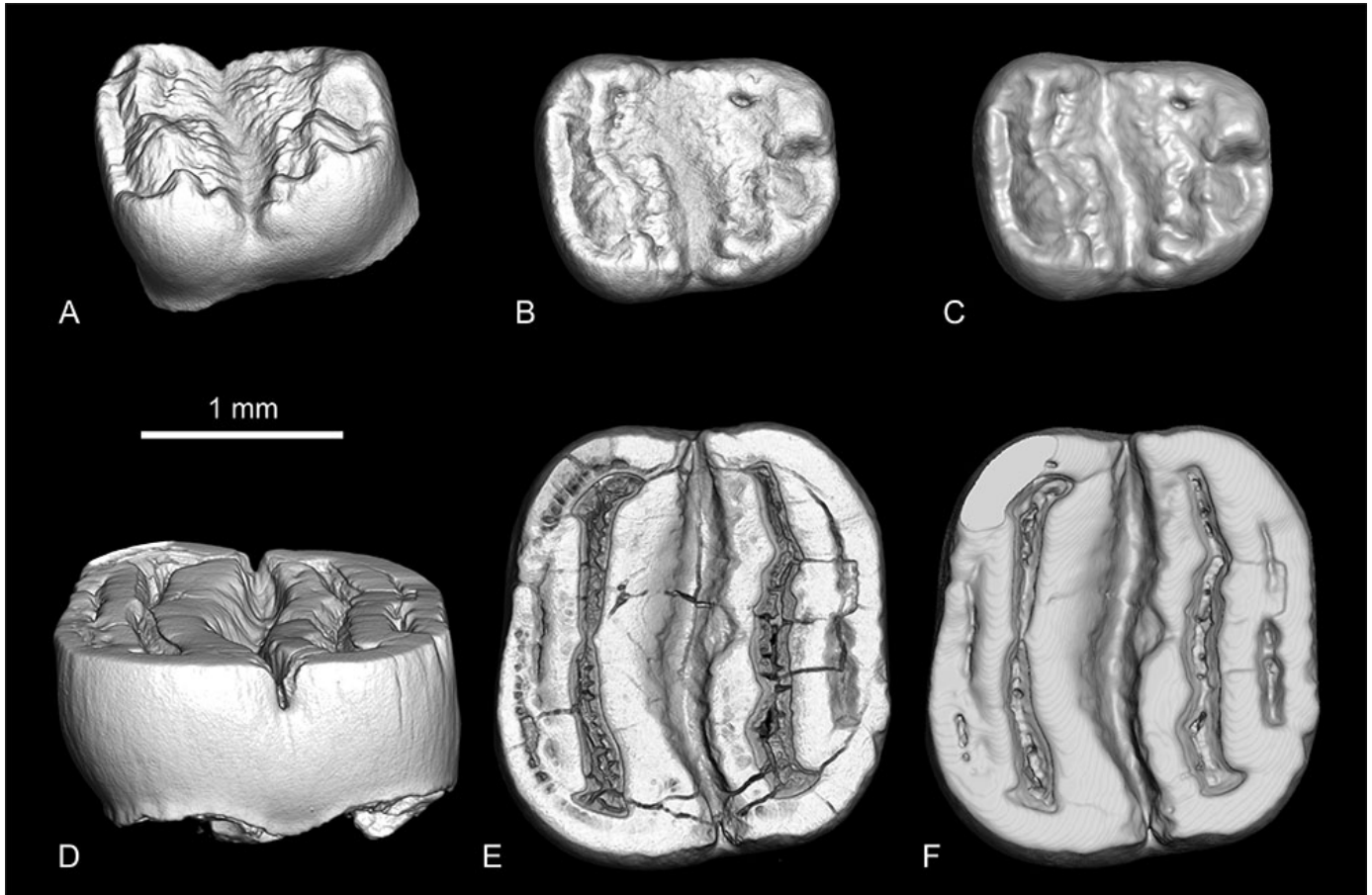


Figure 1. Fossil dental specimens of *Caribeomys merzeraudi* from the late Early Oligocene of Puerto Rico (San Sebastian Formation). A-C) LACM 162478, right lower dp4 in buccal (A) and occlusal (B-C) views; D-F) LACM 162449, right lower molar (m1 or m2) in buccal (D) and occlusal (E-F) views. Images are renderings of 3D digital models of the fossil specimens, obtained by X-ray micro-computed (μ CT) surface reconstructions (A-B and D-E are volume renderings of μ CT-scan data; C and F are renderings of segmented surfaces)