Dataset

# 3D models of fossil specimens related to the publication: Inferring the locomotor ecology of two of the oldest fossil squirrels: influence of operationalisation, trait, body size, and machine learning method

Jan Wölfer[1]*, Lionel Hautier[2]

[1] *Humboldt-Universität zu Berlin, Philippstraße 13, 10115 Berlin*
[2] *Institut des Sciences de l'Évolution de Montpellier, UMR 5554, Univ de Montpellier, CNRS, IRD, Montpellier Cedex 5, France*
***Corresponding author**: jan.woelfer@gmx.de

**Abstract**
This 3D Dataset includes the 3D models analysed in Wölfer J & Hautier L. 2024 Inferring the locomotor ecology of two of the oldest fossil squirrels: influence of operationalisation, trait, body size, and machine learning method. Proceedings of the Royal Society B. https://doi.org/10.1098/rspb.2024-0743

**Keywords:** femur, geometric morphometrics, *Palaeosciurus*, rodents, Sciuridae

Submitted: 19/09/2024, published online: 09/10/2024. https://doi.org/10.18563/journal.m3.246

| Inv nr. | Taxon | Description | Collection |
|---|---|---|---|
| MGB125 | *Palaeosciurus goti* | Left femur | ISEM, Montpellier |
| GER291 | *Palaeosciurus feignouxi* | Right femur | MNHT |
| GER293 | *Palaeosciurus feignouxi* | Right femur | MNHT |
| GER294 | *Palaeosciurus feignouxi* | Right femur | MNHT |
| GER296 | *Palaeosciurus feignouxi* | Left femur | MNHT |
| GER298 | *Palaeosciurus feignouxi* | Left femur | MNHT |
| GER299 | *Palaeosciurus feignouxi* | Left femur | MNHT |

**Table 1.** List of models. ISEM: Université de Montpellier, Institut des Sciences de l'Evolution, Montpellier, France; MNHT: Muséum d'Histoire Naturelle, Toulouse, France.

## INTRODUCTION

Here, we present the 3D models generated from the femora of the two fossil squirrel species, *Palaeosciurus feignouxi* (six specimens) and *P. goti* (one specimen) (Fig. 1). These fossils were used to infer the locomotor behavior of these species based on their femoral morphology (Wölfer and Hautier, 2024). To accomplish this, we first tested various machine learning methods on the ecomorphological data sampled from 180 species of squirrel-related rodents (Sciuromorpha). We found that *P. goti* was most likely arboreal, based on a single specimen for now. *P. feignouxi*, on the other hand, was more likely terrestrial.

## METHODS

Seven femora of two extinct species were studied: one femur of *Palaeosciurus goti* (one specimen) from the French Quercy locality of Mas de Got (lower Oligocene) and six femora of *P. feignouxi* (six specimens) from the French locality of Saint-Gérand-le-Puy (lower Miocene) (Table 1, Fig. 1). The femora were µCT scanned at Montpellier Ressources Imagerie (MRI) platform to obtain the surface information. Some of the fossil specimens were slightly damaged. Easily adjustable superficial defects were fixed in Amira Version 6.0.0. (FEI Visualization Sciences Group, Berlin, Germany) during segmentation, but defects that were considered too ambiguous to be reconstructed by eye were accounted for in a later step during the geometric morphometric analysis and, thus, these defects are still present in the scans that were published here. After segmentation, surface scans were generated in Amira and exported to Geomagic Studio 2013.0.2 (3D Systems, Rock Hill, South Carolina, USA) to remove minor surface irregularities. The *Palaeosciurus goti* specimen had its femoral head and neck glued to the femoral body (Fig. 2), resulting in an artificial offset. The glue was easily identifiable in the µCT scan due to its low density. Both femoral parts were segmented separately in Amira and reassembled in Geomagic, which we also used to reconstruct a missing part of the neck (Fig. 2).

## ACKNOWLEDGEMENTS

We thank A-L. Charruault and M. Mouana (UM) and Y. Laurent (Muséum d'Histoire Naturelle de Toulouse) for specimen access, R. Lebrun for assistance with scanning procedures. Three-dimensional data acquisition of fossil specimens was performed using the microcomputed tomography (µCT) facilities of the MRI platform member of the national infrastructure France-BioImaging supported by the French Agence Nationale de la Recherche (Grant ANR-10-INBS-04, "Investissements d'Avenir"), and those of the Laboratoire d'Excellence (LabEx) Centre Méditerranéen de l'Environnement et de la Biodiversité (LabEx CeMEB, ANR10-LABX-0004). Monique Vianey-Liaud provided valuable feedback on the manuscript, for which we are very grateful. We are also grateful to John A. Nyakatura and Léo Botton-Divet for helpful discussions. Finally, we appreciate the very helpful comments provided by two anonymous reviewers.

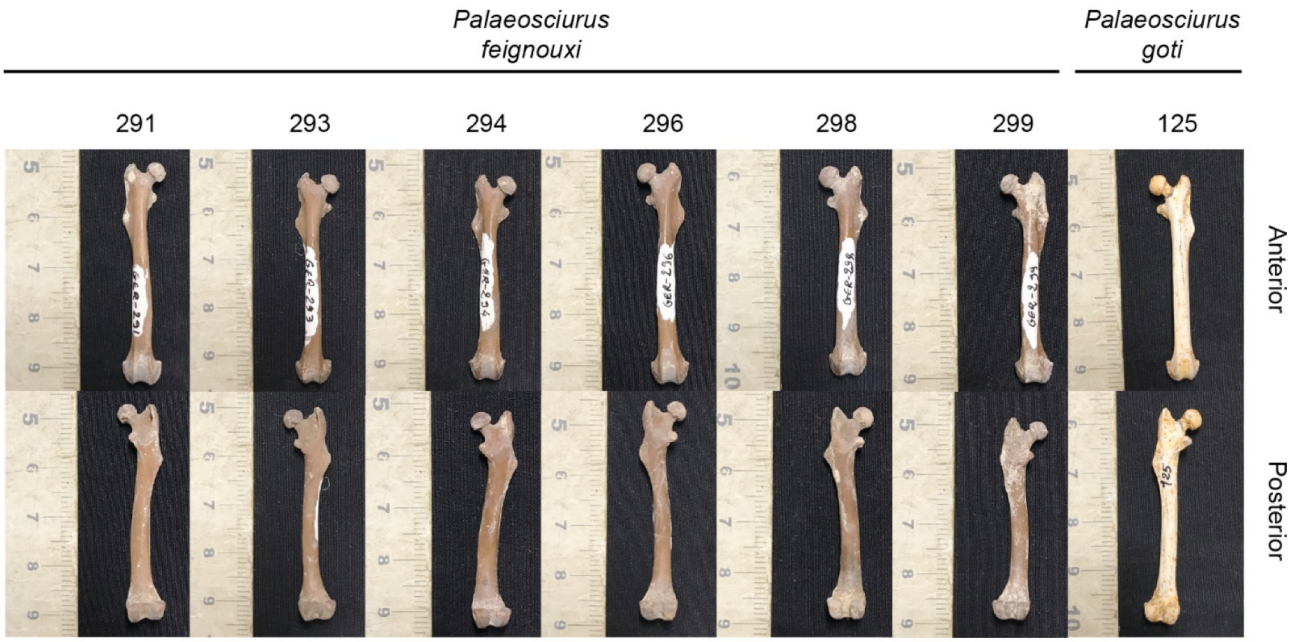


**Figure 1.** Specimens of *Palaeosciurus* analysed in this study. Upper row: anterior view. Lower row: posterior view.

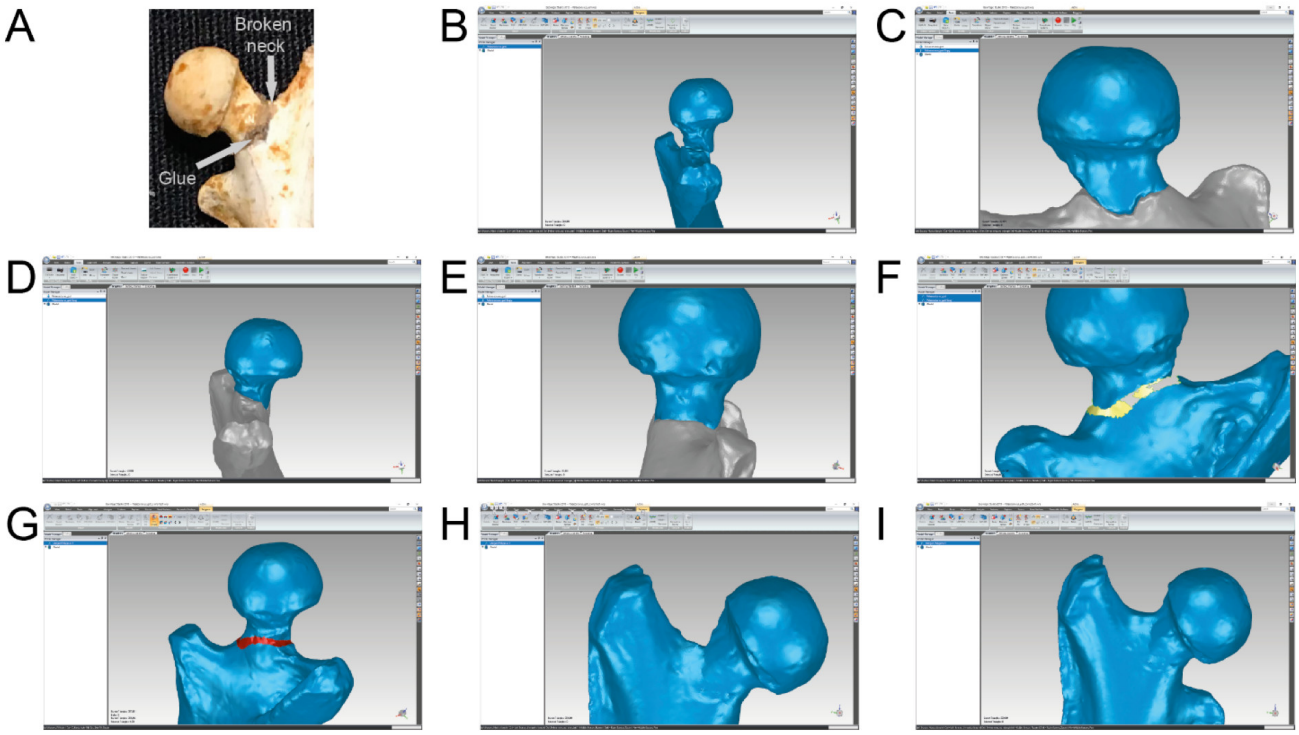


**Figure 2.** Surface scan correction of the neck region of *Palaeosciurus goti* in Geomagic. A) Photo of the specimen showing the glued neck region. B) Geomagic perspective showing the disposition of the head relative to the body of the femur. The head and body were previously exported from Amira as separate surface scans without the glue. C-E) Different perspectives after translating and rotating the head into position to close the gap. F) Removing the edges of the two scans. G) Fusion of the two scans. H) Perspective showing the fractured anterior region of the neck. I) Reconstruction of the neck.


ISSN: 2274-0422

This work was supported by grants from the German Research Council (DFG EXC 1027), the Centre National de la Recherche Scientifique (CNRS), and the Agence Nationale de la Recherche (DispaRat, ANR-20-CE02-0022-01).

## BIBLIOGRAPHY

Wölfer J., Hautier L. 2024. Inferring the locomotor ecology of two of the oldest fossil squirrels: influence of operationalisation, trait, body size, and machine learning method. Proceedings of the Royal Society B. https://doi.org/10.1098/rspb.2024-0743

 ISSN: 2274-0422