Online Resource 1:

New evidence from the bony labyrinth and teeth of the Late Miocene ape *Oreopithecus*, based on a partial cranium from Baccinello

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Supplementary figures

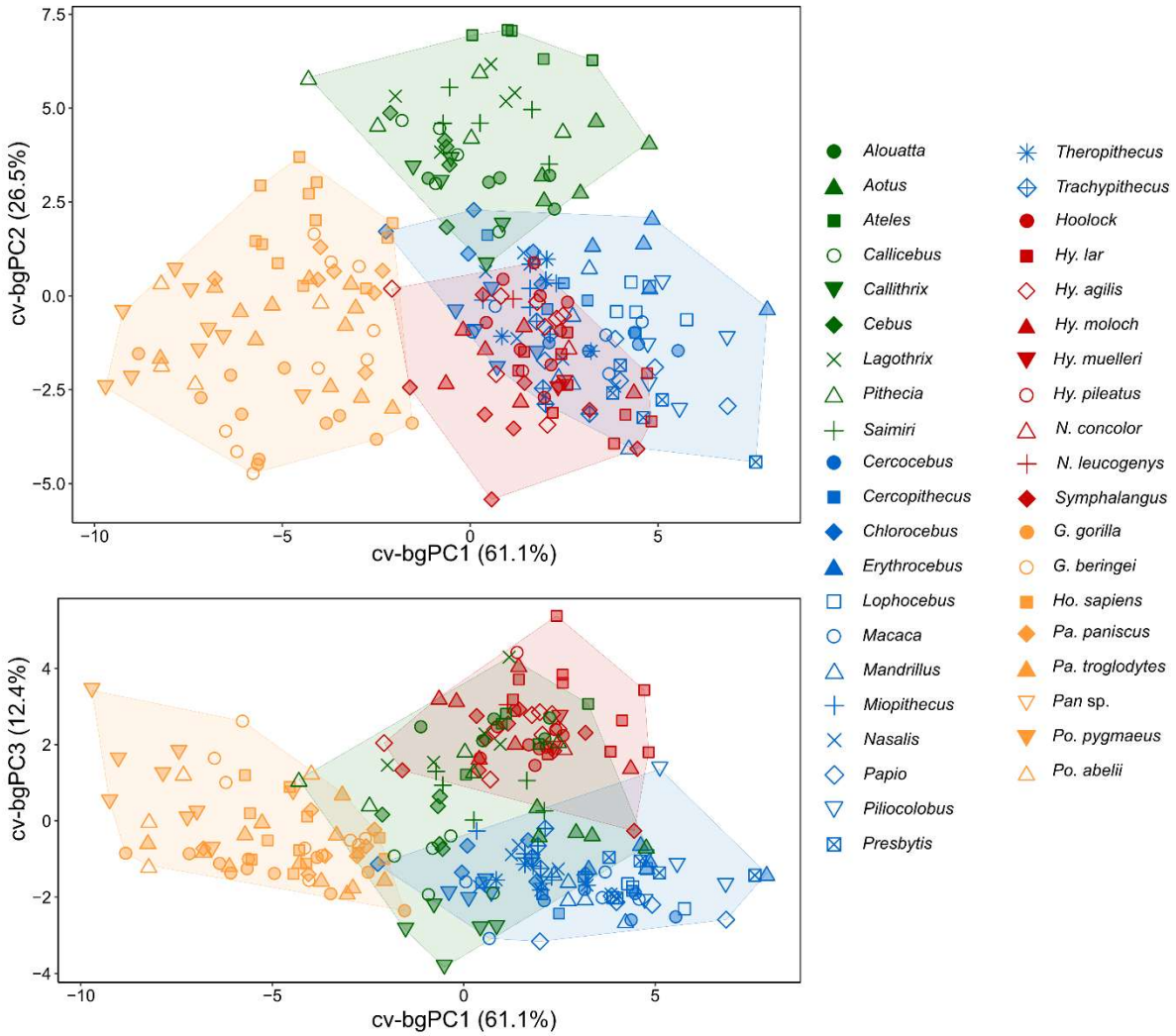

Fig. S1 Bivariate plots of cv-bgPCA scores: **a.** cv-bgPC2 vs. cv-bgPC1; **b.** cv-bgPC3 vs bgPC1. The differences relative to the bgPCA without cross-validation (Fig. 2) are negligible, thus excluding the presence of spurious group discrimination

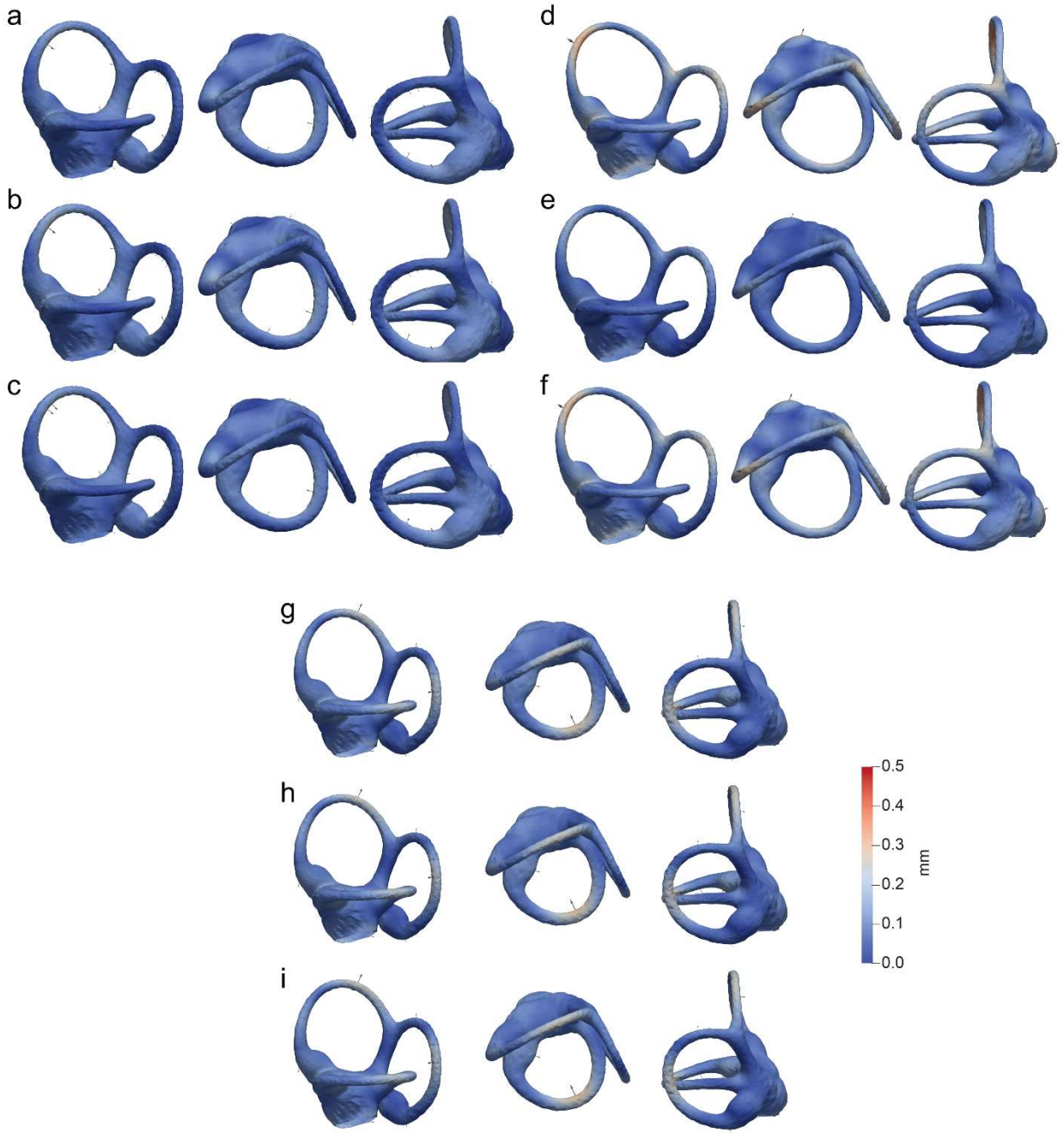

Fig. S2 Rendered three-dimensional models of the reconstructed semicircular canal and vestibule shape for selected last common ancestors (LCAs): **a–c.** crown hominoid LCA; **d–f.** crown hylobatid LCA; **g–i.** pliopithecoid LCA. The LCAs were estimated under different phylogenetic hypotheses for *Oreopithecus*: pliopithecoid stem catarrhine (**a, d, g**); stem hylobatid (**b, e, h**); nyanzapithecid stem hominoid (**c, f, i**). The models in each panel are depicted in lateral (left), superior (middle), and posterior (right) views

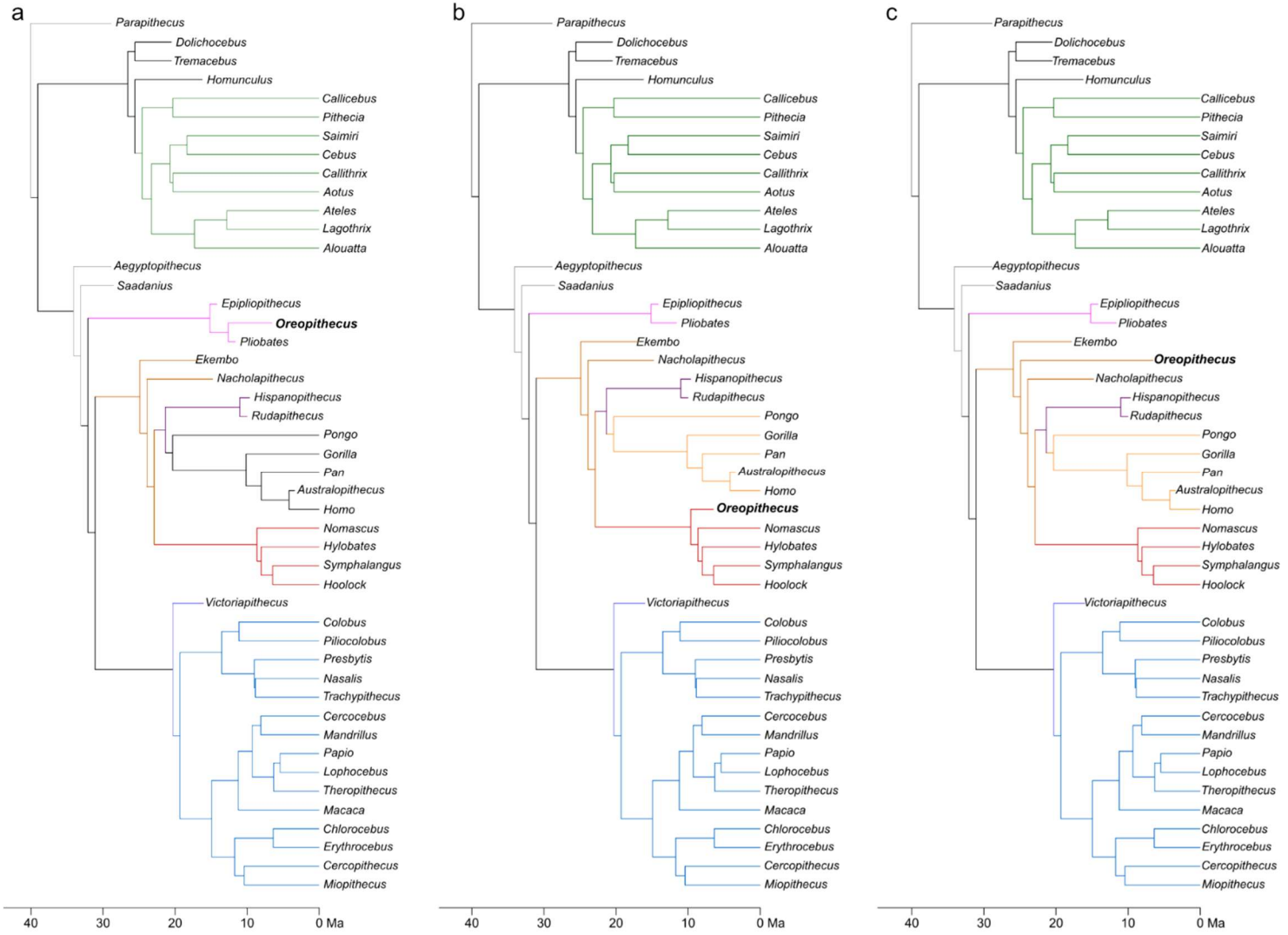

Fig. S3 The three phylogenetic trees used to compute the phylomorphospace (Fig. 3), corresponding to the three main phylogenetic hypotheses discussed in this study: **a.** *Oreopithecus* as a pliopithecoid stem catarrhine; **b.** *Oreopithecus* as a stem hylobatid; **c.** *Oreopithecus* as a nyanzapithecid stem hominoid

Table S1 List of extant anthropoid µCT scans of dried crania and temporal bones included as comparative sample

Species	Catalog No.	Scan source/facility	Voxel size (mm)	DOI/ark	References
Alouatta palliata	DU-EA-LP02	MorphoSource	0.06	10.17602/M2/M6439	Urciuoli et al. (2020, 2021a, 2021b)
Alouatta palliata	DU-EA-LP04	MorphoSource	0.05	10.17602/M2/M3748	Urciuoli et al. (2020, 2021a, 2021b)
Alouatta palliata	DU-EA-LP06	MorphoSource	0.07	10.17602/M2/M5635	Urciuoli et al. (2020, 2021a, 2021b)
Alouatta palliata	DU-EA-LP10	MorphoSource	0.05	10.17602/M2/M3785	Urciuoli et al. (2020, 2021a, 2021b)
Alouatta palliata	DU-EA-LP12	MorphoSource	0.06	10.17602/M2/M5628	Urciuoli et al. (2020, 2021a, 2021b)
Aotus trivirgatus	MCZ-19801	MorphoSource	0.04	10.17602/M2/M2870	Urciuoli et al. (2021b)
Aotus trivirgatus	MCZ-19802	MorphoSource	0.04	10.17602/M2/M2871	Urciuoli et al. (2021b)
Aotus trivirgatus	MCZ-19805	MorphoSource	0.04	10.17602/M2/M2872	Urciuoli et al. (2021b)
Aotus trivirgatus	MCZ-27214	MorphoSource	0.04	10.17602/M2/M2874	Urciuoli et al. (2021b)
Aotus trivirgatus	MCZ-30562	MorphoSource	0.04	10.17602/M2/M2875	Urciuoli et al. (2021b)
Ateles geoffroyi	MCZ-10138	MorphoSource	0.06	10.17602/M2/M2917	Urciuoli et al. (2020, 2021a, 2021b)
Ateles geoffroyi	MCZ-29626	MorphoSource	0.06	10.17602/M2/M2918	Urciuoli et al. (2020, 2021a, 2021b)
Ateles geoffroyi	MCZ-29628	MorphoSource	0.06	10.17602/M2/M2919	Urciuoli et al. (2020, 2021a, 2021b)
Ateles geoffroyi	MCZ-29658	MorphoSource	0.06	10.17602/M2/M2920	Urciuoli et al. (2020, 2021a, 2021b)
Ateles geoffroyi	MCZ-BOM-5351	MorphoSource	0.06	10.17602/M2/M2889	Urciuoli et al. (2020, 2021a, 2021b)
Callithrix argentata	MCZ-30579	MorphoSource	0.04	10.17602/M2/M5192	Urciuoli et al. (2021b)
Callithrix argentata	MCZ-30580	MorphoSource	0.04	10.17602/M2/M5193	Urciuoli et al. (2021b)
Callithrix argentata	MCZ-30582	MorphoSource	0.04	10.17602/M2/M5194	Urciuoli et al. (2021b)
Callithrix argentata	MCZ-30583	MorphoSource	0.04	10.17602/M2/M5195	Urciuoli et al. (2021b)
Callithrix argentata	MCZ-32164	MorphoSource	0.04	10.17602/M2/M5196	Urciuoli et al. (2021b)
Callicebus moloch	MCZ-20186	MorphoSource	0.05	10.17602/M2/M5158	Urciuoli et al. (2021b)
Callicebus moloch	MCZ-20188	MorphoSource	0.05	10.17602/M2/M5159	Urciuoli et al. (2021b)
Callicebus moloch	MCZ-26922	MorphoSource	0.05	10.17602/M2/M5160	Urciuoli et al. (2021b)
Callicebus moloch	MCZ-30559	MorphoSource	0.05	10.17602/M2/M5161	Urciuoli et al. (2021b)
Callicebus moloch	MCZ-30564	MorphoSource	0.05	10.17602/M2/M5167	Urciuoli et al. (2021b)
Cebus apella	MCZ-49635	MorphoSource	0.06	10.17602/M2/M5208	Urciuoli et al. (2020, 2021a, 2021b)

Cebus apella	MCZ-27891	MorphoSource	0.06	10.17602/M2/M5213	Urciuoli et al. (2020, 2021a, 2021b)
Cebus apella	MCZ-31063	MorphoSource	0.07	10.17602/M2/M5218	Urciuoli et al. (2020, 2021a, 2021b)
Cebus apella	MCZ-37833	MorphoSource	0.06	10.17602/M2/M5219	Urciuoli et al. (2020, 2021a, 2021b)
Cebus apella	MCZ-41090	MorphoSource	0.05	10.17602/M2/M5220	Urciuoli et al. (2020, 2021a, 2021b)
Lagothrix lagotricha	DU-BAA-X	MorphoSource	0.06	87602/m4/M1867	Urciuoli et al. (2021b)
Lagothrix lagotricha	USNM-269839	MorphoSource	0.06	10.17602/M2/M10193	Urciuoli et al. (2021b)
Lagothrix lagotricha	USNM-194342	MorphoSource	0.06	10.17602/M2/M9717	Urciuoli et al. (2021b)
Lagothrix lagotricha	USNM-461930	MorphoSource	0.06	10.17602/M2/M10187	Urciuoli et al. (2021b)
Lagothrix lagotricha	USNM-461931	MorphoSource	0.06	10.17602/M2/M10188	Urciuoli et al. (2021b)
Pithecia monachus	MCZ-20265	MorphoSource	0.05	10.17602/M2/M4710	Urciuoli et al. (2021b)
Pithecia monachus	MCZ-20266	MorphoSource	0.05	10.17602/M2/M4709	Urciuoli et al. (2021b)
Pithecia monachus	MCZ-27124	MorphoSource	0.05	10.17602/M2/M4708	Urciuoli et al. (2021b)
Pithecia monachus	MCZ-30720	MorphoSource	0.05	10.17602/M2/M4705	Urciuoli et al. (2021b)
Pithecia monachus	MCZ-BOM-5057	MorphoSource	0.05	10.17602/M2/M4711	Urciuoli et al. (2021b)
Saimiri sciureus	AMNH-M-33875	MorphoSource	0.04	87602/m4/M6322	Urciuoli et al. (2021b)
Saimiri sciureus	AMNH-M-72068	MorphoSource	0.04	10.17602/M2/M6324	Urciuoli et al. (2021b)
Saimiri sciureus	AMNH-M-72074	MorphoSource	0.03	10.17602/M2/M6328	Urciuoli et al. (2021b)
Saimiri sciureus	AMNH-M-72078	MorphoSource	0.03	10.17602/M2/M6330	Urciuoli et al. (2021b)
Saimiri sciureus	AMNH-M-72079	MorphoSource	0.04	10.17602/M2/M6330	Urciuoli et al. (2021b)
Cercocebus galeritus	AMNH-M-52634	MorphoSource	0.06	87602/m4/M13568	Urciuoli et al. (2020, 2021a, 2021b)
Cercocebus galeritus	AMNH-M-52635	MorphoSource	0.06	87602/m4/M13608	Urciuoli et al. (2020, 2021a, 2021b)
Cercocebus galeritus	AMNH-M-52640	MorphoSource	0.06	87602/m4/M13610	Urciuoli et al. (2020, 2021a, 2021b)
Cercocebus galeritus	AMNH-M-52641	MorphoSource	0.07	87602/m4/M13614	Urciuoli et al. (2020, 2021a, 2021b)
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Cercopithecus mitis	MCZ-22734	MorphoSource	0.08	10.17602/M2/M2928	Urciuoli et al. (2020, 2021a, 2021b)
Cercopithecus mitis	MCZ-25022	MorphoSource	0.08	10.17602/M2/M2929	Urciuoli et al. (2020, 2021a, 2021b)
Cercopithecus mitis	MCZ-26832	MorphoSource	0.08	10.17602/M2/M2930	Urciuoli et al. (2020, 2021a, 2021b)
Cercopithecus mitis	MCZ-39389	MorphoSource	0.08	10.17602/M2/M2933	Urciuoli et al. (2020, 2021a, 2021b)
Cercopithecus mitis	MCZ-44264	MorphoSource	0.08	10.17602/M2/M2935	Urciuoli et al. (2020, 2021a, 2021b)
Chlorocebus pygerythrus	SIU-4792	MorphoSource	0.05	10.17602/M2/M13646	Urciuoli et al. (2020, 2021a, 2021b)

Chlorocebus pygerythrus	SIU-4793	MorphoSource	0.05	10.17602/M2/M13652	Urciuoli et al. (2020, 2021a, 2021b)
Chlorocebus pygerythrus	SIU-4794	MorphoSource	0.05	10.17602/M2/M13657	Urciuoli et al. (2020, 2021a, 2021b)
Chlorocebus pygerythrus	SIU-4795	MorphoSource	0.05	10.17602/M2/M13656	Urciuoli et al. (2020, 2021a, 2021b)
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Colobus guereza	AMNH-M-52211	MorphoSource	0.07	87602/m4/M13432	Urciuoli et al. (2020, 2021a, 2021b)
Colobus guereza	AMNH-M-52213	MorphoSource	0.07	87602/m4/M12510	Urciuoli et al. (2020, 2021a, 2021b)
Colobus guereza	AMNH-M-52225	MorphoSource	0.05	87602/m4/M13434	Urciuoli et al. (2020, 2021a, 2021b)
Colobus guereza	AMNH-M-52237	MorphoSource	0.07	87602/m4/M13435	Urciuoli et al. (2020, 2021a, 2021b)
Colobus guereza	AMNH-M-52249	MorphoSource	0.07	87602/m4/M12516	Urciuoli et al. (2020, 2021a, 2021b)
Erythrocebus patas	MCZ-37280	MorphoSource	0.08	10.17602/M2/M2922	Urciuoli et al. (2020, 2021a, 2021b)
Erythrocebus patas	MCZ-47015	MorphoSource	0.08	10.17602/M2/M2923	Urciuoli et al. (2020, 2021a, 2021b)
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Erythrocebus patas	MCZ-47018	MorphoSource	0.08	10.17602/M2/M2926	Urciuoli et al. (2020, 2021a, 2021b)
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Lophocebus albigena	AMNH-M-52603	MorphoSource	0.06	87602/m4/M13493	Urciuoli et al. (2020, 2021a, 2021b)
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Macaca fascicularis	MCZ-12758	MorphoSource	0.06	10.17602/M2/M3028	Urciuoli et al. (2020, 2021a, 2021b)
Macaca fascicularis	MCZ-22277	MorphoSource	0.06	10.17602/M2/M3029	Urciuoli et al. (2020, 2021a, 2021b)
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Mandrillus sphinx	AMNH-A-99.1-2056	MorphoSource	0.08	87602/m4/M26168	Urciuoli et al. (2020, 2021a, 2021b)
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Papio anubis	MCZ-31619	MorphoSource	0.11	10.17602/M2/M4892	Urciuoli et al. (2020, 2021a, 2021b)
Papio anubis	MCZ-BOM-8466	MorphoSource	0.08	10.17602/M2/M4889	Urciuoli et al. (2020, 2021a, 2021b)
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Presbytis rubicunda	MCZ-22276	MorphoSource	0.08	10.17602/M2/M4557	Urciuoli et al. (2020, 2021a, 2021b)
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Presbytis rubicunda	MCZ-35712	MorphoSource	0.08	10.17602/M2/M4555	Urciuoli et al. (2020, 2021a, 2021b)
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Theropithecus gelada	AMNH-M-60568	MorphoSource	0.08	87602/m4/M13676	Urciuoli et al. (2020, 2021a, 2021b)
Theropithecus gelada	AMNH-M-80126	MorphoSource	0.09	87602/m4/M13676	Urciuoli et al. (2020, 2021a, 2021b)
Theropithecus gelada	AMNH-M-90309	MorphoSource	0.09	87602/m4/M18336	Urciuoli et al. (2020, 2021a, 2021b)
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Hoolock hoolock	AMNH-201743	MorphoSource	0.06	87602/m4/M49871	Urciuoli et al. (2020, 2021a, 2021b)
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Hoolock hoolock	SMF-16713	SCHEP	0.04	—	This study
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Hylobates lar	MCZ-41412	MorphoSource	0.07	10.17602/M2/M2961	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates lar	MCZ-41416	MorphoSource	0.07	10.17602/M2/M2965	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates lar	MCZ-41418	MorphoSource	0.07	10.17602/M2/M2967	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates lar	MCZ-41421	MorphoSource	0.07	10.17602/M2/M2969	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates lar	MCZ-41424	MorphoSource	0.07	10.17602/M2/M3007	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates lar	MCZ-41452	MorphoSource	0.07	10.17602/M2/M3011	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates lar	MCZ-41455	MorphoSource	0.07	10.17602/M2/M3014	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates lar	MCZ-41469	MorphoSource	0.07	10.17602/M2/M3023	Urciuoli et al. (2020, 2021a, 2021b)
Hylobates agilis	IPS3773	CENIEH	0.05	—	This study
Hylobates agilis	NHMW-MAMM-1479	NHMW	0.05	—	This study
Hylobates agilis	NHMW-MAMM-1480	NHMW	0.05	—	This study
Hylobates agilis	NHMW-MAMM-2625	NHMW	0.05	—	This study
Hylobates agilis	NHMW-MAMM-52167	NHMW	0.04	—	This study
Hylobates agilis	SMF-1572	SCHEP	0.04	—	This study
Hylobates agilis	SMF-16712	SCHEP	0.05	—	This study

Hylobates agilis	CCEC 50001733	ESRF	0.02	10.15151/ESRF-DC-1634387669	This study
Hylobates moloch	NHMW-MAMM-75609	NHMW	0.04	—	This study
Hylobates moloch	NHMW-MAMM-802	NHMW	0.04	—	This study
Hylobates moloch	SMF-16736	SCHEP	0.04	—	This study
Hylobates moloch	SMF-4225	SCHEP	0.04	—	This study
Hylobates moloch	SMF-47979	SCHEP	0.04	—	This study
Hylobates moloch	SMF-47980	SCHEP	0.04	—	This study
Hylobates muelleri	NHMW-MAMM-660	NHMW	0.04	—	This study
Hylobates muelleri	NHMW-MAMM-663	NHMW	0.05	—	This study
Hylobates pileatus	NHMW-MAMM-2411B3557	NHMW	0.04	—	This study
Nomascus concolor	NHMW-MAMM-57468	NHMW	0.05	—	This study
Nomascus leucogenys	AMNH-87251	MorphoSource	0.10	87602/m4/M21958	This study
Symphalangus syndactylus	AMNH-M-102724	MorphoSource	0.06	87602/m4/M26157	Urciuoli et al. (2020, 2021a, 2021b)
Symphalangus syndactylus	AMNH-M-106583	MorphoSource	0.08	10.17602/M2/M382914	Urciuoli et al. (2020, 2021a, 2021b)
Symphalangus syndactylus	EA-258	MorphoSource	0.11	10.17602/M2/M58633	Urciuoli et al. (2021a, 2021b)
Symphalangus syndactylus	CCEC 50001912	ESRF	0.02	10.15151/ESRF-DC-1634387677	Urciuoli et al. (2021a, 2021b)
Symphalangus syndactylus	MCZ-36031	MorphoSource	0.08	10.17602/M2/M4444	Urciuoli et al. (2020, 2021a, 2021b)
Symphalangus syndactylus	MCZ-36032	MorphoSource	0.07	10.17602/M2/M4443	Urciuoli et al. (2020, 2021a, 2021b)
Symphalangus syndactylus	NHMW-MAMM-665	NHMW	0.05	—	This study
Symphalangus syndactylus	SMF-1103	SCHEP	0.05	—	This study
Symphalangus syndactylus	SMF-3190	SCHEP	0.05	—	This study
Gorilla gorilla	AMNH-A-99-9686	MorphoSource	0.13	87602/m4/M22291	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	AMNH-A-99-9687	MorphoSource	0.08	87602/m4/M22235	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	AMNH-M-167338	MorphoSource	0.13	87602/m4/M21964	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	AMNH-M-54356	MorphoSource	0.11	87602/m4/M22291	Urciuoli et al. (2020, 2021a, 2021b)Smith et al. (2025)
Gorilla gorilla	CCEC 50001994	ESRF	0.05	10.15151/ESRF-DC-1634319693	Urciuoli et al. (2021a, 2021b)

Gorilla gorilla	MCZ-14750	MorphoSource	0.13	10.17602/M2/M2938	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	MCZ-17684	MorphoSource	0.13	10.17602/M2/M2943	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	MCZ-26850	MorphoSource	0.12	10.17602/M2/M2947	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	MCZ-37264	MorphoSource	0.13	10.17602/M2/M2949	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	MCZ-37625	MorphoSource	0.12	10.17602/M2/M2950	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla gorilla	MCZ-49006	MorphoSource	0.13	10.17602/M2/M2957	Urciuoli et al. (2020, 2021a, 2021b)
Gorilla beringei	SMF-63976	SCHEP	0.12	—	This study
Gorilla beringei	SMF-94796	SCHEP	0.12	—	This study
Gorilla beringei	NHMW-3112	NHMW	0.1	—	This study
Homo sapiens	EMBR-121	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Homo sapiens	EMBR-179	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Homo sapiens	EMBR-212	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Homo sapiens	EMBR-281	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Homo sapiens	EMBR-473	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Homo sapiens	EMBR-479	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Homo sapiens	EMBR-583	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Homo sapiens	F01	University of Bern	0.06	10.5281/zenodo.3355271	Wimmer et al. (2019); Urciuoli et al. (2021a, 2021b)
Homo sapiens	F03	University of Bern	0.06	10.5281/zenodo.3355271	Wimmer et al. (2019); Urciuoli et al. (2021a, 2021b)
Homo sapiens	F04	University of Bern	0.06	10.5281/zenodo.3355271	Wimmer et al. (2019); Urciuoli et al. (2021a, 2021b)
Homo sapiens	F05	University of Bern	0.06	10.5281/zenodo.3355271	Wimmer et al. (2019); Urciuoli et al. (2021a, 2021b)
Homo sapiens	F06	University of Bern	0.06	10.5281/zenodo.3355271	Wimmer et al. (2019); Urciuoli et al. (2021a, 2021b)
Pan paniscus	AMNH-M-86857	AMNH	0.12	—	Urciuoli et al. (2020, 2021a, 2021b)
Pan paniscus	IPS9033	CENIEH	0.07	—	Urciuoli et al. (2020, 2021a, 2021b)
Pan paniscus	MCZ-38018	MorphoSource	0.09	10.17602/M2/M4399	Urciuoli et al. (2020, 2021a, 2021b)
Pan paniscus	MCZ-38019	MorphoSource	0.09	10.17602/M2/M4398	Urciuoli et al. (2020, 2021a, 2021b)

Pan paniscus	MCZ-38020	MorphoSource	0.10	10.17602/M2/M4397	Urciuoli et al. (2020, 2021a, 2021b)
Pan paniscus	SMF-92953	SCHEP	0.07	—	This study
Pan paniscus	SMF-94799	SCHEP	0.05	—	This study
Pan sp.	CCEC 50001738	ESRF	0.05	10.15151/ESRF-DC-1634320871	Urciuoli et al. (2021a, 2021b)
Pan sp.	CCEC 50001754	ESRF	0.05	10.15151/ESRF-DC-1634320895	Urciuoli et al. (2021a, 2021b)
Pan sp.	CCEC 50001759	ESRF	0.02	10.15151/ESRF-DC-1634320183	Urciuoli et al. (2021a, 2021b)
Pan sp.	CCEC 50001797	ESRF	0.05	—	Urciuoli et al. (2021a, 2021b)
Pan sp.	CCEC 50001988	ESRF	0.05	10.15151/ESRF-DC-1634320175	Urciuoli et al. (2021a, 2021b)
Pan sp.	CCEC 50002604	ESRF	0.05	10.15151/ESRF-DC-1634320523	Urciuoli et al. (2021a, 2021b)
Pan troglodytes	AMNH-M-167342	MorphoSource	0.09	87602/m4/M21967	Urciuoli et al. (2020, 2021a, 2021b)
Pan troglodytes	AMNH-M-167344	MorphoSource	0.11	87602/m4/M23479	Urciuoli et al. (2020, 2021a, 2021b)
Pan troglodytes	AMNH-M-51204	MorphoSource	0.08	87602/m4/M21952	Urciuoli et al. (2020, 2021a, 2021b)
Pan troglodytes	CCEC 50001793	ESRF	0.05	10.15151/ESRF-DC-1634320191	Urciuoli et al. (2021a, 2021b)
Pan troglodytes	CCEC 50001795	ESRF	0.05	10.15151/ESRF-DC-1634320515	Urciuoli et al. (2021a, 2021b)
Pan troglodytes	CCEC 50001796	ESRF	0.05	10.15151/ESRF-DC-1634320199	Urciuoli et al. (2021a, 2021b)
Pan troglodytes	CCEC 50001799	ESRF	0.05	10.15151/ESRF-DC-1634320855	Urciuoli et al. (2021a, 2021b)
Pan troglodytes	IPS5698	CENIEH	0.08	—	Urciuoli et al. (2020, 2021a, 2021b)
Pan troglodytes	MCZ-23167	MorphoSource	0.11	10.17602/M2/M4390	Urciuoli et al. (2020, 2021a, 2021b)
Pan troglodytes	MCZ-37260	MorphoSource	0.10	10.17602/M2/M4387	Urciuoli et al. (2020, 2021a, 2021b)
Pan troglodytes	MCZ-46414	MorphoSource	0.08	10.17602/M2/M4386	Urciuoli et al. (2020, 2021a, 2021b)
Pan troglodytes	MCZ-46415	MorphoSource	0.09	10.17602/M2/M4385	Urciuoli et al. (2020, 2021a, 2021b)

Pongo pygmaeus	CCEC 50001801	ESRF	0.05	10.15151/ESRF-DC-1634320879	Urciuoli et al. (2021a, 2021b)
Pongo pygmaeus	IPS10647	CENIEH	0.08	—	Urciuoli et al. (2020, 2021a, 2021b)
Pongo pygmaeus	IPS10651	CENIEH	0.08	—	Urciuoli et al. (2020, 2021a, 2021b)
Pongo pygmaeus	IPS9031	CENIEH	0.08	—	Urciuoli et al. (2020, 2021a, 2021b)
Pongo pygmaeus	IPSSN	CENIEH	0.08	—	Urciuoli et al. (2020, 2021a, 2021b)
Pongo pygmaeus	MHNT-ZOO-201108	PSU	0.04	—	Urciuoli et al. (2020, 2021a, 2021b)
Pongo pygmaeus	SMF-1576	PSU	0.01	—	This study
Pongo pygmaeus	SMF-6782	PSU	0.01	—	This study
Pongo sp.	MRAC-5593	PSU	0.01	—	This study
Pongo abelii	NHMW-31054	NHMW	0.13	—	This study
Pongo abelii	NHMW-3108	NHMW	0.11	—	This study
Pongo abelii	NHMW-3109	NHMW	0.12	—	This study
Pongo abelii	NHMW-658	NHMW	0.1	—	This study

Abbreviations of scanning facilities: AMNH, American Museum of Natural History, New York, NY, USA; CENIEH, Centro Nacional de Investigación sobre la Evolución Humana, Burgos, Spain; ESRF, European Synchrotron Radiation Facility, Grenoble, France; NHMW, Naturhistorisches Museum Wien, Viena, Austra; PSU, Paul Sabatier University, Toulouse, France; SCHEP, 3D Imaging Lab, Senckenberg Centre for Human Evolution and Palaeoenvironment, Tübingen, Germany

Table S2 List of µCT scans comprised in the fossil comparative sample for the semicircular canal and vestibule analysis

Catalog No.	Taxon	DOI/ARK	Voxel size (mm)[a]	Age range (tip age)	Age reference
DPC 18651	*Parapithecus grangeri*	87602/m4/M39638	0.0353	30.2–29.5 Ma (29.85 Ma)	Seiffert (2006)
MPM-PV 3501	*Homunculus patagonicus*	10.17602/M2/M9341	0.040	17.9–16.5 Ma (17.2 Ma)	Kay (2015)
MPM-PV 3502	*Homunculus patagonicus*	10.17602/M2/M9345	0.039	17.9–16.5 Ma (17.2 Ma)	Kay (2015)
MPM-PV 3503	*Homunculus patagonicus*	10.17602/M2/M9347	0.044	17.9–16.5 Ma (17.2 Ma)	Kay (2015)
MACN 14128	*Dolichocebus gaimanensis*	10.17602/M2/M9459	0.047	21–20 Ma (20.5 Ma)	Kay (2015)
FMI-619	*Tremacebus harringtoni*	10.17602/M2/M9339	0.042	21–20 Ma (20.5 Ma)	Kay (2015)
CGM85785	*Aegyptopithecus zeuxis*	10.17602/M2/M35988	0.056 × 0.056 × 0.064	30.2–29.5 Ma (29.85 Ma)	Seiffert (2006)
DPC-12081	*Aegyptopithecus zeuxis*	87602/m4/M36825	0.036	30.2–29.5 Ma (29.85 Ma)	Seiffert (2006)
SG-SUM-2009002	*Saadanius hijazensis*	10.7302/t0ty-pj64	0.064 × 0.064 × 0.069	29–28 Ma (28.5 Ma)	Zalmout et al. (2010)
NHMW/1970/1397/0003	*Epipliopithecus vindobonensis*	10.17602/M2/M113932	0.025	14.15 Ma (14.15 Ma)	van der Meulen et al. (2011)
NMBOE303	*Epipliopithecus vindobonensis*	10.17602/M2/M113933	0.022	14.15 Ma (14.15 Ma)	van der Meulen et al. (2011)
NMBOE303	*Epipliopithecus vindobonensis*	10.17602/M2/M113935	0.022	14.15 Ma (14.15 Ma)	van der Meulen et al. (2011)
IPS58443	*Pliobates cataloniae*	—	0.021	11.6 Ma (11.6 Ma)	Alba et al. (2017, 2022)
KNM-MB 29100	*Victoriapithecus macinnesi*	—	0.044	15 Ma (15 Ma)	Benefit (1999)
KNM-RU 2036al	*Ekembo heseloni*	—	0.064	18.5–16 Ma (17.25 Ma)	Van Couvering and Delson (2020)
Bac 183	*Oreopithecus bambolii*	10.17602/M2/M166428	0.029	7.0–6.5 Ma (6.75 Ma)	Rook (2016)
KNM-BG 42744	*Nacholapithecus kerioi*	87602/m4/M166427	0.050	14.77 Ma (14.77 Ma)	Kunimatsu et al. (2019)
RUD 200	*Rudapithecus hungaricus*	10.17602/M2/M126216	0.014	10.1 Ma (10.1 Ma)	Casanovas-Vilar et al. (2011)
RUD 77L	*Rudapithecus hungaricus*	10.17602/M2/M126215	0.014	10.1 Ma (10.1 Ma)	Casanovas-Vilar et al. (2011)
RUD 77R	*Rudapithecus hungaricus*	10.17602/M2/M126214	0.014	10.1 Ma (10.1 Ma)	Casanovas-Vilar et al. (2011)
IPS18000	*Hispanopithecus laietanus*	10.17602/M2/M126217	0.030	9.6 Ma (9.6 Ma)	Casanovas-Vilar et al. (2011)
StW 98	*Australopithecus africanus*	—	0.033	4.02 Ma (4.02 Ma)	Wood and Boyle (2016)
SK 847	*Homo erectus*	—	0.064	2.19–1.80 Ma (1.99 Ma)	Gibbon et al. (2014)

[a] Voxel size for isometric µCT image stacks repeated just once.

Table S3 Confusion matrix showing the cross-validated classification results (percentages are within parentheses) obtained from the cv-bgPCA (Online Resource 1: Fig. S1) performed on the SC shape data using major clades (platyrrhines, cercopithecoids, hominids, and hylobatids) as the grouping factor and based on typicality probabilities of group membership

A priori group	Classification			
	Cercopithecoids	Hominids	Hylobatids	Platyrrhines
Cercopithecoids	72 (96.0 %)	1 (1.3%)	0 (0%)	2 (2.7%)
Hominids	0 (0%)	63 (98.4%)	0 (0%)	1 (1.6%)
Hylobatids	1 (2.1%)	1 (2.1%)	45 (95.8%)	0 (0%)
Platyrrhines	3 (6.7%)	0 (0%)	0 (0%)	42 (93.3%)

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