

A new land snail from the
Quaternary of Mallorca
(Balearic Islands, Western Mediterranean):
Darderia bellverica n. gen., n. sp.
(Gastropoda, Pulmonata, Helicodontidae)

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Abstract

A new land snail from the Quaternary of Mallorca (Balearic Islands, Western Mediterranean): Darderia bellverica n. gen., n. sp. (Gastropoda, Pulmonata, Helicodontidae).— A new genus and species of land snail is described from pre-human paleosoils at Bellver hill in the island of Mallorca. It is a medium-sized helicodontid with 6 tight coils, dome-shaped spire, obtuse peripheral keel, eccentric umbilicus, narrow aperture inclined forward, sinuous reflected peristome, a low angular tooth, 5 infrapalatal denticles, teleoconch with many regular riblets and widely scattered hair pits, and protoconch with simple wrinkles and very thin spiral lines. This very rare species had been reported as a member of the Iberian–Maghribian *Oestophora*. Similar Plio–Pleistocene fossils from the Balearics and Sardinia are placed in the new genus. This may constitute a biogeographic link within the Lindholmiolinae, now surviving at both ends of the Mediterranean basin. It remains unknown when, why or whether it became extinct.

Key words: Taxonomy, Land snail, Quaternary, fossil, Helicodontidae, Balearic Islands.

Resumen

Un nuevo caracol terrestre del cuaternario de Mallorca (islas Baleares, Mediterráneo occidental): Darderia bellverica gen. n., sp. n. (Gastropoda, Pulmonata, Helicodontidae).— Se describe un nuevo género y especie de caracol terrestre de paleosuelos prehumanos de la colina de Bellver en la isla de Mallorca. Se trata de un helicodóntido de talla media con 6 vueltas apretadas, espira abovedada, quilla periférica obtusa, ombligo excéntrico, apertura inclinada hacia delante, peristoma sinuoso reflejado, un diente angular bajo, 5 denticulos infrapalatales, teleoconcha con muchas costillitas regulares y depresiones de pelos muy dispersas, y protoconcha con arrugas simples y líneas espirales muy finas. Esta rarísima especie se había dado a conocer como un miembro del género ibero–magrebí *Oestophora*. Algunos fósiles semejantes del pliopleistoceno de las Baleares y Cerdeña se asignan al nuevo género. Éste podría constituir un enlace biogeográfico en el seno de Lindholmiolinae, que sobrevive hoy a ambos extremos de la cuenca mediterránea. Se desconoce cuándo, por qué o si realmente se extinguió.

Palabras clave: Taxonomía, Caracol terrestre, Cuaternario, fósil, Helicodontidae, Islas Baleares.

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Introduction

The Mediterranean islands stand apart from other archipelagoes in the exceedingly low rate of known extinctions for most taxa during the Holocene, particularly among land snails (Altaba, 2004). Only one instance is known outside the Balearics, this being in Santorini, where a historical volcanic eruption wiped out the island's ecosystems (Riedel & Norris, 1987).

The Quaternary of the Balearic Islands is known from numerous well-preserved sites, often involving extensive stratigraphic sequences with abundant molluscan remains (Cuerda, 1989). Land snails are common in terrigenous sediments, and provide a valuable tool to understand the evolution of the native fauna (Gasull, 1972; Altaba, 1993). In the early Pleistocene, a remarkably diverse fauna lived in the southern group (Eivissa and Formentera), also known as the Pytiusic Islands (Paul, 1984; Paul & Altaba, 1992). A mass extinction event left a depauperate biota and the ecological conditions changed towards those of oceanic islands (Alcover et al., 1994). In the northern group (Mallorca and Menorca, also known as the Gymnesics), there is no evidence of such a radical change, and the pre-human fauna largely survived throughout the Quaternary (Cuerda, 1989; Altaba, 1993).

Throughout the Balearics, the most recent levels (Wurmian, or last glacial) contain the extant native land snail species, plus a few that apparently became extinct in the postglacial or even the Holocene. Among these extinctions, a few Pytiusic endemics were probably extirpated through the ecological changes triggered by human occupation. In the northern island group, only two species in these top layers have stratigraphic value because they appear to be missing today; one belonging to the family Hygromiidae and one to the Enidae likely disappeared before the arrival of humans (Cuerda, 1959; Gasull, 1964; Altaba, in press). In this paper a third Gymnesic extinct land snail species, which apparently existed in Mallorca until the latest Pleistocene, is described.

Material and methods

A shell exhibiting distinctive traits was found by Lluís Gasull in 1963, at a roadcut in the outskirts of the city of Palma. The building of new houses in the hillside near the castle of Bellver exposed a late Pleistocene paleosoil where this whitened shell had been preserved within a matrix of hardened clay. Two other specimens were found at a comparable site in Mallorca's northern coast. All three were identified as *Oestophora barbula* (Rossmässler, 1838), providing the only reports of this species in the Balearic archipelago (Gasull, 1963; Cuerda, 1989). Remarkably, *O. barbula* lives in the western half of the Iberian Peninsula (an area subject to strong climatic influence from the Atlantic ocean), but this has not prevented mentioning the fossils from Mallorca as proof of a previously wider distribution for this species (Puente, 1996). Outside of

Atlantic drainages, *O. barbula* has its easternmost stations in an isolated locality in the Pyrenees in northwestern Aragon (Prieto, 1986). The species has also been collected at three sites in the mountains of easternmost Andalusia and southwestern Murcia (Hidalgo, 1875; Ortiz de Zárate, 1962; Gasull, 1975). These stations are located in subdesertic areas, and the specimens found there (not studied by Puente, 1996) cannot be ascribed to this species (unpubl. obs. on the Gasull specimens). *O. barbula* was also mentioned from northeastern Catalonia (Ortiz de Zárate, 1962), but this was based on a single shell purportedly collected in a well-known area (Banyoles), thus constituting an obviously erroneous record. This taxon has never been found alive anywhere in the Balearics, and it is unlikely that it could survive under the Mediterranean conditions prevailing there since the Pliocene. The identity of the Mallorcan specimens was questioned in the context of the fossil land snail fauna found in the Pytiusics (Paul & Altaba, 1992), but as no further studies have been reported, the biogeographic puzzle remains.

The Gasull collection was donated by his widow to the Museu de Zoologia in Barcelona (MZB, now part of the Museu de Ciències Naturals de la Ciutadella). A partial revision of the materials housed in this collection revealed two further specimens of the same species. They were collected in 1965 at a roadcut very close to the initial finding, and although fragile, they exhibit a remarkably fine state of preservation. These two specimens collected near Bellver remained well kept and catalogued, yet unstudied for four decades.

Prior to revising their identity, these shells had to be better cleaned. Initially some loose clay was removed after immersion in water for three days. However, in order to eliminate the hardened clay covering the aperture and much of the delicate shell surface, they were subsequently treated with ultrasound for short intervals, with careful rinsing at every step. Given the fragility of the specimens, this procedure caused some mechanical damage. The cleaning process was halted as soon as the diagnostic traits were clearly visible, and before the damage became extensive.

Extensive collecting in a large number of Quaternary sites throughout the Balearics during the last 15 years has not yielded a single specimen of this species. The area around Bellver is now completely built up, and there are no remnants available of the fossiliferous paleosoils mentioned by Gasull. The other specimens mentioned by Gasull (1963) and Cuerda (1989) were housed in the Cuerda collection, now partially kept at the Societat d'Història Natural de les Balears in Palma, but they have not been located. Thus, only the two specimens in Barcelona have been studied.

In the absence of anatomical data, the assessment of taxonomic affinities for a gastropod fossil needs to be based solely on the preserved shell. Careful preparation and detailed observation appear to have been absent from the early identifications by Gasull and Cuerda. However, this shortcoming was

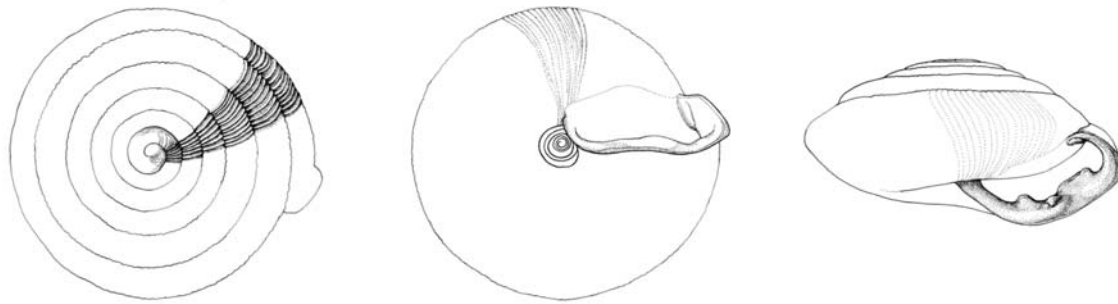


Fig. 1. Holotype of *Darderia bellverica*, n. gen., n. sp. from Bellver in Mallorca (MZB 84–6550A). Maximum diameter is 10.1 mm. Not shown are tiny remnants of encrusted hardened soil on the spire and within the umbilicus, and a crevice in the lower surface.

Fig. 1. Holotipo de *Darderia bellverica*, gen. n., sp. n. de Bellver en Mallorca (MZB 84–6550A). Su diámetro máximo es de 10,1 mm. No se muestran los pequeños restos de suelo endurecido incrustados sobre la espira y en el interior del ombligo, ni una grieta en la superficie inferior.

due mostly to the limited equipment available to these scientists working in severely adverse conditions. Their merit remains, highlighted by their explorations, findings and patient gathering of data and specimens.

Results

The two specimens studied are very similar to each other and differ from any extant or fossil species. The general shape, sculpture and aperture traits confirm it is a helicodontid. This group of land snails includes several genera with one or a few species each (Hesse, 1918; Germain, 1930; Gittenberger, 1968; Schileyko, 1991; Prieto et al., 1993; Arrébola et al., 2006). The group is considered here as a family of Helicoidea, following the phylogenetic analysis of Steinke et al. (2004) and the classification proposed by Nordsieck (1987) and Bouchet & Rocroi (2005). Being unable to fit the Mallorcan fossils into any known taxon below the family level, they are herewith described as a new genus and species.

Phylum Mollusca Cuvier, 1795
 Classis Gastropoda Cuvier, 1795
 Ordo Pulmonata Cuvier in Blainville, 1814
 Superfamilia Helicoidea Rafinesque, 1815
 Familia Helicodontidae Kobelt, 1904

Darderia, n. gen.

Diagnosis

A medium-sized helicodontid with about 6 tumid, tightly coiled whorls, dome-shaped spire, shallow but incised suture, obtuse peripheral keel, and moderately wide, slightly eccentric umbilicus; aperture inclined forward, narrow and oblique trapezoidal,

with low angular tooth and sinuous, reflected, thickened peristome preceded by a conspicuous constriction and carrying 1–5 infrapalatal denticles of various shapes and orientation; teleoconch with numerous strong, regular, backwardly curving riblets, becoming obsolete on the lower side, and very thin, dense longitudinal lines and widely scattered hair pits in between; protoconch with simple wrinkles reminiscent of the teleoconch riblets and very thin spiral lines.

Darderia has a general habitus similar to *Oestophora* Hesse, 1907, but differs in having much more developed apertural armature, protoconch microsculpture lacking distinctive spiral incised lines, and showing hair pits in the teleoconch. Other helicodontid genera have very different aperture and/or spire.

Species included

Darderia bellverica sp. nov. from the late Pleistocene of Mallorca, and *D. dentata* (Paul, 1984) from the Plio–Pleistocene of the Balearic Islands and perhaps Sardinia (see below).

Etymology

In memory of Emili Darder i Cànaves, mayor of Palma from 1933 to 1937. A physician and a politician, he introduced tremendous improvements in public health, education, culture, water supply, housing and labor conditions. He was imprisoned and murdered at the onset of the Spanish Civil War in the Bellver castle, very close to the site where the type specimens were found.

Darderia bellverica n. sp.

Description

Shell (fig. 1) lenticular, of about 1 cm maximum diameter. The spire is low dome-shaped and con-

sists of six somewhat tumid, tightly coiled whorls separated by a distinctly incised yet shallow suture; the last whorl is slightly descending and thus appears narrower in top view; the periphery is keeled, forming an obtuse angle somewhat above the middle of the last whorl. The umbilicus is moderately wide, spanning 1/8 of the maximum diameter; it is conic and slightly eccentric, especially so by the last whorl.

The aperture is inclined forward, forming an angle of about 50° with the coiling axis; it is preceded by a marked constriction, and is narrow and oblique, having a trapezoidal shape; it is armed with a low angular tooth and several palatal denticles: two basally fused into a nearly lamellar structure just under the peripheral keel; one prominent at the lower angle, a small one between the previously mentioned, and a more bulky, blunt, forward protruding thickening at the lower angle. The peristome is rather sinuous, well reflected, and conspicuously thickened.

The teleoconch surface is covered by a dense sculpture consisting of numerous strong, regular, backwardly curving riblets; these become obsolete on the lower side, especially in the end 3/4 of the last whorl; in between, there is a very fine sculpture of longitudinal lines and widely scattered hair pits. The protoconch has one whorl and is ornamented with two kinds of surface sculpture: radial, backwardly curving, simple wrinkles reminiscent of the teleoconch riblets, but lower and more inclined; and very thin spiral lines, some of which are fused into very fine ridges on the outer side.

Type material

Holotype (MZB 84–6550A) and paratype (MZB 84–6550B) in the malacological collection of the Museu de Ciències Naturals de la Ciutadella, in Barcelona. The paratype is almost identical to the holotype, although it has a slightly less developed basal tooth, and has a narrow fracture in the last whorl.

Type locality

Late Pleistocene paleosoil near the surface, at the crossroad of Andrea Doria and Son Armadans streets, near the main entrance to the park of Bellver forest, in Palma de Mallorca (Balearic Islands, Spain); 15 II 1965; L. Gasull, col. UTM 31S DD 6780; 35 m a.s.l.

Etymology

The species name is derived from Bellver ("lovely sight"), a hill overlooking the city of Palma from the southwest and crowned by a round gothic castle. The castle and surrounding forest became a public property and park under Darder's administration.

Common names

It is proposed to call this species "Darder's toothed snail" in English, "caracol dentado de Darder" in Spanish, and "caragol denticulat d'en Darder" in Catalan.

Range

Known only from the island of Mallorca, in the west–central part of the Serra de Tramuntana mountain range and its southern foothills at Serra de na Burguesa, near Palma.

Comparison with similar taxa

Darderia bellverica n. sp. cannot be confused with any of the living or fossil species of land snails known in the Balearics. Likewise, there is no clear similarity to any species known from the neighboring mainland, including various restricted–range helicodontid species (Gasull, 1975; Altaba, 1991; Puente et al., 1998; Martínez–Ortí & Robles, 2003). It is only similar to the fossil *Oestophora dentata* Paul, 1984 from the island of Eivissa (Paul, 1984). Although this species has a different shape and apertural traits, and is slightly larger, it shares various traits with the new species such as the inclined aperture and microsculpture. Therefore, it is proposed to transfer *O. dentata* into the new genus, as *Darderia dentata* (Paul, 1984). Older fossils from Menorca, attributed to the genus *Oestophora* and presumed to be of Messinian age (Quintana, 1995), although incompletely known and possibly dating from the Plio–Pleistocene, can be attributed to *D. dentata*. The specimens identified as *Oestophora* from the Quaternary of Sardinia (Esu, 1978 also) probably belong to *Darderia*, and can be assigned with caution to *D. dentata*. However, this adscription is only tentative, given the fragmentary nature of the Sardinian materials (not studied here).

Discussion

A point needs to be made about the decision to create a new genus and species for the Mallorcan specimens. They cannot be placed within any known species, either Recent or fossil, without stretching the morphological variation of the recipient taxon far beyond the limits known in extant species. Likewise, the new species cannot be allocated into any of the currently recognized genus–level taxa, without considerably blurring the definition of the existing taxonomy. Describing a new genus is not convenient simply because its hypothesized relationships are not with *Oestophora* or any other superficially similar taxa. The dilemma between multiplying genera and moving species among existing genera is not a purely nomenclatural problem, but a fundamental issue if our goal is to know the history of life through a coherent, logical classification based on monophyletic groupings (Cela–Conde & Altaba, 2002). The description of a new genus and species appears herewith justified under the premises of building a taxonomy that aims at reflecting cladistic relationships and being phylogenetically informative. The overall shape of *Darderia bellverica* is intriguingly reminiscent of *Lindholmiola* Hesse, 1931, a taxonomically iso-

lated helicodontid genus comprising several species from the Eastern Mediterranean region. The only other genus belonging to the Lindholmiolinae Schileyko, 1978, is *Atenia* Gittenberger, 1968, a rare, monotypic endemic of eastern Iberia, whose aspect and aperture are quite distinctive and unusual. Nevertheless, the protoconch microsculpture of *Atenia* (Martínez-Ortí, 2006) is apparently identical to that of *Darderia*, probably indicating phylogenetic proximity. Indeed, the low angular tooth of *Darderia*, a feature absent from other helicodontids, could be homologous to the parietal lip of *Atenia*. The latter feature is a homoplasy (Gittenberger, 1968) shared with *Trissexodon* Pilsbry, 1895, which belongs to a different subfamily, the Trissexodontinae (Nordsieck, 1987). However, the parietal lip of *Trissexodon* is continuous with and can be interpreted as a prolongation of its flaring peristome. Thus, the mere presence of a parietal tooth or lip may have a low phylogenetic value; yet, the existence of such an armature extending from the angular area, in addition to the protoconch characters, may indicate a common ancestry of *Atenia* and *Darderia* within the Lindholmiolinae.

The biogeographic position of *Darderia bellverica* in Mallorca, and of *D. dentata* in older sites in Eivissa, Menorca and (if it is the same species) Sardinia, may not be as puzzling as previously thought. Their probable relatedness to the living Lindholmiolinae might fill a geographic gap between the two genera currently placed in this subfamily and living at opposite ends of the Mediterranean basin. If this systematic position is correct, *Darderia* may have its origin in the continental fauna present in the Balearic Promontory when it became detached from the Corso-Sardinian block. This area was located 30 My ago between the Iberian eastern edge and the Alps, prior to the formation of the current complex geography of the eastern Mediterranean. This biogeographic centrality would be in accordance with the patterns observed in other ancient taxa with limited dispersal abilities (Paul & Altaba, 1992; Oosterbroek & Arntzen, 1992; Altaba, 1998; De Jong, 1998).

Whether *Darderia bellverica* is still extant is open to further explorations. In spite of intense searches throughout the Balearics during the last 30 years, it has not been found live anywhere. However, the profound ecological changes that have taken place in Mallorca during the Holocene and especially in recent decades (Altaba & Ponsell, 2001) may have pushed it into remote refugia. It is conceivable that this little snail followed the path of the ferreret, or Balearic midwife toad (*Alytes muletensis* Sanchiz & Adrover, 1977), an endemic with a long history of isolation that was first discovered as a fossil and survives only in a few inaccessible canyons (Hemmer & Alcover, 1984; Altaba, 1997). To date *D. bellverica* has been found only in rugged terrain, and Paul (1984) considered the traits of *D. dentata* to indicate a humid environment.

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