

# 1 Semicircular canal morphology of the Miocene small-bodied catarrhine

## 2 *Pliobates cataloniae*: Phylogenetic implications

3 Alessandro Urciuoli<sup>1</sup>, Clément Zanolli<sup>2</sup>, Florian Bouchet<sup>1</sup>, Sergio Almécija<sup>3,4,1</sup>, Salvador Moyà-Solà<sup>1,5,6</sup>,  
4 David M. Alba<sup>1</sup>

5 <sup>1</sup>Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona

6 <sup>2</sup>PACEA, UMR 5199 CNRS, MCC, Université de Bordeaux

7 <sup>3</sup>Division of Anthropology, American Museum of Natural History

8 <sup>4</sup>New York Consortium in Evolutionary Primatology (NYCEP)

9 <sup>5</sup>Institució Catalana de Recerca i Estudis Avançats (ICREA)

10 <sup>6</sup>Unitat d'Antropologia Biològica, Departament de Biologia Animal, Biologia Vegetal i  
11 Ecologia, Universitat Autònoma de Barcelona

12

### 13 Abstract

14 Phylogenetic hypotheses about the Miocene small-bodied catarrhine *Pliobates cataloniae*  
15 (11.6 Ma, NE Iberian Peninsula) consider it a stem hominoid, a pliopithecoid, or a  
16 dendropithecoid. Given the phylogenetic signal carried by semicircular canals, we compared  
17 their morphology in *Pliobates* with that of extant and fossil anthropoids using deformation-  
18 based 3D geometric morphometrics. We investigated patterns of shape variation using  
19 phylogenetically aligned component analysis, computed typicality probabilities of group  
20 membership (for platyrrhines, cercopithecoids, hylobatids, and hominids), and modeled  
21 semicircular canal evolution using a phylomorphospace approach. We also assessed the  
22 phylogenetic position of *Pliobates* against previously identified synapomorphies for  
23 anthropoid clades and used cladistic indices to test among several competing phylogenetic  
24 hypotheses. Our analyses indicate that *Pliobates* displays close morphological similarities to  
25 platyrrhines and pliopithecoids (*Epipliopithecus*). They further render the stem hominoid  
26 hypothesis much less parsimonious than considering *Pliobates* a stem catarrhine, thereby  
27 hinting at an independent acquisition of its ape-like locomotor adaptations. However, the  
28 shorter common cranium of *Pliobates* supports a more derived status than that of pliopithecoids  
29 and older African catarrhines (*Aegyptopithecus* and *Saadanius*). This suggests that the  
30 ossified ectotympanic of *Saadanius* may be homoplastic relative to that of crown catarrhines  
31 and that *Pliobates* may belong to a stem catarrhine clade other than pliopithecoids. The  
32 latter hypothesis would be consistent with the dental similarities between *Pliobates* and  
33 African dendropithecids, which are frequently considered stem catarrhines but whose inner  
34 ear is unknown. The inclusion of semicircular canal characters in future cladistic analyses  
35 will hopefully help to clarify the phylogenetic relationships of *Pliobates*.

36

### 37 Funding Citation

38 Funded by: MCIN/AEI (PID2020-116908GB-I00, PID2020-117289GB-I00), Generalitat de  
39 Catalunya (CERCA Programme and 2017 SGR 086 and 2017 SGR 116), MCIN (PRE2018-  
40 083299), French CNRS. Data: Morphosource, UMich, ESFR, AMIS-UMR5288, KNM.