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NOTA PALEONTOLÓGICA

Pleistocene *Retrotapes* del Río, 1997 (Veneridae, Bivalvia) from Tierra del Fuego, Argentina

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Introduction

Retrotapes, as described and characterized by del Río (1997), is a neoaustral taxon that first appeared in Patagonia and Antarctica during the early Tertiary, with Miocene and Holocene records in southern South America. Del Río (1997) transferred to *Retrotapes* some species previously assigned to *Eurhomalea* Cossmann, restricting *Eurhomalea* to strata younger than Pliocene. After that, some species included in the genus are: *R. ninfasiensis* del Río, 1997 (earliest Late Miocene, Península Valdés, Patagonia); *R. fuegoensis* del Río, 1997 (Late Oligocene-Early Miocene, Tierra del Fuego; del Río, 1997); *R. lenticularis* (Sowerby, 1835) (Pleistocene, Central Chile; Herm, 1969); and *R. exalbidus* (Dillwyn, 1817) (Quaternary, Patagonia and Tierra del Fuego; Feruglio, 1950; Gordillo, 1999; Aguirre and Farinati, 2000). The two last taxa are extant species in South America (Gallardo *et al.*, 2003), with *R. exalbidus* living at present in the Magellan Region along both coasts of southern South America (Carcelles, 1944; Reid and Osorio, 2000).

Based on the fossil record, del Río (1997) concluded that this genus exhibits great adaptability ("plasticity") and is able to live under warm to temperate-cold conditions. She pointed out that while almost 70% of the earliest Middle Miocene genera became extinct, *Retrotapes* survived under colder conditions after this period.

Carcelles (1944) and Dell (1964) mentioned that current *R. exalbidus* shells are variable in outline. Later, Lomovasky and Morriconi (1999) and Lomovasky (2002) documented the existence of two distinctive shell morphs in living *R. exalbidus* from Ushuaia Bay, on the Beagle Channel. Electrophoretic studies by Gallardo *et al.* (2003) on *R. exalbidus* and *R. lenticularis* showed that they are allozymically different, indicating that genetic distances are consistent with the morphological and distributional criteria used for species recognition within this genus. However, the two shell morphs from Ushuaia Bay described by Lomovasky (2002) have no genetic basis to substantiate their taxonomic separation. Thus, they appear to represent different age cohorts of *R. exalbidus* (Lomovasky, 2002).

The genus *Retrotapes* is also present in the Pleistocene of Tierra del Fuego. The aim of this paper is to provide an accurate description of this record, taking into account that Pleistocene molluscs represent a connection between the Tertiary fauna that inhabited southern South America and the modern fauna living today in the region.

The fossil material comes from Pleistocene marine terraces exposed along the northeastern coast of the Isla Grande of Tierra del Fuego. Lithostratigraphic units yielding representatives of *Retrotapes* are La Sara (Codignotto and Malumián, 1981), Las Vueltas and La Arcillosa (Bujalesky *et al.*, 2001) formations (figure 1), which represent different Pleistocene interglacial deposits (Bujalesky *et al.*, 2001). Between the confluence of the rivers Chico and Avilés a marine terrace 2.5 km long overlies Tertiary rocks, and in this area the Laguna Arcillosa and the Las Vueltas formations were respectively assigned with doubt to MIS (Marine Isotopic Stage) 11, and to MIS 9 or MIS 7 (*sensu* Bujalesky *et al.*, 2001). Laguna Arcillosa Formation is a fossil beach mainly composed of coquinoid sands with pebbles, situated 29 m above present sea level. Specimens of *Retrotapes* are associated with *Mytilus edulis chilensis* Hupé, 1854, *Mulinia edulis* (King and Broderip, 1832), *Trophon geversianus* (Pallas, 1774) and *Buccinanops squalidum* (King and Broderip, 1832). The Las Vueltas Formation is situated 25 m above present sea level and *Retrotapes* specimens collected from this unit are mostly broken and eroded, and associated with volutid gastropods. Finally, the La Sara Formation (*sensu* Codignotto and Malumián, 1981) is a large, elongated gravel deposit (14 km long and 2 km wide) located near Estancia La

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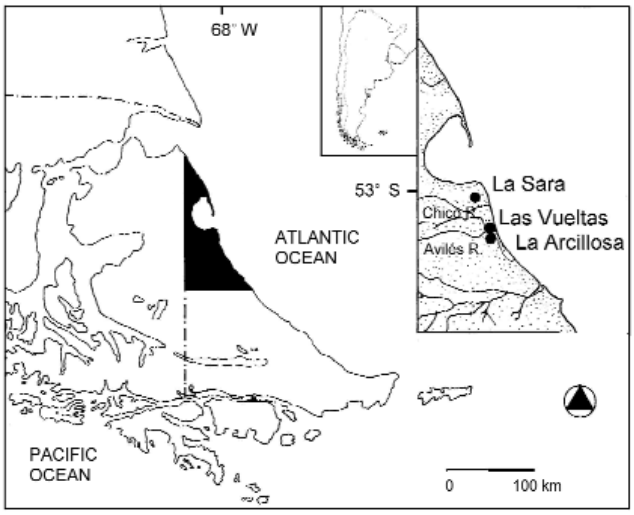


Figure 1. Map of Tierra del Fuego showing analized pleistocene localities / *mapa de Tierra del Fuego mostrando las localidades del Pleistoceno analizadas*.

Sara, at 14 m above present sea level. It is attributed to the Late Pleistocene (Codignotto and Malumián, 1981), and it correlates with MIS 5 (Bujalesky *et al*., 2001). Broken shells and fragments of *Retrotapes* associated with volutid gastropods have also been collected. Faunal composition, taphonomy and sediments yielding this association resemble those of the Las Vueltas Formation.

Systematic paleontology follows the synoptical classification of fossil and recent Bivalvia by Amler (1999). Specimens described are housed in the Centro de Investigaciones Paleobiológicas (CIPAL), Universidad Nacional de Córdoba, Argentina under the prefix CEGH-UNC.

Systematic Paleontology

Phylum MOLLUSCA Linné, 1758
Class BIVALVIA Linné, 1758
Subclass HETEROCONCHIA Hertwig, 1895
Superorder HETERODONTA Neumayr, 1884
Order VENEROIDA Adams and Adams, 1856
Superfamily VENEROIDEA Rafinesque, 1815
Family VENERIDAE Rafinesque, 1815
Subfamily TAPETINAE Adams and Adams, 1857

Genus ***Retrotapes*** del Río, 1997

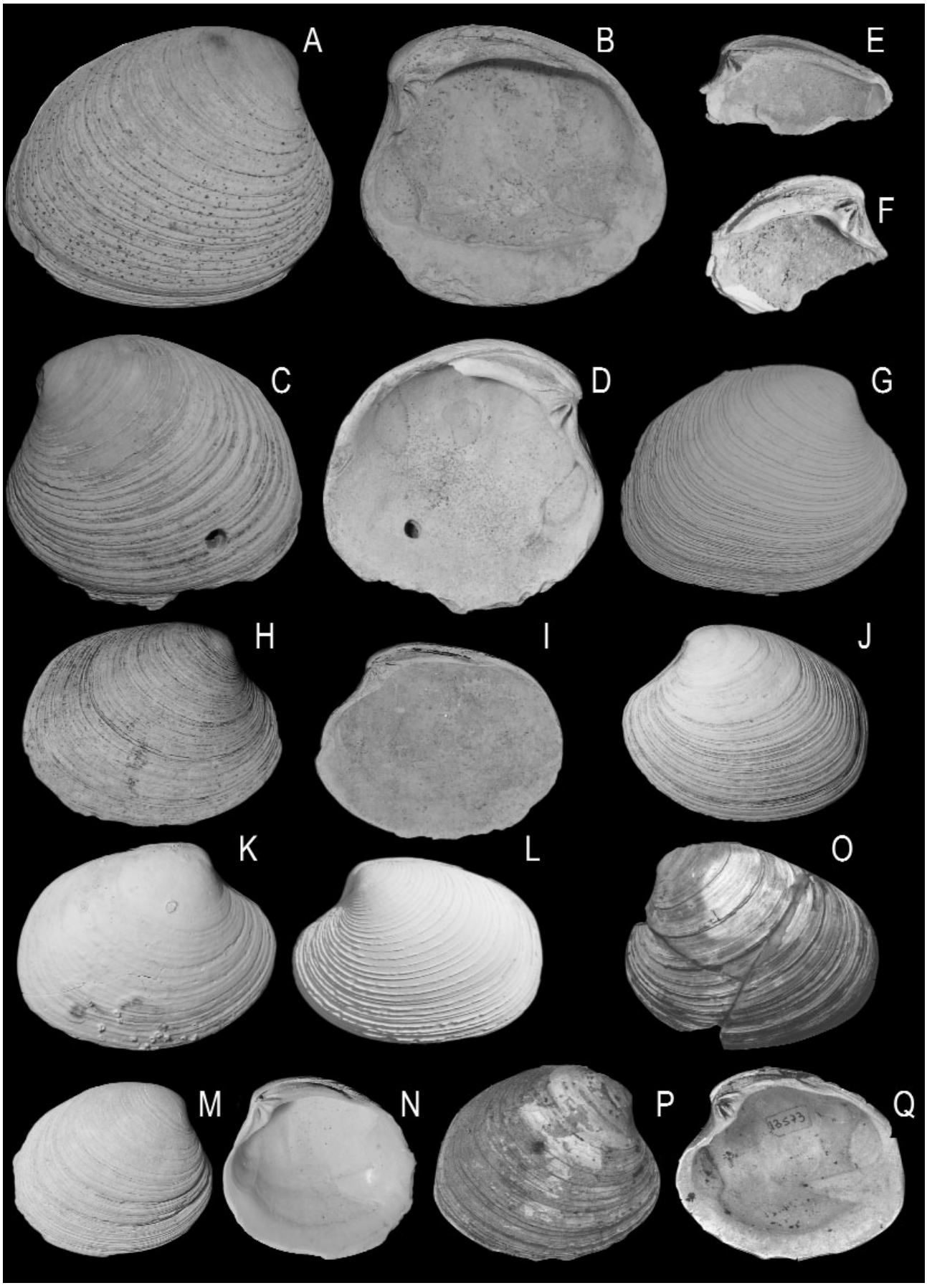
Type species. *Retrotapes ninfasiensis* del Río, 1997, Puerto Madryn Formation (Late Miocene).

Retrotapes sp.
Figures 2.A-F.

Material. Locality La Sara: CEGH-UNC22118, 22119, 22120; Locality La Arcillosa: CEGH-UNC22121; Locality Las Vueltas: CEGH-UNC22122, 22123, 22124, 22125. Broken specimens and fragments belonging to the Quaternary collection of Tierra del Fuego in the CIPAL: La Sara (27 specimens), Las Vueltas (10); La Arcillosa (15).

Description. Shell large, very thick and solid; outline ovate to subrectangular. Umbo small, anterior. Hinge plate wide with strong cardinal teeth; nymph long; three long cardinal teeth sloping backwards, with a horizontal posterior tooth and an almost vertical anterior tooth; left hinge with median cardinal tooth bifid. Lunule deeply impressed and concave, inclined towards the opposite valve. Pallial sinus short. Anterior adductor muscle more deeply impressed than posterior muscle scar. Sculpture of spaced commarginal ridges. Smooth inner ventral margins.
Stratigraphic and geographic distribution. Locality

Figure 2. A-F, Pleistocene ***Retrotapes*** sp. / **Retrotapes** *sp. del Pleistoceno.* **A-B,** external and internal views of right valve / *vista externa y vista interna de valva derecha*, CEGH-UNC22118, La Sara Formation, x0.7; **C-D,** external and internal views of left valve / *vista externa y vista interna de valva izquierda*, CEGH-UNC22119, La Sara Formation, x0.7; **E,** broken right valve / *valva derecha rota*, CEGH-UNC22121, La Arcillosa Formation, x0.6; **F,** broken left valve / *valva izquierda rota*, CEGH-UNC22122, Las Vueltas Formation, x0.7. **G-I,** Fossil holocene ***Retrotapes exalbidus*** (Dillwyn, 1817) / **Retrotapes exalbidus** *(Dillwyn, 1817) fósil del Holoceno*; **G,** external view of right valve / *vista externa de valva derecha*, CEGH-UNC22126, Puerto Madryn terrace, Patagonia, x0.6; **H-I**,external and internal views of right valve / *vista externa y vista interna de valva derecha*, CEGH-UNC22132, Isla Gable terrace, Beagle Channel, Tierra del Fuego, x0.9. **J-N,** Recent ***Retrotapes exalbidus*** (Dillwyn, 1817) / **Retrotapes exalbidus** *(Dillwyn, 1817) reciente*; external view of left valve / *vista externa de valva izquierda*, CEGH-UNC22133, Ushuaia, Beagle Channel, Tierra del Fuego, x0.6. external view of right valve / *vista externa de valva derecha*, CEGH-UNC22134, Bahía Brown, Beagle Channel, Tierra del Fuego, x0.7; external view of left valve / *vista externa de valva izquierda*, CEGH-UNC22127, *Golfo Nuevo, Patagonia*, x0.8. **M-N,**external and internal views of right valve / *vista externa y vista interna de valva derecha*, CEGH-UNC22135, Bahía Brown, Beagle Channel, Tierra del Fuego, x0.6. **O,** Tertiary ***Retrotapes fuegoensis*** del Río, 1997 / **Retrotapes fuegoensis** *del Río, 1997 del Terciario*, external view of left valve of holotype / *vista externa de valva izquierda del holotipo*, PU 356-12, Carmen Silva Formation, Tierra del Fuego, x0.7. **P-Q,** Tertiary ***Retrotapes ninfasiensis*** del Río, 1997 / **Retrotapes ninfasiensis** *del Río*, 1997, *del Terciario*; external and internal views of right valve of holotype / *vista externa y vista interna de valva derecha del holotipo*, CPBA 13573, Puerto Madryn Formation, Patagonia, x0.6 / **O,P** and **Q** are reproductions of del Río (1997) / **O, P** y **Q** *son reproducciones de del Río* (1997).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La Sara (53º30´S, 68º05´W), La Sara Fm. (MIS 5, Late Pleistocene). Locality La Arcillosa (53º34´S, 68º02´W), La Arcillosa Fm. (MIS 11?, Middle Pleistocene). Locality Las Vueltas (53º34´S, 68º03´W), Las Vueltas Fm. (MIS 7 or 9?, Middle Pleistocene). Tierra del Fuego.

Comments. Bujalesky *et al.* (2001) attributed specimens from Pleistocene marine deposits in Tierra del Fuego to *Eurhomalea exalbida* (i.e. *Retrotapes exalbidus*). However, based on our material, Pleistocene *Retrotapes* sp. is quite different from the living *R. exalbidus*. The material described here mainly differs in shell shape (more rectangular in *R. exalbidus*), and the different development of the cardinal platform (narrower in *R. exalbidus*). Both fossil Holocene and recent *R. exalbidus* specimens from different regions of Patagonia and Tierra del Fuego were compared and show a similar subrectangular outline (figures 2.G-L). One exception is given by one recent specimen of *Retrotapes* collected in Bahía Brown, on the Beagle Channel (figures 2.M-N), which strongly differs from the typical form of *R. exalbidus* in having a more inflated shell. This atypical shell correlates with the second morph of *R. exalbidus* described for living specimens (Lomovasky, 2002). Pleistocene *Retrotapes* sp. reported here is easily separated from the typical *R. exalbidus* (Dillwyn, 1817), but it is more difficult to differentiate in shape from the atypical form (a second morph). However, Pleistocene *Retrotapes* sp. and the recent atypical *R. exalbidus* notably differ in size and thickness. Another additional slight difference is that Pleistocene *Retrotapes* sp. has a more concave and more vertical lunule than the living atypical form. When comparing Pleistocene *Retrotapes* sp. with *R. fuegoensis* del Río, 1997 (figure 2.O) they differ in having different outlines. *R. fuegoensis* also has a pallial sinus which is tongue-shaped (del Río, 1997) and deeper than our Pleistocene specimens. Finally, when comparing our material with the type species, the Miocene *R. ninfasiensis* del Río, 1997 (figures 2.P-Q), both have thick shells with similar outline. However, the Pleistocene *Retrotapes* sp. differs from *R. ninfasiensis* in having a slightly less elongated shell shape, a more conspicuous ligamental nymph, a pallial line which is more separated from the ventral margin (leaving a wider space), and an umbo which is more displaced to the anterior margin than *R. ninfasiensis*.

Thus, taking into account the great similarity of the Pleistocene *Retrotapes* to *R. ninfasiensis*, and considering that our material is not enough to evaluate the existence of morphological variations associated with ontogeny (as living *R. exalbidus* seems to have), it is very difficult to determine if Pleistocene *Retrotapes* shells are more related to the Tertiary *R. ninfasiensis* or to extant *R. exalbidus*. More integrated work between paleontologists and biologists is required to unify criteria used in systematics of Cenozoic molluscs.

Discussion

In Tierra del Fuego, throughout most of the Pleistocene, *Retrotapes* inhabited the marine environments as is indicated by their occurrence in extensive Middle and Late Pleistocene terraces along the northeastern Atlantic coast of the island.

When comparing the Pleistocene deposits with the Holocene ones, or with the fauna living today in the region, a different faunal composition is noted. The Pleistocene is characterized by the dominance of *Retrotapes*, a typically infaunal taxon of soft substrates. However, during the Holocene, *Retrotapes* was locally replaced by different taxa, mostly epifaunal, suggesting Quaternary environmental changes. The spread of other taxa (*e.g.* mytilids) and the local extinction of *Retrotapes*, appear to be more related to changes in current regimes (affecting the substrates) than to changes in sea temperature, although warmer conditions at the age of deposition cannot be rejected. The persistence of this genus from at least the Middle to the Late Pleistocene also reflects the ability of the members of this taxon to survive during colder glacial intervals that also occurred during the Middle and Late Pleistocene.

It was also noted that the species richness of the Holocene fauna (Gordillo, 1999) is consistently greater than that from the Pleistocene, which is characterized by very low numbers of species (3 gastropods and 3 bivalves), and large shells of *Retrotapes*. Similar conclusions were reached by Aguirre (2003) who mentioned very low diversity and large shells of the mactrid *Mulinia edulis* (King and Broderip, 1832) in Late Pleistocene deposits from the Golfo San Jorge, further north in Patagonia.

Pleistocene *Retrotapes* shells considered here are thicker and larger than Holocene fossil and living *Retrotapes* spp. shells. Therefore, *Retrotapes*, as a suspension feeder, directly depends on primary productivity for growth (Lomovasky *et al.*, 2002) and these differences in size and thickness may be explained partly by different productivity conditions (*i.e.* associated with a greater food supply during the Pleistocene compared with the Holocene). However, large size and fast growth rates may also reflect exposure to higher alkalinity and calcium concentrations associated with fully marine environments (Kirby, 2000). At present, the reasons why *Retrotapes* specimens produce large and thick shells during the Pleistocene have not been well understood. For example, it is unknown whether thicker *Retrotapes* shells formed from faster growth or longer life periods. Moreover, onto-

genetic variations in shell morphology of living *R. exalbidus* make it difficult to determine whether the size and shape of Pleistocene *Retrotapes* specimens are influenced only by changes in productivity conditions, or if it is also genetically controlled. More paleontological work, combined with information on living taxa, is necessary for a better understanding of relationships between fossil and living faunas.

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