

3D models related to the publication: Hidden diversity of Palaeogene metatherians: a new family of polydolopimorphian marsupials from Peruvian Amazonia

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Abstract

This contribution contains the 3D digital models of some fossil specimens of *Wamradolops telloi* Stutz and *Pozodolops manuelorum* Stutz (Metatheria: Polydolopimorphia), from several Palaeogene locations of Peruvian Amazonia. These taxa were described and analyzed in detail in the following publication: Stutz *et al.* (2026), Hidden diversity of Palaeogene metatherians: a new family of polydolopimorphian marsupials from Peruvian Amazonia. Zoological Journal of the Linnean Society. <https://doi.org/10.1093/zoolinlean/zlag006>.

Keywords: body mass, Cenozoic, low latitudes, minituarisation, phylogeny

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INTRODUCTION

Polydolopimorphia (Mammalia: Metatheria) are recorded from the earliest Palaeocene (Peligran South American Land Mammal Age [SALMA]) to the Pleistocene (Chapadmalalan SALMA) in Argentina, Brazil, Bolivia, Chile, Peru and Antarctica, in addition to potential representatives in Australian and North American fossiliferous deposits (*e.g.*, Sigé *et al.*, 2009; Goin *et al.*, 2016; Beck, 2017). Several new Palaeogene localities in Peruvian Amazonia (Contamana and Huallaga basin areas; Antoine *et al.*, 2016, 2017, 2021; Assemat *et al.*, 2019; Boivin *et al.*, 2022) delivered numerous fossils of polydolopimorphians, including taxa presenting close affinities to *Wamradolops tsullodon* Goin & Candela, 2004, an enigmatic taxon previously described and only known for the Santa Rosa locality (early Oligocene, Peruvian Amazonia; Goin and Candela, 2004). This recently studied material has allowed for the description of a new species of *Wamradolops*, *W. telloi* (Figure 1 and 2; see also Table 1), and a new genus and species closely related to it, *Pozodolops manuelorum* (Figure 3; Stutz *et al.*, 2026). Based on the abundant number of specimens, intra and interspecific morphological variation could be assessed (*e.g.*, size, presence/absence of cinguli, styler cusps, etc.), especially by applying high resolution RX micromotography (μ CT). These morphological features were also integrated into phylogenetic analyses, which indicated

that *Wamradolops* spp. and *Pozodolops manuelorum* form a basal clade representing a new polydolopimorphian family, the Wamradolopidae. This new family was restricted to tropical-equatorial lowlands of South America. Wamradolopids included taxa so far extremely small-bodied, with estimated body masses ranging 3–55 g, counting among the smallest mammals ever described (Bloch *et al.*, 1998; Blacket *et al.* 2008; Stutz *et al.*, 2026). Moreover, according to the phylogenetic analyses performed by Stutz *et al.* (2026), the composition and suprageneric arrangement of Polydolopimorphia are still largely unresolved, pending the discovery of additional remains and the integration of more complete datasets into the matrix of phylogenetic analyses.

METHODS

All the specimens are permanently deposited in the collection of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM). The scans were made on the EasyTom 150 multiscale multiresolution RX microtomograph, which had a 40-150 kV RX source and resolution up to 5 μ m, of the Montpellier Ressources Imagerie (MRI) platform, Institut des Sciences de l'Évolution de Montpellier, Montpellier, France. The scanned specimens were virtually prepared by manual segmentation using AVIZO 7.1 software (Visualization Sciences

Inv nr.	Taxon	Description
MUSM 4029	<i>Pozodolops manuelorum</i>	Fragmentary left dentary with p3–m1
MUSM 4036	<i>Pozodolops manuelorum</i>	Holotype, fragmentary right maxilla with M1
MUSM 4041	<i>Pozodolops manuelorum</i>	Fragmentary right dentary with m1
MUSM 4058	<i>Pozodolops manuelorum</i>	Fragmentary left P3
MUSM 4032	<i>Wamradolops telloi</i>	Fragmentary right dentary with m1–m2
MUSM 4144	<i>Wamradolops telloi</i>	Fragmentary left dentary with p2–m1
MUSM 4179	<i>Wamradolops telloi</i>	Holotype, partial skull, with right P2–M4 and left I4–M3, plus boneless lower teeth below upper teeth, belonging to the same individual
MUSM 4221	<i>Wamradolops telloi</i>	Fragmentary of right dentary with p3–m2

Table 1. List of 3D models. All specimens belong to the collections of the *Museo de Historia Natural, Universidad Nacional Mayor de San Marcos* (MUSM), Lima, Peru.

Group). Bony structures and teeth were prepared within a “Label Field” module of AVIZO, using the segmentation threshold selection tool. The 3D surface models are provided in .ply format and can therefore be opened with a wide range of freeware.

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BIBLIOGRAPHY

- Antoine P.-O., Abello M. A., Adnet S., Altamirano Sierra, A. J., Baby P., Billet G., Boivin M., Calderón Y., Candela A., Chabain J., Corfu F., Croft D. A., Ganerød M., Jaramillo C., Klaus S., Marivaux L., Navarrete R. E., Orliac M. J., Parra F., Pérez M. E., Pujos F., Rage J.-C., Ravel A., Robinet C., Roddaz M., Tejada-Lara J. V., Vélez-Juarbe J., Wesselingh F. P., Salas-Gismondi R., 2016. A 60-million-year Cenozoic history of western Amazonian ecosystems in Contamana, Eastern Peru. *Gondwana Research* 31, 30–59. <https://doi.org/10.1016/j.gr.2015.11.001>
- Antoine P.-O., Salas-Gismondi R., Pujos F., Ganerød M., Marivaux L., 2017. Western Amazonia as a hotspot of mammalian biodiversity throughout the Cenozoic. *Journal of Mammalian Evolution* 24, 5–17. <https://doi.org/10.1007/s10914-016-9333-1>
- Antoine P.-O., Yans J., Aliaga Castillo A., Stutz N., Abello M. A., Adnet S., Custódio M. A., Benites-Palomino A., Billet G., Boivin M., Herrera F., Jaramillo C., Martínez C., Moreno F., Navarrete R. E., Negri F. R., Parra F., Pujos F., Rage J.-C., Ribeiro A. M., Robinet C., Roddaz M., Tejada-Lara J. V., Varas-Malca R., Ventura Santos R., Salas-Gismondi R., Marivaux L., 2021. Biotic community and landscape changes around the Eocene–Oligocene transition at Shapaja, Peruvian Amazonia: regional or global drivers? *Global and Planetary Change* 202, 103512. <https://doi.org/10.1016/j.gloplacha.2021.103512>
- Assemat A., Boivin M., Marivaux L., Pujos F., Benites-Palomino A. M., Salas-Gismondi R., Tejada-Lara J. V., Varas-Malca R. M., Negri F. R., Ribeiro A. M., Antoine P.-O., 2019. Restes inédits de rongeurs caviomorphes du Paléogène de la région de Juanjuí (Amazonie péruvienne) : systématique, implications macro-évolutives et biostratigraphiques. *Geodiversitas* 21, 699–730. <https://doi.org/10.5252/geodiversitas2019v41a20>
- Beck R. M. D., 2017. The skull of *Epidolops ameghinoi* from the Early Eocene Itaboraí fauna, Southeastern Brazil, and the affinities of the extinct marsupialiform order Polydolopimorphia. *Journal of Mammalian Evolution* 24, 373–414. <https://doi.org/10.1007/s10914-016-9357-6>
- Blacket M. J., Kemper C., Brandle R., 2008. Planigales (Marsupialia: Dasyuridae) of eastern Australia’s interior: a comparison of morphology, distributions and habitat preferences, with particular emphasis on South Australia. *Australian Journal of Zoology* 56, 195–205. <https://doi.org/10.1071/ZO08057>
- Bloch J. I., Rose K. D., Gingerich P. D., 1998. New species of *Batodonoides* (Lipotyphla, Geolabididae) from the early Eocene of Wyoming: smallest known mammal? *Journal of Mammalogy* 79, 804–827. <https://doi.org/10.2307/1383090>
- Boivin M., Marivaux L., Aguirre-Díaz W., Custódio M. A., Benites-Palomino A., Pujos F., Roddaz M., Salas-Gismondi R., Stutz N., Tejada-Lara J. V., Yans J., Antoine P.-O., 2022. Eocene caviomorph rodents from Balsayacu (Peruvian Amazonia). *Paläontologische Zeitschrift* 96, 135–160. <https://doi.org/10.1007/s12542-021-00551-0>

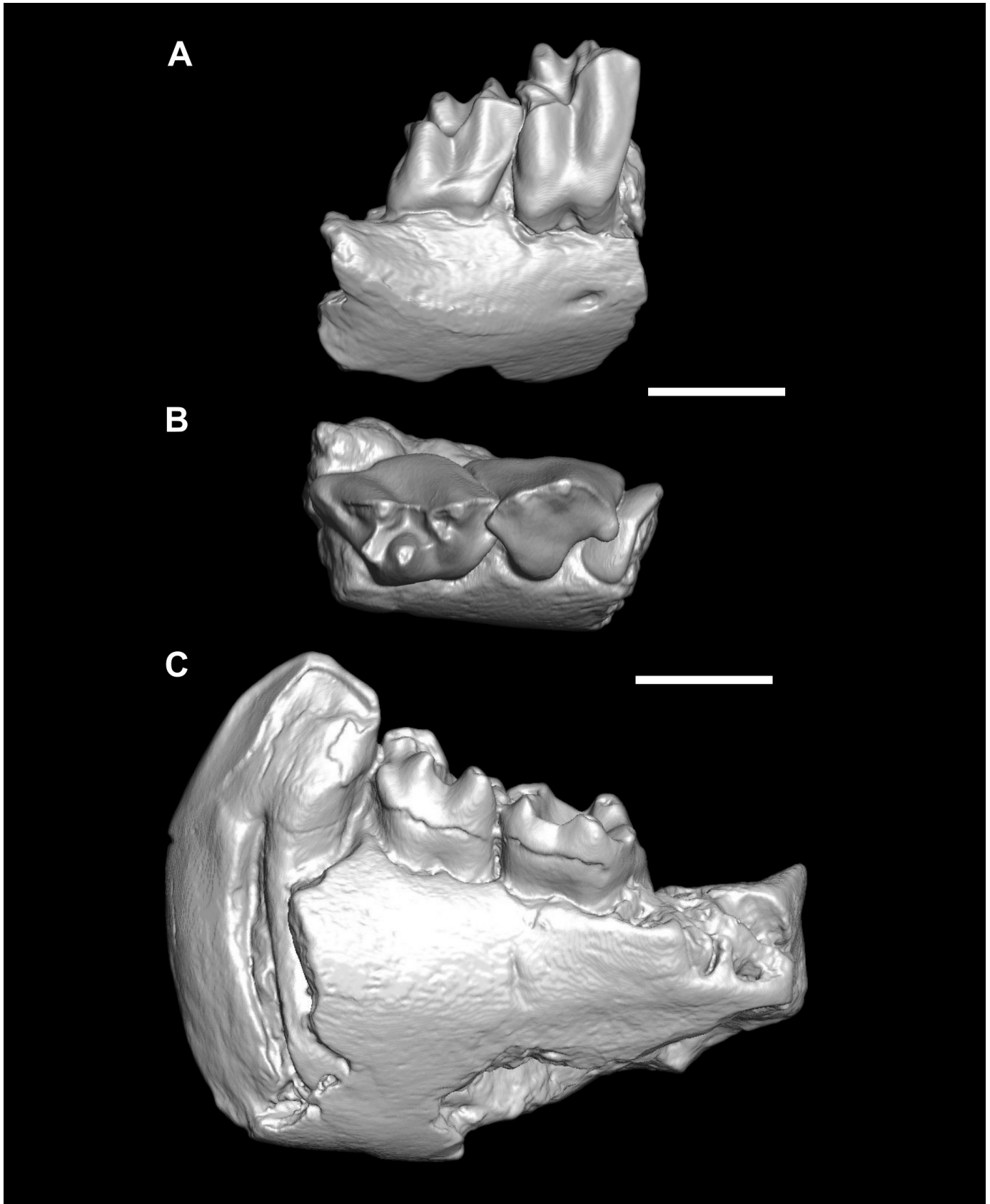


Figure 1. *Wamradolops telloi* Stutz in Stutz *et al.* (2026): **A**, MUSM 4032, fragmentary right dentary with m1–m2; **B**, MUSM 4144, fragmentary left dentary with p2–m1; **C**, MUSM 4221, fragmentary of right dentary with p3–m2. Lateral (A), occlusal (B), and labial (C) views. Scale bars = 1 mm.

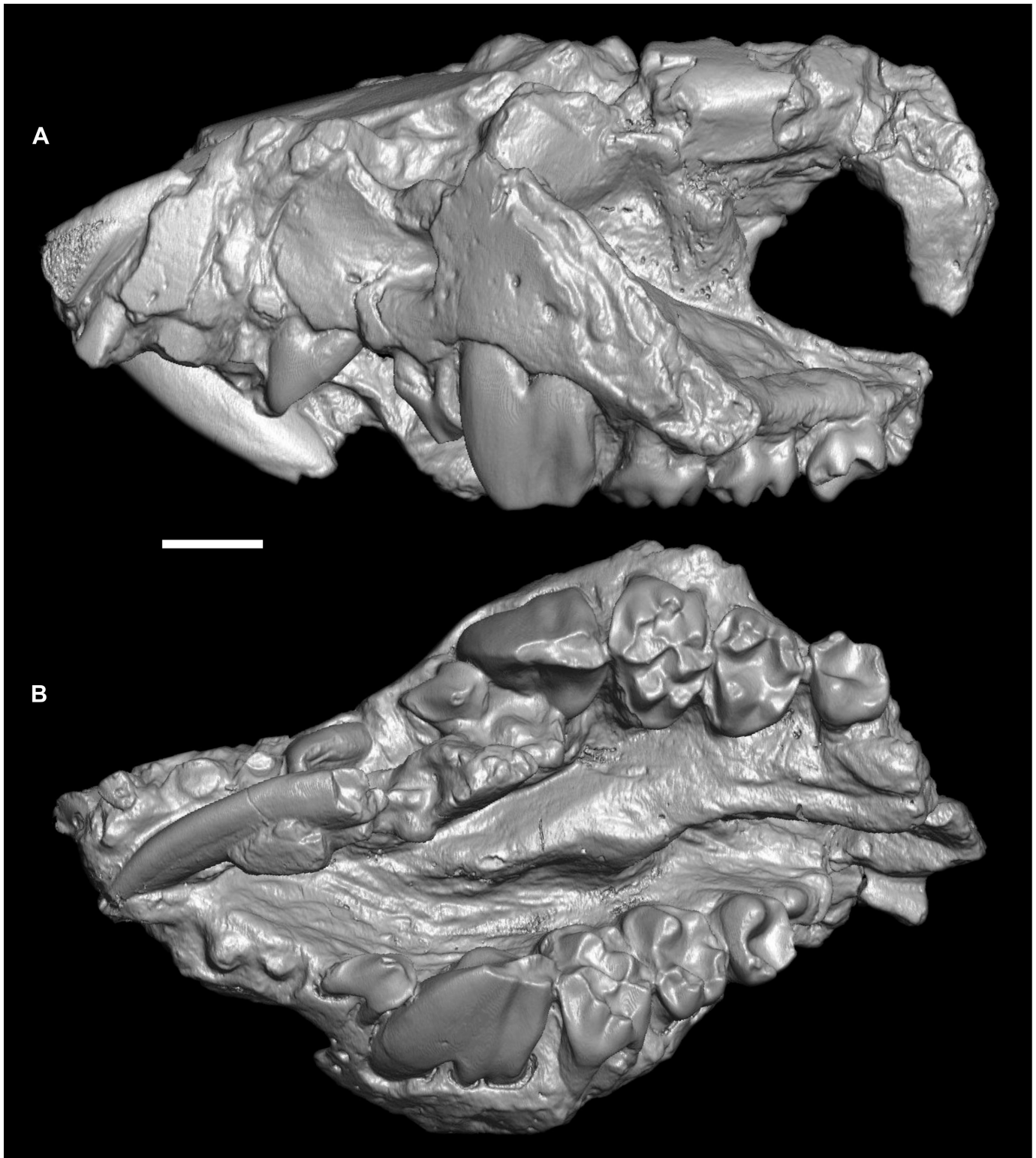


Figure 2. *Wamradolops telloi* Stutz in Stutz *et al.* (2026), MUSM 4179, holotype, partial skull, with right P2–M4 and left I4–M3, plus boneless lower teeth below upper teeth, belonging to the same individual, in left lateral (A) and ventral (B) views. Scale bar = 1 mm.

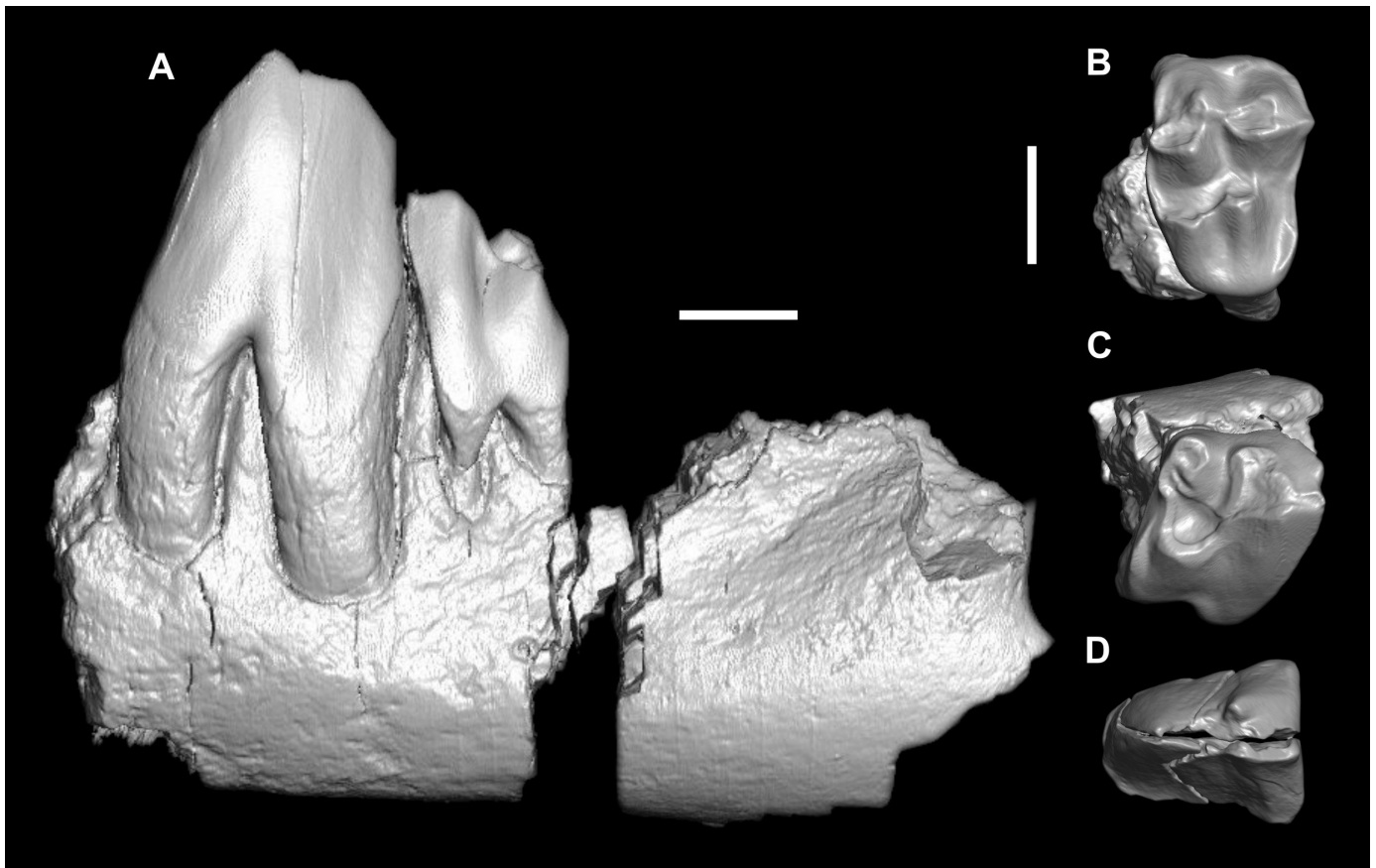


Figure 3. *Pozodolops manuelorum* Stutz in Stutz *et al.* (2026): **A**, MUSM 4029, fragmentary left dentary with p3–m1; **B**, MUSM 4036, holotype, fragmentary right maxilla with M1; **C**, MUSM 4041, fragmentary right dentary with m1; **D**, MUSM 4058, fragmentary left P3. Lateral (A) and occlusal (B–D) views. Scale bars = 1 mm.

Goin F. J., Candela A. M., 2004. New Palaeogene marsupials from the Amazon Basin of Eastern Peru. In: Campbell K. E. (Ed.), *The Paleogene mammalian fauna of Santa Rosa, Amazonian Peru*. Natural History Museum of Los Angeles County, Los Angeles, Science Series 40, pp. 15–60.

Goin F. J., Woodburne M. O., Zimicz A. N., Martin G. M., Chornogubsky L., 2016. *A brief history of South American metatherians*. Springer Earth System Sciences, New York.

Sigé B., Archer M., Crochet J.-Y., Godthelp H., Hand S., Beck R. M. D., 2009. *Chulpasia* and *Thylacotinga*, late Paleocene-earliest Eocene trans-Antarctic Gondwanan bunodont marsupials: New data from Australia. *Geobios* 42, 813–823. <https://doi.org/10.1016/j.geobios.2009.08.001>

Stutz N. S., Ribeiro A. M., Charruault A.-L., Boivin M., Pujos F., Salas-Gismondi R., Tejada-Lara J. V., Benites-Palomino A. M., Orliac M. J., Varas-Malca R., Marivaux L., Antoine P.-O., 2026. Hidden diversity of Palaeogene metatherians: a new family of polydolopimorphian marsupials from Peruvian Amazonia. *Zoological Journal of the Linnean Society*. <https://doi.org/10.1093/zoolinnea/zlag006>