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Pierre-Olivier Antoine & François Pujos

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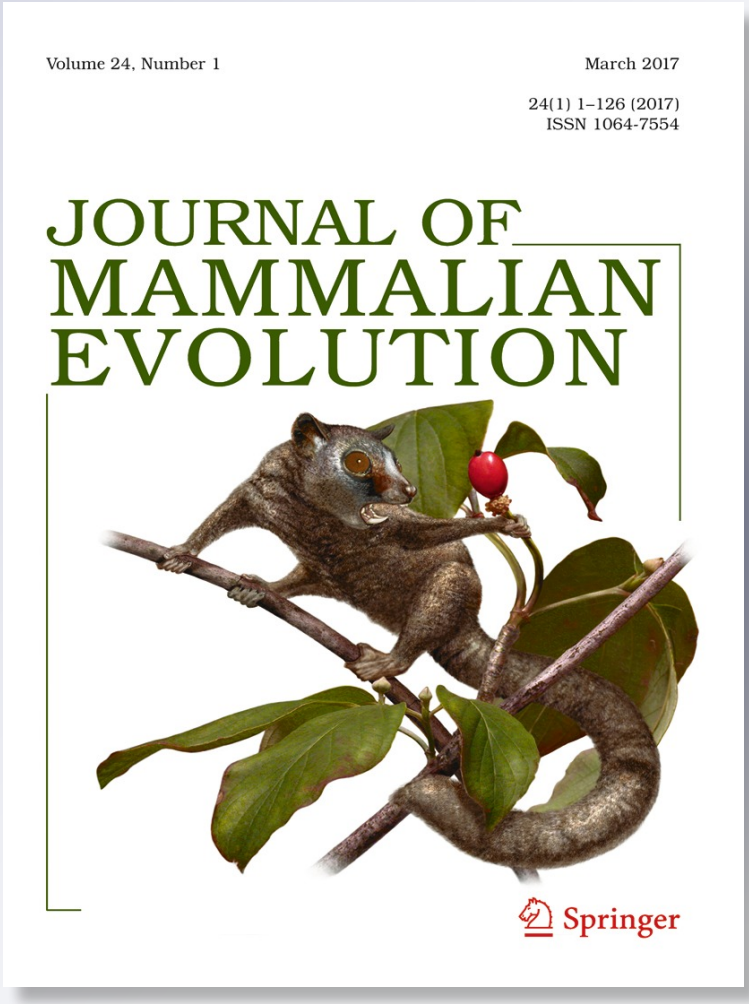

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BRIEF COMMUNICATION

Cenozoic Evolution of TRopical-Equatorial MAmmals (TREMA)–an Introduction to the Symposium Proceedings Volume

Pierre-Olivier Antoine[1] · **François Pujos**[2]

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Abstract This special issue of the *Journal of Mammalian Evolution* coincides with the proceedings from a symposium held in conjunction with the 4th International Palaeontological Congress (IPC4, Mendoza, Argentina; September 28, 2014), entitled "Cenozoic evolution of TRopical-Equatorial MAmmals," and abbreviated as TREMA. In this short introduction to the symposium proceedings, in which we present the contents of the current issue, we discuss the pivotal role of the mammalian fossil record at low latitudes for understanding the origin, structural organization, and dynamics of present mammalian biodiversity.

Keywords Mammalian evolution · Paleotropics · Neotropics · TREMA · IPC4

Understanding the origin, the structural organization, and the dynamics of present mammalian biodiversity requires a substantial background relying on the evolutionary history of biological and ecological communities from the past. Among vertebrates, modern mammals have attracted considerable attention, as paleobiological investigation on that group reveals some aspects of our own genealogy and provides a framework to interpret our evolutionary and geographic histories. Modern mammals group into three major clades (Monotremata, Metatheria, and Eutheria), the origin of which is deeply nested in Mesozoic and early Cenozoic times (e.g., Meredith et al. 2011; O'Leary et al. 2013). Present-day mammalian diversity (Wilson and Reeder 2005) encompasses *c.* 5140 species grouped within 28 orders and 91 families (placentals: ~4800/20/70; marsupials: ~346/7/19; monotremes: 5/1/2). Such biodiversity is much smaller than its early and middle Cenozoic counterparts (65.5–10 Ma), as shown by the available fossil record (e.g., McKenna and Bell 1997). This latter interval records both the rise of the living orders and the climax and decline of a wide array of extinct mammalian orders within Monotremata, Metatheria, and Eutheria. Placentals have been more intensely studied from morphological and molecular data than have monotremes and marsupials, and their higher-level phylogenetic pattern is generally considered as having attained a reliable degree of accuracy and resolution (e.g., Meredith et al. 2011), with four major clades recognized through molecular systematics: Xenarthra (e.g., sloths, armadillos, and anteaters), Afrotheria (e.g., elephants, hyraxes, and aardvarks), Laurasiatheria (e.g., bats, ruminants, pigs, whales, dogs, and horses), and Euarchontoglires (e.g., mice, rabbits, flying lemurs, and monkeys). However, if the position of Xenarthra as sister group to other placentals is supported by most data sets, alternate hypotheses (Afrotheria as first offshoot; Xenarthra + Afrotheria as a clade; Afrotheria and Laurasiatheria as polyphyletic groups, on morphological/paleontological grounds) show that such basal relationships are still far from being well established (Delsuc et al. 2004; Gheerbrant 2009; Nishihara et al. 2009; O'Leary et al. 2013). Interestingly, the phylogenetic relationships within marsupials are also debated, as is their biogeographical history (Nilsson et al. 2010).

During the early time of mammalian diversification, paleontologists assume that mammals displayed significantly higher diversities, notably exceeding 40 orders and 140 families by the

✉ Pierre-Olivier Antoine
pierre-olivier.antoine@univ-montp2.fr

François Pujos
fpujos@mendoza-conicet.gov.ar

[1] Institut des Sciences de l'Evolution, CNRS, IRD, EPHE, Université de Montpellier, F-34095 Montpellier, France

[2] IANIGLA, CCT–CONICET–Mendoza, Avda. Ruiz Leal s/n, Parque Gral. San Martín, 5500 Mendoza, Argentina

late Eocene (*c.* 37 Ma; McKenna and Bell 1997). Moreover, for historical reasons closely tied to the dawn of paleontology in the last centuries, mammalian paleodiversity has been primarily estimated from the Cenozoic record of arid areas of North America, Eurasia (Western Europe + Central Asia), and southernmost South America (Patagonia). In contrast, the tropical-equatorial areas from South Asia, Africa (Paleotropics), and South and Central America (Neotropics), which shelter the world's highest mammalian diversity, have always been widely under-investigated from a paleontological perspective. Despite a very poor fossil record, the available paleontological evidence from the early and middle Cenozoic of Africa, South Asia, South and Central America suggests that these regions were already major epicenters of paleobiodiversity at that time (with 20–30 coeval mammalian orders recorded in each landmass; McKenna and Bell 1997; Gelfo et al. 2009; Seiffert 2012; Antoine et al. 2016a, 2016b). Indeed, at least ¾ of modern orders are proposed to originate from there (Beard 1998). These areas have experienced drastic geographical and environmental changes throughout the Cenozoic era, under the joint influence of physical-chemical parameters (climate, eustasy, tectonics, and carbon cycle). Together with biological factors, such as ecological interactions or evolutionary trends within lineages, these parameters are deeply involved in the dynamics of biodiversity (Delsuc et al. 2004). Accordingly, the history of mammals is punctuated by vicariant episodes, dispersals, and biological crises, most of them only perceptible by paleontologists, but having notably resulted in today's biodiversity.

In this context, it was indisputably worth providing a state-of-the-art overview regarding the Cenozoic TRopical-Equatorial MAmmalian fossil record (TREMA). This was the aim of the TREMA Symposium held in the IPC4 at Mendoza. The symposium, in reduced committee but of quality, included seven oral contributions and four posters, encompassing not less than 32 contributors from nine countries (Argentina, Brazil, Canada, Colombia, France, Panama, Peru, Switzerland, and USA). The topics ranged from hydrogeography of northern South America to osteoanatomy of a wide array of mammals (i.e., primates, rodents, xenarthrans, and metatherians), but also regional overviews, faunal descriptions, biodiversity curves, and characterization of different aspects of the Great American Biotic Interchange (Fig. 1; MacFadden 2013; Carrillo et al. 2015). An oral contribution revealed the first occurrence of a South American monkey in early Miocene deposits of Central America, in Panama, an extraordinary discovery published in the meantime (Bloch et al. 2016). The stratigraphic interval covered by the contributors ranged the entire Cenozoic era.

The present symposium proceedings include papers drawn from two talks (Antoine et al. 2016b: Western Amazonian mammalian fossil record; Pérez et al. 2016: a new Pliocene capybara from La Guajira, Colombia) and two posters (Pujos et al. 2016: overview of tropical fossil sloths; Kerber et al. 2016: fossil caviomorph rodents from southwestern Brazil). Another paper resulted from gathering a talk and a poster from TREMA, and a talk from another symposium all focused on a new Paleogene fauna from Guabirotuba, Brazil (Sedor, et al. accepted). Additional contributions are dedicated to (i) Neogene cetaceans from Venezuela and Colombia (Aguirre-Fernández et al. 2016) and (ii) tooth enamel microstructure evolution of hyracoids (Tabuce et al. 2016), which broadens the scope of TREMA in involving marine mammals and paleotropical ungulates, and further allows publishing contributions from colleagues who unfortunately could not travel to Mendoza in 2014, irrespective of their will!

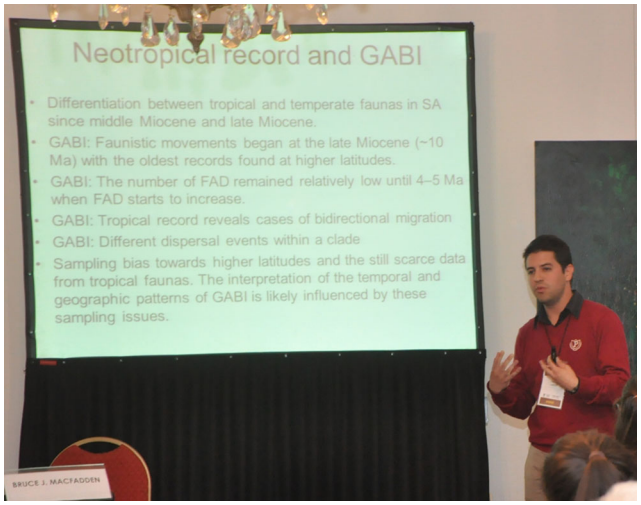

Fig. 1 Juan D. Carrillo presenting a northern South American perspective of the Great American Biotic Interchange during the TREMA Symposium (Cenozoic evolution of TRopical-Equatorial MAmmals) at the International Palaeontological Congress 4, in Mendoza, Argentina in 2014

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