



RESEARCH NOTE

REWRITING THE FOSSIL HISTORY OF CERIONIDAE (GASTROPODA:
PULMONATA): NEW FAMILY ASSIGNMENT OF THE BRAZILIAN
PALAEOCENE GENUS *BRASILENNEA* MAURY, 1935

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The limestone formation of the Itaboraí Basin at São José de Itaboraí, Rio de Janeiro, Brazil, harbours a rich fauna of well-preserved terrestrial pulmonates: 18 species have been described to date, mainly in Bulimulidae/Orthalicidae (Simone & Mezzalana, 1994). Following mammal correlations, the Itaboraí limestones are now agreed to be of Palaeocene age (e.g. Paula Couto, 1952; Medeiros & Bergqvist, 1999) and, more precisely, the pulmonate fauna to be of Middle to Late Palaeocene age, although influential past malacological works have listed its pulmonate taxa as Miocene or Pliocene (e.g. Zilch, 1959–1960; Parodiz, 1969). Itaboraí's fossils are a valuable tool for studying the evolution of South American taxa due to their early Cenozoic age and the basin location.

The genus *Brasilennea* Maury, 1935 is known only from the Itaboraí basin. The type species (by original designation) is *B. arethusae* Maury, 1935, with *B. minor* Trindade, 1956 at first considered a variation, now considered a second sympatric species (Brito, 1967). A third *Brasilennea* species was recently found in museum collections (Salvador & Simone, unpubl.). *Brasilennea* was assigned to Streptaxidae subfamily Enneinae (=Ptychotrematinae) of the mainly Old World Streptaxoidea (Maury, 1935) on the basis of similarities with the African genus *Ptychotrema* Pfeiffer, 1853, in particular its subgenus *Ennea* Adams & Adams, 1855. This streptaxid allocation has been followed by all subsequent workers on the Itaboraí fauna. *Brasilennea* remains the only fossil New World Enneinae streptaxid and there are no known Recent New World Enneinae (Rowson, 2010). The phylogenetic analysis of Rowson, Tattersfield & Symondson (2010) found that extant South American streptaxids belong to Streptaxinae, unrelated to genera in Enneinae, a result also supported by morphology (Rowson, 2010). They considered *Brasilennea* to be a Miocene genus (following Parodiz, 1969) that may have dispersed from Africa, but noted that several Cretaceous and early Cenozoic 'streptaxid' fossils have been shown to belong to other families (Nordsieck, 1986). As *Brasilennea* is distant in space and time from other Enneinae streptaxids its family assignment should be carefully examined.

To do so we reviewed all existing literature on *Brasilennea* and examined type and abundant material from Itaboraí of both species in the following museums: American Museum of Natural History, New York, USA (AMNH); Museu de Ciências da

Terra, Rio de Janeiro, Brazil (DGM); Museu Nacional, Rio de Janeiro, Brazil (MNRJ); Museu de Zoologia, São Paulo, Brazil (MZSP). Comparisons were made with material of extant Cerionidae and Streptaxidae taxa at MZSP and the National Museum of Wales, Cardiff, UK (NMW). The material of *Brasilennea* examined included: *B. arethusae*: AMNH 24237–24239 (holotype and 2 paratypes); DGM 4222, 4998, 5002, unregistered (18 specimens); MNRJ 3346, 3348, 4338 (9 specimens); MZSP 86321, 86322, 86324 (25 specimens). *B. minor*: DGM 4224 (holotype), 4999, unregistered (12 specimens); MNRJ 3346, 4338 (3 specimens); MZSP 86323 (2 specimens).

The genus *Brasilennea* (Fig. 1A–L) is characterized as follows. Shell dextral, pupiform (cylindrical, multispiral, narrowing in both extremities, with acuminate apex), greatest width near central portion; triphasic (*sensu* Gould, 1989). Whorls slightly convex. Columella hollow in early whorls at least. Sutures well marked and linear, nearly perpendicular to columellar axis. Sculptured by regularly distributed, fine, raised ribs, becoming less oblique towards aperture; first two to three whorls unsculptured. Body whorl with two well-marked spiral furrows. Large ovate aperture, with rounded outer lip and straight inner lip. Peristome complete, upper lip virtually straight, doubled. Nearly median, single, strong parietal tooth/lamella reaching peristome. Columellar spiral lamella present. The genus remains known only from the type locality and stratum: Itaboraí Basin, facies of grey limestone: Facies B in sequence S1 (Middle to Late Palaeocene) *sensu* Medeiros & Bergqvist (1999).

Our study leads us to argue that *Brasilennea* should be transferred to Cerionidae in Urocoptoidea, a revision with biogeographic and evolutionary implications [Streptaxoidea and Urocoptoidea (represented by *Cerion*) are very distantly related; Wade, Mordan, & Naggs, 2006]. Although *Brasilennea* is not identical to any fossil or Recent taxon, it shows several features common in Cerionidae but not Streptaxidae (we restrict ourselves to Enneinae and other pupiform streptaxids). The considerable shell thickness, sculpture, triphasic shape, acuminate apex and large number of whorls are features common among cerionids (Fig. 1M, N) and larger urocoptids, but uncommon or rare among streptaxids. The doubled peristome is very common among cerionids, but almost unknown in streptaxids (apparently present only in the tiny *Gulella kimbozae* Verdcourt, 2004 from Tanzania). The virtually straight parietal edge of the peristome

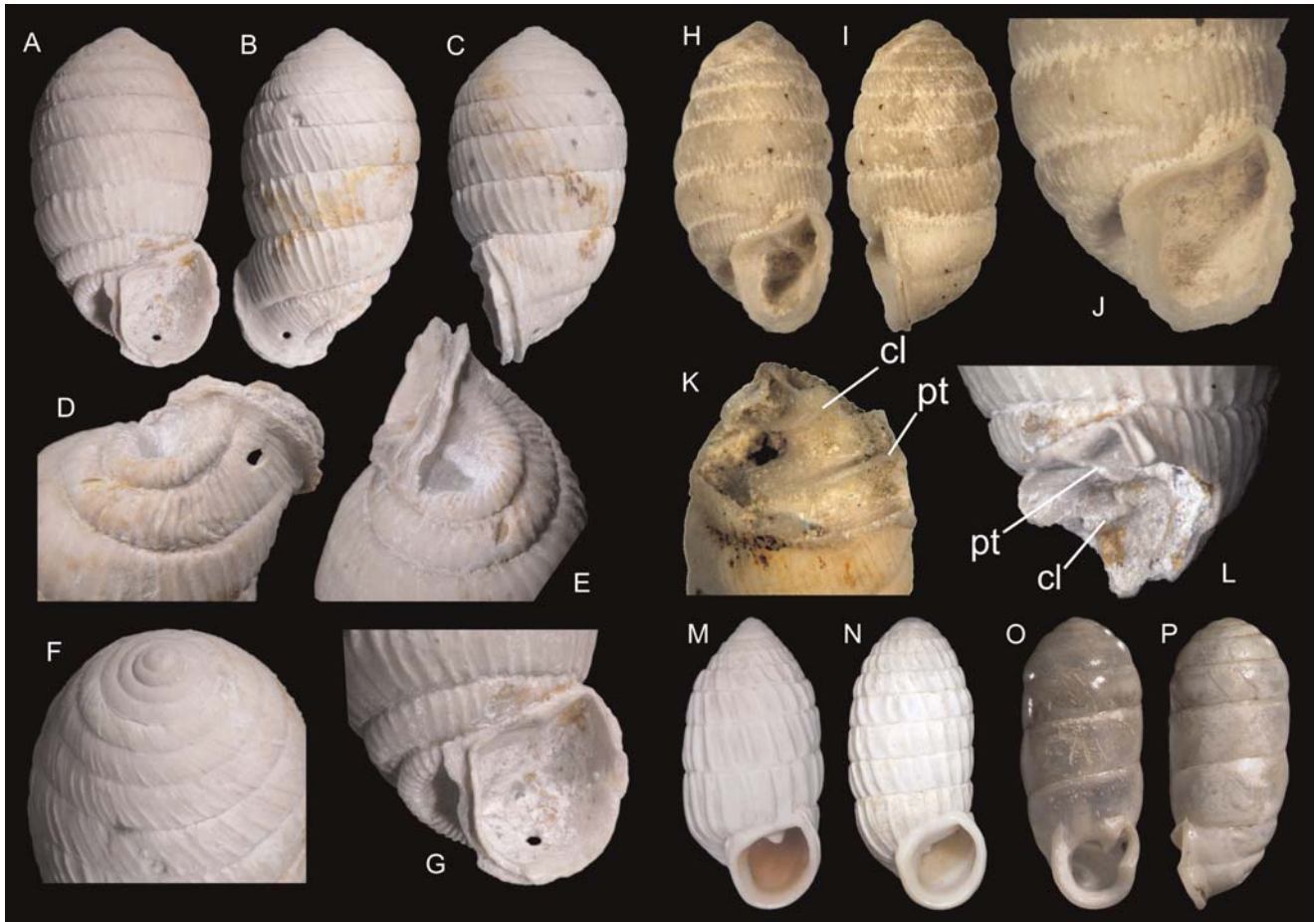


Figure 1. A–G, L. *Brasilennea arethusae* (MZSP 86322); shell length 21 mm. A–C. Overall view. D, E. Body whorl with two well-marked furrows. F. Absence of sculpture on the first whorls. G. Doubled peristome. H, I. *B. minor* (DGM 4999); shell length 11.5 mm. H, I. Overall view. J. Doubled peristome. K, L. Broken aperture showing pt and cl. M. *Cerion richiei* (MZSP 66147); Exuma Island, Bahamas; shell length 27.6 mm. N. *Cerion uva* (MZSP 3189); Curaçao, Dutch West Indies; shell length 25.3 mm. O, P. *Ptychotrema (Ennea) elegantula* (BMNH 1854.5.31.32); Liberia; shell length 7.8 mm. Abbreviations: BMNH, Natural History Museum, London; cl, columellar lamella; pt, parietal tooth. This figure appears in colour in the online version of *Journal of Molluscan Studies*.

and shape of the aperture, sharply angled at the top of the columella, are characteristically cerionid, despite occurring in some streptaxids. The apertural dentition shows a basic pattern common in cerionids (Fig. 1M). In streptaxids the single, strong parietal tooth (=angular lamella) usually projects beyond the plane of the aperture (Fig. 1O) rather than stopping at it (as in *Brasilennea*; Fig. 1K, L) or before it. A spiral columellar lamella (Fig. 1K, L) is often present in cerionids (Fig. 1N) and widespread and elaborate in Urocoptidae; in streptaxids a columellar tooth is common but very rarely takes the form of a spiral lamella. Only one feature of *Brasilennea* is present in Streptaxidae but not Cerionidae: the spiral furrows on the body whorl (Fig. 1D, E, I). This was what influenced Maury's (1935) placement of *Brasilennea* in Streptaxidae, suggesting proximity to *Ptychotrema (Ennea)* (Fig. 1P). However, a spiral furrow is also present in many Urocoptidae in genera including *Apoma* Beck, 1837, *Brachypodella* Beck, 1837, *Mychostoma* Albers, 1850 and *Spirostemma* Pilsbry & Vanatta, 1898.

The Cerionidae were recently shown to be closely related to, if not nested within, Urocoptidae in the superfamily Urocoptoidea by Uit de Weerd (2008), who considered all three to be exclusively New World groups. As he noted, this places the morphologically somewhat uniform Cerionidae among taxa showing a far greater morphological diversity. Extant Cerionidae occur in the south of North America (the

islands of southern Florida) and in most of the Caribbean islands, with their oldest known fossil, *Cerion acherontis*, in the Upper Cretaceous of the northwestern USA (Roth & Hartman, 1998). Extant Urocoptidae occur in the south of North America, Central America, the Caribbean islands and northernmost South America and occurred as far north as modern Canada in the Upper Cretaceous (Tozer, 1956). One urocoptid, *Brachypodella britoi* Ferreira & Coelho, 1971, has already been described from the Itaboraí deposits, showing that in the Palaeocene they extended much further south and were both contemporaneous and sympatric with *Brasilennea*. By means of biogeographical data alone, it is not possible to state with confidence if *Brasilennea* is an Enneinae streptaxid that arrived from Africa in the Cenozoic (Rowson *et al.*, 2010) or if it is a Cerionidae far removed from the family's current distribution. However, given the conchological features described above and the recent creation of Urocoptoidea (along with the presence of the urocoptid *Brachypodella britoi* in Itaboraí), we can conclude that *Brasilennea* should be transferred to this superfamily and to Cerionidae in particular.

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