## PL-7 Fossils and neutrons: unraveling paleontological questions using neutrographies

## <u>F. Novas<sup>1</sup></u>, M. Laaß<sup>2</sup>, A. Tartaglione<sup>3</sup>, L. Gaetano<sup>4</sup>, A. Backs<sup>5</sup>, F. Agnolín <sup>1</sup>, A. Martinelli<sup>1</sup>, M. Ezcurra<sup>1</sup>

<sup>1</sup> CONICET- Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Avenida Ángel Gallardo 470, C1405DJR Buenos Aires, Argentina.

<sup>2</sup> Technische Universität München, Physik Department T35, James-Franck-Straße 1, 85748 Garching, Germany.

<sup>3</sup> CONICET-Laboratorio Argentino de Haces de Neutrones (LAHN), Centro Atómico Constituyentes, Av. Gral. Paz 1400, B1650, Villa Maipú, Buenos Aires, Argentina.

<sup>4</sup> Departamento de Ciencias Geológicas, Facultad de Ciencias Exactas y Naturales, Instituto de Estudios Andinos 'Don Pablo Groeber', IDEAN (Universidad de Buenos Aires – CONICET), Intendente Güiraldes 2160, Ciudad Universitaria–Pabellón II, C1428EGA, Ciudad Autónoma de Buenos Aires, Argentina.

<sup>5</sup> Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II) - Technische Universität München - Neutron Tomography ANTARES, Lichtenbergstr.1, D – 85747, Garching, Germany.

Paleontological exploration has a long history in Argentina. The rich and diverse Argentinian fossil record has proven to be of upmost importance, profusely contributing to the resolution of important evolutionary interrogations. The technological advances, in particular those regarding three-dimensional tomographic imaging, opened a new field of research. Otherwise inaccessible features such as tiny structures or internal cavities have been made available for analysis. Hence, tomographies are employed to tackle still unanswered questions. Although much less common than X-rays tomographies, neutrographies have usually produced excellent images that allow the study of the internal anatomy of extinct animals. Our team employed neutron tomographies to analyze the fossilized skulls of three different animals from the beginning of the age of dinosaurs found in the world-wide renowned Los Chañares Formation (236.1–233.7 million years ago) at the Parque Nacional Talampaya (La Rioja Province, Argentina). One of these animals, Gualosuchus reigi, is basal to the lineage that originated extant crocodiles and birds. The other two are cynodonts, the carnivorous Probainognathus jenseni and the herbivorous Massetognathus pascuali; basal forms to the lineage that ultimately led to mammals. The images were obtained at the ANTARES instrument in the FRM2 reactor (Heinz Maier-Leibnitz Zentrum, Garching, Germany). The tomographic reconstructions allowed for the digital isolation of each bone. Additionally, it was possible to identify and isolate the inner ear, including the cochlea and the semi-circular canals. The brain morphology and the path of certain important cranial nerves and blood vessels were also digitally reconstructed. These results make possible to study structures not available with other methodologies as well as provided accurate metrics for the internal cavities. The employment of neutrographies in such specimens has produced promising results for the ever growing Argentinian paleontological community that would very much benefit from the access to neutron imaging instruments.