

# LATE CRETACEOUS *PUPOIDES* PFEIFFER 1854 (GASTROPODA: PUPILLIDAE) FROM URUGUAY (QUEGUAY FORMATION)

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*Abstract* A new species of *Pupoides* Pfeiffer 1854, subgenus *Ischnopupoides* Pilsbry 1926, is described for the Late Cretaceous of Uruguay (Queguay Formation), being the oldest record of the genus and subgenus. *Pupoides* (I.) *gnocco* new species is characterized by a small dextral fusiform shell, constituted by a spire comprising five slightly convex whorls, oblicuous axial ornamentation, subrounded aperture, and an expanded outer lip that lacks dentition.

*Key words* Pupillidae, *Ischnopupoides*, Late Cretaceous, Uruguay

## INTRODUCTION

The family Pupillidae (Turton 1831) comprises a clade of very small pulmonate snails distributed all over the world, mainly in Europe, North America and North Africa, but also recorded in Asia, Oceania and South America. *Pupoides* Pfeiffer 1854 is widely distributed throughout the world. In South America it is recognized in many regions in Recent and earlier periods (Hylton Scott, 1970; Stuardo & Vargas-Almonacid, 2000; Mächtle *et al.*, 2010). It is characterized by small pupoid to fusiform dextral shells with an oval to subrounded aperture, without lamellae in most species (Pfeiffer, 1854; Thiele, 1992); a few possess a small parietal tubercle (Schileyko, 1998).

The material herein described was found in the Queguay Formation (Late Cretaceous) of Uruguay (Fig. 1), which is composed by calcretes (pedogenic and groundwater), palustrine, and lacustrine limestones (Veroslavsky *et al.*, 1997; Martínez & Veroslavsky, 2004; Tófaló & Morrás, 2009; Alonso Zarza *et al.*, 2011). Fossils are found in the limestone beds that represent paleosols, that yield diverse terrestrial and freshwater gastropod assemblages. These assemblages include *Biomphalaria walteri*, *Eoborus charruanus*, *Bulimulus klappenbachi* and *Bahiensis priscus* (Martínez *et al.*, 1997; Martínez *et al.*, 2001; Cabrera & Martínez, 2012; Cabrera, 2015). Other fossils are characean oogons, ostracods, *Celtis santosi* (Ulmaceae) endocarps, ichnofossils such as *Celliforma* isp. and *Fictovichnus* isp. (hymenopteran nests and coleopteran pupal chambers respectively), and Neosauropoda

eggshells (Genise *et al.*, 2010; Alonso Zarza *et al.*, 2011; Verde, 2012; Cabrera, 2015).

The Holotype and most specimens are deposited in the Paleontological Collection of Facultad de Ciencias FCDP-I (Universidad de la República; Montevideo, Uruguay); other specimens are deposited in the Paleontological Collection of Centro de Estudios Aplicados del Litoral PZ-CTES (Universidad del Nordeste; Corrientes, Argentina).

## SYSTEMATICS

Suprageneric classification follows Bouchet & Rocroi (2005).

Superfamily PUPILLOIDEA Turton 1831

Family PUPILLIDAE Turton 1831

Genus *Pupoides* Pfeiffer 1845

*Type species* *Bulimus nitidulus* Pfeiffer 1845

Subgenus *Ischnopupoides* Pilsbry 1926

*Type species* *Pupa hordacea* Gabb 1866

*Pupoides* (*Ischnopupoides*) *gnocco* sp. nov.

*Pupoides* sp.: Morton & Herbst, 1993

*Vertigo* sp.: Morton & Herbst, 1993

Pupillidae indet.: Martínez *et al.*, 2001

*Holotype* FCDP-I 7258 (Fig. 2A–C).

*Type locality* Uruguay, Canelones Department, Sauce Solo locality (34°24'03.4"S 55°38'37.7"W).

*Paratype* FCDP-I 7843 (Fig. 2D–F)

*Paratype locality* Uruguay, Paysandú Department, Quebracho locality (31°55'13.55"S 57°54'21.62"W)

*Other material* (n=40) FCDP – I 4662, 6471, 6475, 7242, 7262, 11 shells (Quebracho, Paysandú); 4665, 4666, 7225, 7264, 8 shells (Piedras Coloradas, Paysandú); 4679, 7219, 8 shells (Sauce Solo, Canelones); 7215, 3 shells (surroundings of Algorta Town, Río Negro); 7231, 1 shell (Palmar, Soriano); PZ-CTES 5340, 9 shells (Piedras Coloradas, Paysandú).

*Holotype measurements* (mm) height 3.57 (height range of 10 individuals: 2.8 to 4.15), width 1.84, last whorl 2.47; aperture height 1.70, width 1.32 (figure 2A–C).

*Geographic and stratigraphic occurrence* Sauce Solo (Canelones Department); surroundings of Algorta Town (Río Negro Department); Palmar (Soriano Department); Piedras Coloradas and Quebracho (Paysandú Department), Uruguay (Fig. 1). Queguay Formation, Late Cretaceous.



**Figure 1** Map of Uruguay showing the locations where the species was found. 1 Quebracho, Paysandú; 2 Piedras Coloradas, Paysandú; 3 surroundings of Algorta Town, Río Negro; 4 Palmar, Soriano; 5 Sauce Solo, Canelones.

*Etymology* *gnocco* is the singular name for the unit of an Italian pasta (plural *gnocchi*). The shell shape of the new species resembles this traditional food.

*Diagnosis* Small dextral fusiform shell, with five slightly convex whorls; oblique axial ornamentation. Subrounded aperture, outer lip expanded without lamellae.

*Description* Shell small (near 4mm long) with a fusiform dextral shape, five slightly convex whorls; last whorl comprises 70% of the shell; shallow sutures; conspicuous slightly oblique and sigmoidal axial striations. Subrounded toothless aperture; thick and expanded outer lip.

*Discussion* The morphology of the studied specimens is consistent with the general diagnostic characters of Pupillidae Turton 1831. The particular features of our fossil material, either by their morphology and by their geographic occurrence, resemble those of other three genera included in the family: *Pupoides* Pfeiffer 1854, *Gastrocopta* Wollaston 1878 and *Pupilla* Fleming 1828. Species of Diplommatinidae (Pfeiffer 1857) were also considered, but rejected. Species of this family are small, some of them with a pupoid-fusiform shell, as in the new species. But the ornamentation is quite different, consisting of conspicuous separated ribs in Diplommatinidae, compared to narrow striae in the new species. Whorls and sutures are also different – in Diplommatinidae sutures are deep, and whorls are rounded and globose, while in the new species, whorls are less rounded, and sutures are shallow. In South America there is only one genus (with eight species) of this family: *Adelopoma* Doering, 1884, that have a sinistral shell (Hausdorf & Muñoz, 2004; Martins & Simone, 2014).

*Pupilla* is the most similar in shape to the new species, except for the absence of the characteristic parietal teeth in this genus. Recent work of Nekola *et al.* (2014) indicates that the aperture and the number of apertural teeth vary between individuals within species of *Pupilla*, so the lack of a parietal tooth in the new species would not be diagnostic. The new species differs from this genus by the ornamentation, and by the shape of whorls and sutures, along with the geographical distribution of this genus that does not currently include South America according to GBIF



**Figure 2** A–C *Pupoides (Ischnopupoides) gnocco* sp. nov. Holotype, FCDP–I 7258. **A** apertural view, **B** lateral view, **C** posterior view. The aperture is reconstructed because it was broken while removing the carbonates that were encrusted on it. Photos and reconstruction by Gustavo Lecuona. **D–F** *Pupoides (Ischnopupoides) gnocco* sp. nov. Paratype, FCDP–I 7843. **D** apertural view, **E** lateral view, **F** posterior view. Scales: 1mm.



(<http://www.gbif.org/species/2294040>, visited on 01/15/15).

*Gastrocopta* is reported from many regions of South America, especially in Brazil and Uruguay (Scarabino, 2003; Simone, 2006). However, *Gastrocopta* has many teeth in the aperture and a folded outer lip (Wollaston, 1878; Roth, 1999), while the new species has no teeth, and the outer lip is smooth and expanded.

*Pupoides* has a wide geographic occurrence and, although many species have been described in the region (Argentina, Chile, Perú and Bolivia) (Hylton Scott, 1970; Stuardo & Vargas-Almonacid, 2000; Mächtle *et al.*, 2010), it had not been yet recorded in Uruguay. Its peculiar morphological characters are the presence of a fusiform to subconical shell, with five to six spire whorls ornamented with axial striae, and the development of an oval to subrounded aperture that can be toothless or have small teeth (Pfeiffer, 1854; Hylton Scott, 1970). In consequence, both the morphology and geographic proximity contribute to our placement of the new species within this genus. Moreover, they can be assigned to the subgenus *Ischnopupoides* Pilsbry 1926, which is recognized by the possession of small shells (less than 3.5mm) in most species, with a rounded aperture without teeth or with a small tubercle, and a spire devoid of sculpture or ornamented by thin striae parallel to the growth lines (Pilsbry, 1926; Schileyko, 1998; Benton *et al.*, 2015).

The type species of *Pupoides* is *Bulimus nitidulus* according to Pfeiffer (1845). This species has a small, turreted shell (5.1mm) of six whorls separated by deeply impressed sutures and an oval, toothless aperture. This species differs from *Pupoides (Ischnopupoides) gnocco* sp. nov. in the number of whorls (five in the new species), and the size and shape of the shell.

*Pupa hordacea* Gabb 1866 is the type species of *Ischnopupoides* (AMNH – [http://research.amnh.org/iz/types\\_db/details.php?specimen\\_id=10296](http://research.amnh.org/iz/types_db/details.php?specimen_id=10296), visited on 07/05/2016), and taking into account the characters described originally, this species differs from *Pupoides (Ischnopupoides) gnocco* sp. nov. by the number of whorls (six in *P. hordacea*); the shell shape (being more elongated in *P. hordacea*) and because it is smaller than the fossil species, being almost 3mm in length (2.8mm).

Two extant species of *Pupoides (Ischnopupoides)* and two extant species of *Pupoides (Pupoides)* are recorded from Chile, Bolivia, Peru and Argentina

(Hylton Scott, 1970; Stuardo & Vargas-Almonacid, 2000). *Pupoides (Ischnopupoides) minimus* (Philippi 1860), from Chile, differs from the new species by the presence of a tubercle situated close to the top of the outer lip, and by the number of whorls (six whorls in *P. (I.) minimus*).

*Pupoides (Ischnopupoides) paredesi* (d'Orbigny 1835), inhabiting Chile, Peru, Bolivia and Argentina, is separated from the new species by its larger shell (5mm), with six whorls, and its large oval aperture.

*Pupoides (Pupoides) chordatus* (Pfeiffer 1857) from Argentina, may be distinguished from the new species by its almost conical – sub conical shell provided with an expanded last whorl, while the new Uruguayan taxon has a pupoid shell. *Pupoides (P.) centralis* (Hylton Scott 1970), also from Argentina, is similar to *P. (P.) chordatus*, therefore differs from the new species by the same characters.

*Pupoides (P.) albilabris* (Adams 1841) has been mentioned from the Pleistocene – Holocene of Perú (Mächtle *et al.*, 2010) and differs from *P. (I.) gnocco* sp. nov. by the shell-shape, which conical in *P. albilabris* and pupoid in the new species, and by the number of whorls, six in *P. albilabris* and five in *P. (I.) gnocco* sp. nov.

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