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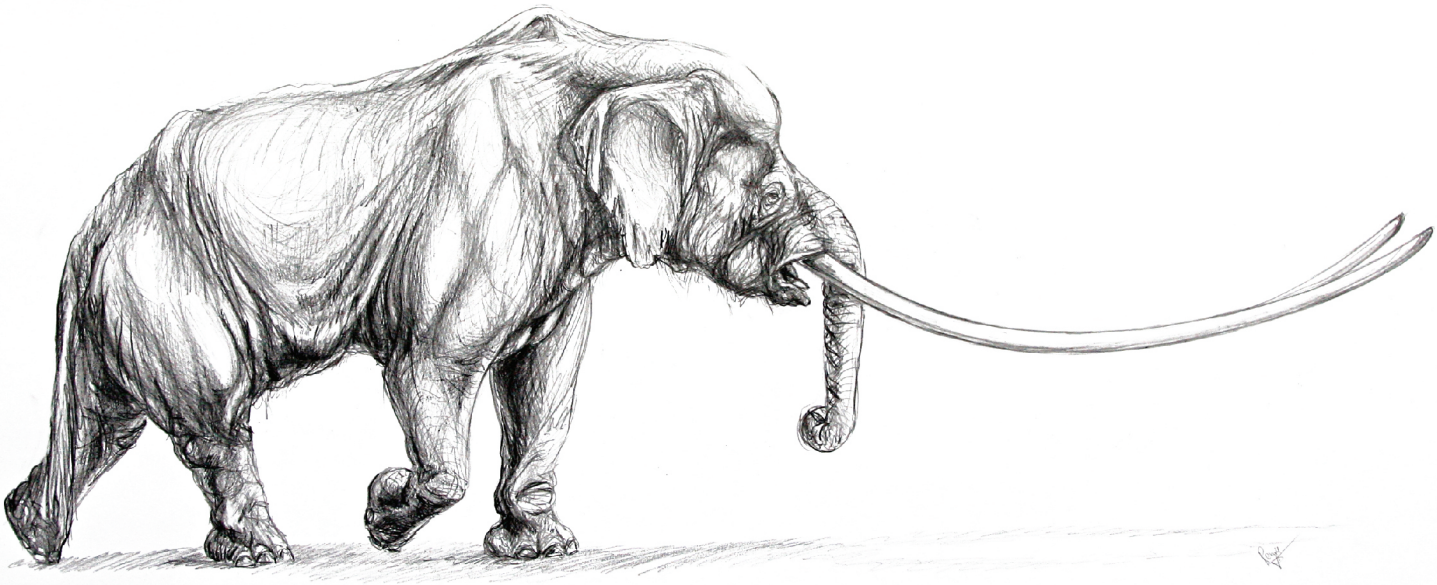

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ABSTRACT BOOK

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Once upon a time, the Gomphotheriidae (Proboscidea, Mammalia) ruled South America

Dimila MOTHÉ ✉, Leonardo AVILLA, and Alexander KELLNER

The South American Gomphotheriidae (SAG) is one of the most common megafaunal fossils. However, its taxonomy, phylogeny and biogeography are still unsolved – unclear species diagnosis, misidentified records, doubtful biogeographic and stratigraphic distributions and lack of absolute datings (Mothé et al., 2012; Lucas, 2013). Thus, the classic knowledge of SAG is, currently, outdated and a revision of the "dogmatic concepts" is needed.

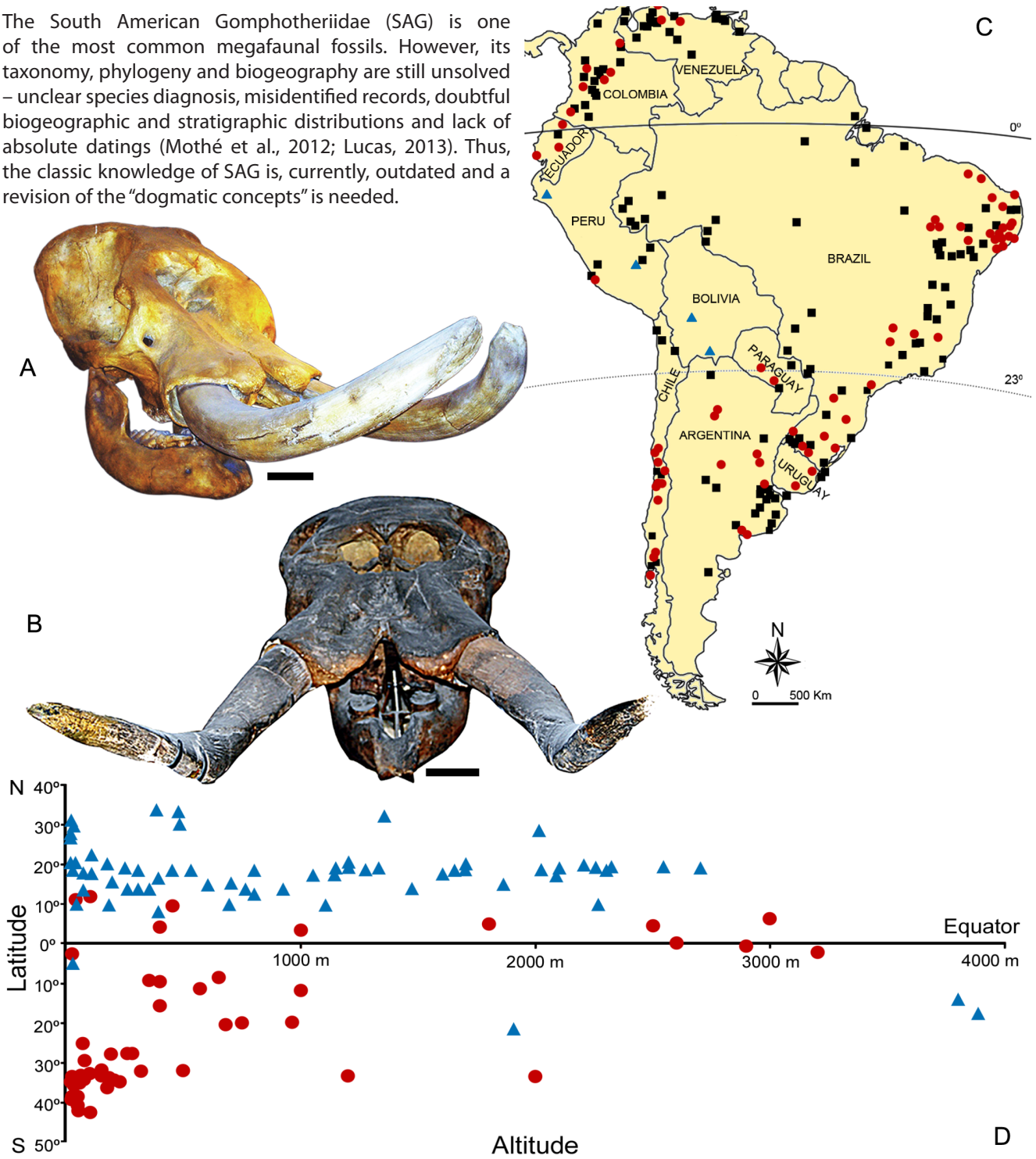

Fig. 1. General aspect and biogeographic distribution of the South American Gomphotheriidae. **A**, Skull of *Notiomastodon platensis* from Minas Gerais, Brazil (no collection number, paleontological collection of Museo de Ciências Naturais da PUCMinas, Minas Gerais, Brazil); **B**, skull of *Cuvieronius hyodon* from Tarija, Bolivia (MACN 1891, paleontological collection of Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina); **C**, geographical distribution of South American gomphotheres; **D**, latitudinal and altitudinal distribution of *C. hyodon* and *N. platensis* in Central and South Americas. Both taxa occur from sea level up to 3000 m height in a latitudinal range of 12ºN to 21ºS. Records of *C. hyodon* in Northern hemisphere refer to Central America, and *N. platensis* records refer to South America. Scale bar equals 15 cm.

▲= *Cuvieronius hyodon;* ●= *Notiomastodon platensis;* ■= non-diagnostic records of Gomphotheriidae

We analyzed a large sample of Gomphotheriidae (over 4.000 specimens) from North (Plio-Pleistocene) and South (Pleistocene) Americas. The morphological comparative analysis was based on the observation of diagnostic characters of *Cuvieronius*, *Notiomastodon*, *Stegomastodon*, *Rhynchotherium* and *Gomphotherium*. The reviewed records resulted in an updated distribution map for SAG recognized taxa and the proposition of a biogeographic hypothesis for their arrival in South America.

Many SAG specimens could not be taxonomically identified due to their fragmentary nature, deformations caused by taphonomic processes and/or lack of diagnostic features – those are restricted to upper tusks and/or complete skull. A taxonomic revision based on well preserved diagnostic material allowed the recognition of two species for SAG: *Notiomastodon platensis* and *Cuvieronius hyodon*. Although, traditionally, two species were attributed to *Stegomastodon* (*S. waringi* and *S. platensis*) in South America and, after our revision, both were reviewed and synonymized with *N. platensis* (which also includes *Haplomastodon chimborazi*). Also, the genera *Stegomastodon*, *Rhynchotherium* and *Gomphotherium* were not recognized to South America. *Notiomastodon platensis* is characterized by having a brachycephalic skull (high parieto-occipital region), a pair of non twisted upper tusks which vary from robust to thin and straight to upcurved, with enamel present or absence (Fig. 1A). *Cuvieronius hyodon* is characterized by the presence of a pair of twisted upper tusks with a longitudinal enamel band, a brachycephalic skull with a flattened frontal region and large upper incisor fossa (Fig. 1B). The molar morphology and post-crania elements of SAG still remain indistinguishable.

The geographic distribution revision of SAG records indicates that *C. hyodon* is restricted to Bolivia and Peru, while *N. platensis* is widely recorded (Brazil, Uruguay, Argentina, Chile, Paraguay, Peru, Colombia, Ecuador and Venezuela; (Fig. 1C) and endemic to South America. Also, SAG occurred from sea level to highland areas (over 3000 AMSL) and in the latitudinal range from 21º of the south latitude to 12º of the north latitude (including the Central America occurrence of *C. hyodon*; (Fig. 1D), sympatric only in Peru. Therefore, the SAG biogeographical pattern recognized here does not support the "traditional" dispersal routes proposed in previous studies – an Andean route to *C. hyodon* and eastern route to *N. platensis*, since they are recorded in a lowland locality (La Huaca, Peru) and in Andean region from Ecuador, Venezuela, Colombia and Chile, respectively. Thus, *N. platensis* also has an Andean distribution and the records of *C. hyodon* are insufficient to establish an ensured migratory route.

Moreover, the understanding of SAG biogeography is directly related to *Amahuacatherium peruvium* validity, which encompasses several disagreements. M.T. Alberdi et al. (2004) and Ferretti (2008) argue that *A. peruvium* is undistinguishable to other SAG from Peru, and we observed that all its exclusive features are in the morphological variability range of *C. hyodon* and/or *N. platensis*. Also, the structure proposed by K.E. Campbell et al. (2010) as the *A. peruvium* lower tusk "root" is, in fact, a molar root fragment. The stratigraphic and type locality of *A. peruvium* is considered controversial and questionable (Lucas, 2013) and we agree with several authors that it is invalid and possibly represents a Pleistocene gomphotere remain (Alberdi et al., 2004; Ferretti, 2008; Carlotto, et al., 2008; Lucas, 2013).

Regarding the arrival of Gomphotheriidae in South America, considering the genus *Stegomastodon restricted* to North America, *A. peruvium* invalidity and the most recent phylogenetic proposition to South American gomphotheres (Mothé et al., 2013), in which *C. hyodon* or *N. platensis* form a monophyletic clade, we suggest a single immigration pulse of Gomphotheriidae to South America, after the closure of the Isthmus of Panamá, throughout the dispersion of *C. hyodon* from Central America, at least at 2.5 Mya (oldest record of Gomphotheriidae in South America). As previously proposed by Mothé et al. (2013), the ancestor of SAG gave rise to *C. hyodon* and the South American endemic *N. platensis*, during the Pliocene in Central or North America. However, the few diagnostic records and the lack of absolute dating information directly impact the knowledge about evolutionary history of Gomphotheriidae in South America.

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