Dataset

3D model related to the publication: A new cynodont from the Late Triassic Los Colorados Formation (Argentina, South America) reveals a novel paleobiogeographic context for mammalian ancestors

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Abstract
The present 3D Dataset contains the 3D model analyzed in Gaetano, L. C., Abdala, F., Seoane, F. D., Tartaglione, A., Schulz, M., Otero, A., Leardi, J. M., Apaldetti, C., Krapovickas, V., and Steinbach, E. 2021. A new cynodont from the Late Triassic Los Colorados Formation (Argentina, South America) reveals a novel paleobiogeographic context for mammalian ancestors. Scientific Reports.

Keywords: Cynodontia, Late Triassic, paleobiogeography, phylogeny, Probainognathia

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Inv nr.	Taxon
PULR-V121	*Tessellatia bonapartei*

Table 1. 3D surface model of PULR-V121. Collection: PULR (Museo de Ciencias Naturales, Paleontología, Universidad Nacional de La Rioja), Argentina

INTRODUCTION

We here present a 3D model of a new probainognathian cynodont from the Late Triassic (Norian) Los Colorados Formation of the Ischigualasto-Villa Unión Basin, north-western Argentina. *Tessellatia bonapartei* Gaetano et al. (in press), gen. et sp. nov., is represented by a partial cranium with articulated lower jaws (Fig. **??** and Table **??**) that was analyzed through micro-tomography (µCT). The high-resolution neutron µCT data allowed the identification of a unique character state combination, including features inaccessible through traditional techniques.

METHODS

The small size and delicate bones of the holotype and only known specimen of *Tessellatia bonapartei* (PULR-V121) make it impossible to remove the hard rock matrix without damaging the fossil and losing important information. In order to overcome this issue, PULR-V121 was analyzed through µCT. We performed a neutron µCT with the highest possible spatial resolution at the ANTARES instrument (Calzada et al., 2009; Schulz and Schillinger, 2015) in the Forschungs-Neutronenquelle Heinz Maier-Leibnitz Zentrum (FRM II, Garching, Germany). The specimen did not show previous radioactivity before introducing it directly to the reactor hall at ANTARES instrument. For the neutron tomography, PULR-V121 was wrapped in aluminum foil together with two additional specimens from the same stratigraphic levels (PULR-V222 and PULR-V223) to reduce the required beam-time. The package was placed in a 5cm long slot of an aluminum cylinder. A small aluminum plate was fixed to the cylinder using aluminum tape to act as a floor. This stabilized the specimens during the tomography and allowed to place them as close as possible to the detector. At ANTARES, a collimation ratio of L/D=500 was used. The Andor Neo sCMOS detector was equipped with a 100mm Zeiss Milvus f2.0 lens which allowed us to obtain high resolution images, with a 19.74µm pixel size. We performed a standard (white-beam), 360° tomography employing a Gd2O2S based neutron scintillator of 6 cm x 6 cm of 20µm thickness. The exposure time was 17s and each angular position (every 0.192°) was acquired three times for improving statistics. The neutron tomography took circa 17 hours and 42 minutes. Approximately two weeks after the tomography, the induced radioactivity of PULR-V121 had sufficiently decayed to remove it from the reactor hall. In order to normalize the images obtained, 19 open beam (open shutter, no sample in the beam) and 5 dark field (closed shutter) images were taken before and after the tomographic acquisition of the fossil remains, respectively. The images were normalized and

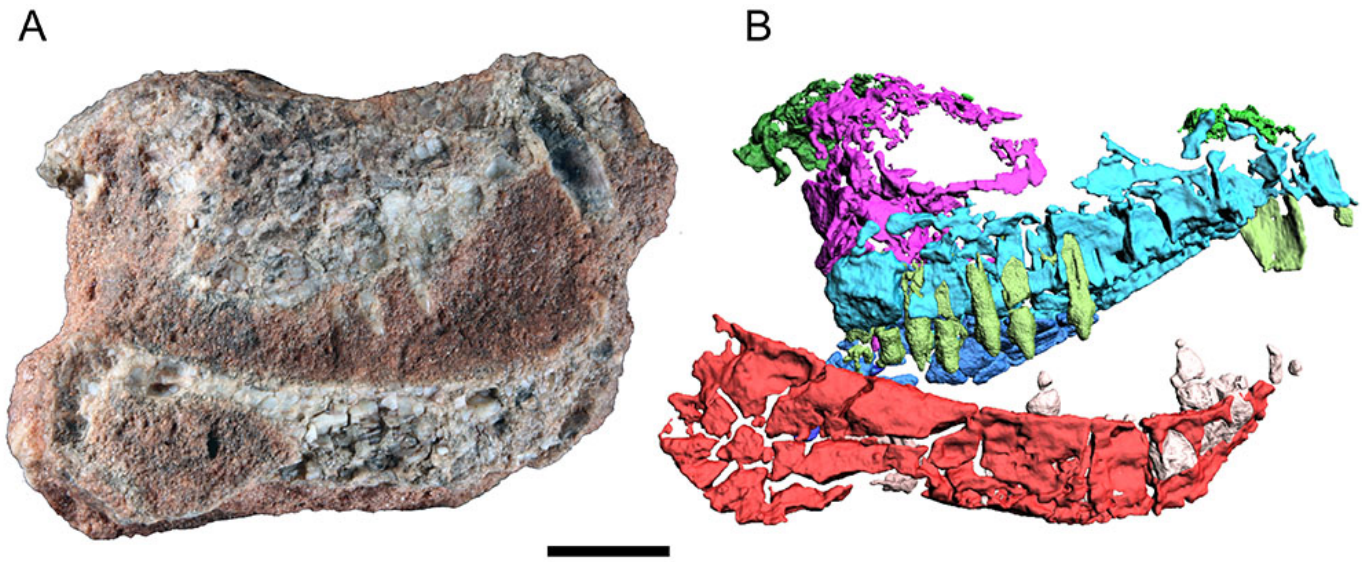

Figure 1. Holotype specimen of *Tessellatia bonapartei* gen. et sp. nov. (PULR-V121). Cranium as preserved (A) and 3D model (B) in right lateral view. Scale bar equals 5mm.

filtered using Image-J v. 1.52p (Rasband, 1997-2018) software and then reconstructed with Octopus Reconstruction v. 8.9.3.4 software at the Heinz Maier-Leibnitz Zentrum facility. Posteriorly, the reconstructed images were subjected to a new filtering process with the Inverse Scale Space Filter (ISS) module implemented in KipTool (Kaestner and Schulz, 2015; Kaestner and Carminati, 2019, Carminati et al., 2019). The ISS, an edge preserving de-noising filter based on the equation formulated by Burger et al. (2006), notably increased the sharpness of the images without sacrificing morphological information. The digital segmentation and 3D surface models of the bones were obtained using Avizo 7.1 (FEI) though semi-automatic selection tools (i.e., Brush, Lasso, and Magic Wand tools). The 3D surface models were colored and oriented in Morphodig (Lebrun, 2018). The 3D surface models are provided in .ply format, and can therefore be opened with a wide range of freeware.

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