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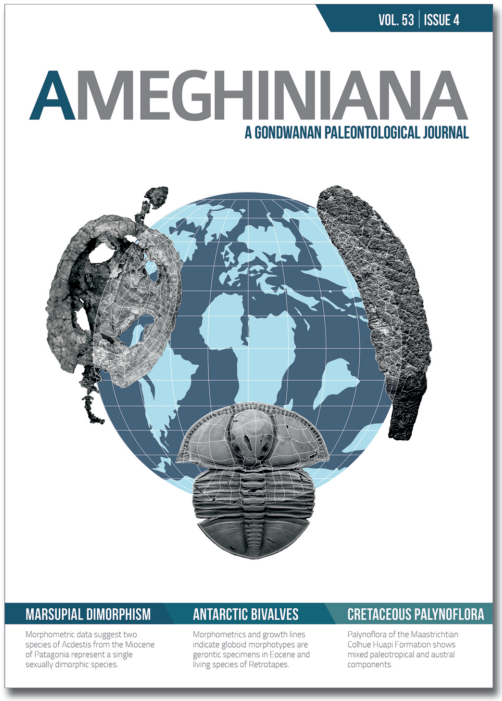

FIRST FOSSIL PREDACEOUS DIVING BEETLE FROM THE LATE PLEISTOCENE OF BUENOS AIRES, ARGENTINA

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FIRST FOSSIL PREDACEOUS DIVING BEETLE FROM THE LATE PLEISTOCENE OF BUENOS AIRES, ARGENTINA

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Key words. Fossil diving beetle. *Megadytes glaucus.* Luján Formation. Late Pleistocene. Buenos Aires Province.

LATE Pleistocene outcrops exposed in Buenos Aires Province, Argentina, represent one of the most informative sources for paleoecological studies on South American fauna and flora. Several proxies have been used for the study of Pleistocene environmental conditions in the Pampean region (Scanferla *et al.*, 2013 and references therein). Only a few studies, however, were based on paleoentomological data (*e.g.*, Ramírez, 2015; Ramírez and Alonso, 2014; Petrulevičius *et al.*, 2012).

Aquatic beetles (together with nepomorphan bugs) are the only group of insects that spend virtually their entire life in the water, with the exception of the pupal stage (aquatic beetles) that is usually spent in the shoreline sediments. Dytiscidae (or predaceous diving beetles) is the largest and most common group of aquatic Adephaga. This family is cosmopolitan, has its greatest diversity in the tropics (Jäch and Balke, 2008), and inhabits a variety of lentic freshwater habitats including steppe lakes, ponds, forest puddles, large lakes, springs, phytotelmata, hygropetric sites, and alpine lakes up to 4,700 m.a.s.l. (Trémouilles, 1995; Balke *et al.*, 2004). They are also found in lotic systems, where they are most commonly encountered in streams with a greatly reduced flow rate (Trémouilles, 1995). Both adults and larvae prey on other aquatic animals, including insects, crustaceans, worms, leeches, molluscs, tadpoles, and even small fishes.

Dytiscids are the largest family of water beetles, comprising 11 subfamilies, 26 tribes, 181 genera, and more than 4,300 described species (Nilsson, 2015). In Argentina, the family is represented by 8 subfamilies, 16 tribes, 31 genera, and 119 species (Libonatti *et al.*, 2011). The distribution of *Megadytes (Paramegadytes) glaucus* (Brullé, 1837), the most common and widespread species of *Megadytes* Sharp, 1882, in Argentina, extends over Brazil, Bolivia, Paraguay, Uruguay, and the Argentinean territory with the exception of Tierra del Fuego, Santa Cruz, Neuquén, Mendoza, San Juan, and Catamarca Provinces (Trémouilles and Bachmann, 1980; personal collections).

The aim of this study is to present the first record of a diving beetle from in late Pleistocene beds of Buenos Aires Province, and to provide new data on the paleoenvironmental conditions prevailing in the region at that time.

Fossil record of the Hydradephaga. The first record of the family Dytiscidae dates from 120 million years BP (Crowson, 1975). Whereas hydradephagans are known from the Late Triassic of Eurasia (*Triaplus* Ponomarenko, 1977), dytiscids are actually rather rare in the Mesozoic (Grimaldi and Engel, 2005). Probably, the oldest truly dytiscid is *Cretodytes* Ponomarenko, 1977, from the Turonian (Late Cretaceous) of southern Kazakhstan. Most of the published Cenozoic records of aquatic beetles originate from the classical palaeontological localities in Europe (*i.e.*, Fikáček *et al.*, 2008 and references therein). Cenozoic fossil Hydradephaga seem to be all Dytiscidae and Gyrinidae of modern types

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(Crowson, 1975), and have been cited from Quaternary sediments of Japan, Korea, Sakhalin island, eastern Siberia, Australia (Elias, 2010), North Greenland (Böcher, 1995), and now Argentina.

MATERIALS AND METHODS

The techniques used for extraction and concentration of fossil insects were summarized by Elias (1994). However, we opted for an alternative to the kerosene flotation, the most commonly used method. Before treating the sedi-

Figure 1. MHM-PI 35 ***Megadytes (Paramegadytes) glaucus.*** **1,** head; **2,** pronotum. Scale bar= 3mm.

ments with deflocculant (calgon), the clay blocks were inspected in search of conspicuous pieces of insects. Once disaggregated, we avoided sieving and checked all the material under the microscope. This method allows recovering fragments of heavy non-floating insect and prevents damage of the material during sieving and detergent washing. Moreover, the material remains suitable for radiocarbon dating. The remains were stored in small vials with ethanol 70%. Measurements were taken using a filar micrometer as follows: head length, from anterior margin of the clypeus to posterior end; head width, across the widest point; pronotal length, straight from anterior to posterior margin along midline; pronotal width, across the widest point. The fossil specimens were identified by comparison with modern specimens from the author's personal collection, and using published identification keys (Trémouilles and Bachmann 1980).

SYSTEMATIC PALEONTOLOGY

Family Dytiscidae Leach, 1815
Subfamily Cybistrinae Sharp, 1880
Tribe Cybistrini Sharp, 1880

Genus ***Megadytes*** Sharp, 1882
Subenus ***Paramegadytes*** Trémouilles and Bachmann, 1980

Type species. *Dytiscus glaucus* Brullé, 1837.

Megadytes (Paramegadytes) glaucus (Brullé, 1837)
Figure 1

Description. The fossil consists of part of the head and pronotum of an adult. The head is 5.56 mm long and 3.93 mm wide, and the pronotum is 3.06 mm long and 9.67 mm wide. The dorsal surface of both structures is smooth, moderately convex, and has the typical olive-green pigmentation of this species. The anterior margin of the eyes is rounded and lacks a notch above the base of the antenna (Fig. 1.1). The pronotum has a fine row of punctures following the shape of the margin. Two small shallow transverse grooves are present on the anterior portion of the pronotum, preceding the longitudinal medial groove (Fig. 1.2).

Type-locality and repository. La Chumbiada, about 30 km east General Belgrano City, 35° 44' 47'' S, 58° 45' 49'' W. Label: "*Megadytes (Paramegadytes) glaucus* MHM-PI 35/ Col. Ramírez, L.C. 2013". Deposited in the Museo Histórico Municipal "Alfredo Enrique Mulgura" of General Belgrano City, Buenos Aires Province, Argentina (MHM).

Geological settings. The fossiliferous strata consist of greenish-brown sandy clays deposited in a small paleopond environment that was filled by fluvial sediments, exhibiting abundant organic matter, gypsum, and carbonate concretions (Scanferla *et al.*, 2013). The age of the sediments containing fossil insects is 12,100 ± 100 14C BP and 13,400 ± 200 14C BP and was obtained by radiocarbon analysis of bone collagen (Scanferla *et al.*, 2013) and molluscan shells (Fucks *et al.*, 2012). These deposits correspond to the time span represented by the Guerrero Member of the Luján Formation (Fidalgo *et al.*, 1973). The deposition of the Guerrero Member began around the Last Glacial Maximum (ca. 21,000 yr BP) and continued at least until ca. 10,000 yr BP (Tonni *et al.*, 2003).

DISCUSSION

Several proxies used for inferring Pleistocene paleoclimate have indicated arid environmental conditions in the Pampean region during the deposition of the Guerrero Member of the Luján Formation (*ca.* 21,000-13,000 yr BP), which has been associated to a lower sea level during this period of time (Clapperton, 1993; Tonello and Prieto, 2010). The presence of *Megadytes (Paramegadytes) glaucus* argues against these interpretations. Current distribution of this species covers much of the Argentinean territory, although apparently it is absent from some provinces close to the Andes mountain system. *Megadytes glaucus* inhabits generally large, lentic, permanent or semipermanent water bodies. Torres *et al.* (2007) found it in a pond that covered an area of about 250 m^2, with about 50 cm in maximum depth, scarce marginal vegetation (Poaceae), abundant organic matter, turbid water, and muddy bottom. In Buenos Aires Province it was regularly collected among the vegetated margins of ponds and lagoons of various sizes, although generally large, at depths of about 15–20 cm or deeper (pers. obs.). As these insects spend practically their entire life in the water, it appears unlikely that an arid environment could support them.

On the other hand, the success of the megafauna in this environment, studied and discussed by many authors (*e.g.,* Scanferla *et al.*, 2013 and references therein), does not reflect the arid climate historically proposed and is still under intense debate. Moreover, the large amount of rhizoconcretions suggests favorable environmental conditions in the area of the paleopond. Considering the sedimentological data, the predominance of fluvial and fluvio-lacustrine deposits in the studied locality indicates that humid conditions prevailed in the Salado River basin. Based on the low degree of fragmentation, a very low energy depositional environment can be assumed.

The prevailing climatic conditions during the time span of the paleopond were probably similar to those currently found in this region. Current climate in the studied area is humid and temperate, with annual average temperatures of 23° C in the hottest month (January) and 10° C in the coldest month (July) (National Weather Service, climate statistics, from 1951 to 2000). This record, therefore, could represent one of the first pulses of post-glacial climate recovery and the establishment of an insect fauna similar to that currently found in these environments.

This study is one of the first approaches to the quaternary paleoentomology of Argentina, and highlights the potential of paleoentomological information, when evaluated in combination with previous knowledge on global climate conditions after the Last Glacial Maximum.

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