

**New species of *Canariella* (Gastropoda: Hygromiidae)
from the Pliocene of Gran Canaria, Canary Islands**

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The genus *Canariella* is endemic to the Canary Islands. Curiously, it was never found on the central island of Gran Canaria but on all other islands to the east (Lanzarote, Fuerteventura) and west (Tenerife, La Gomera, La Palma, El Hierro). This zoogeographic paradox can now be solved. Here we report on the discovery of a Pliocene gastropod fauna on Gran Canaria that yielded remains of four previously undescribed species of *Canariella*. Species of this genus once inhabited all islands of the archipelago but vanished from Gran Canaria presumably at the end of the Pliocene.

Key words: Stylommatophora, Hygromiidae, *Canariella*, taxonomy, biogeography, Pliocene, new species, Atlantic Islands.

INTRODUCTION

Extant representatives of the genus *Canariella* Hesse, 1918 are endemic to the Canary Islands. Several fossil taxa from the Eocene and Oligocene to Pleistocene of Europe were assigned to this genus (Wenz, 1924; Pfeffer, 1929; Zilch, 1960; Schlickum, 1976; Esu, 1984) but their relationships with the Canarian species are not clear. The extant species were summarized by Ibañez et al. (2006), with additions by Alonso et al. (2006). At least 19 species are known to live in the Canary Islands, 6 on Tenerife (perhaps more, see Bank et al., 2002), 7 on La Gomera, 1 on La Palma, 2 on El Hierro, 2 on Fuerteventura. One additional species occurs both on Fuerteventura and Lanzarote. In addition, two extinct species were recorded (one named) from the Miocene of Lanzarote (Gittenberger & Ripken, 1985). Gran Canaria is the only major island without a record of *Canariella*. Although the gastropod fauna of this island was thoroughly studied (Ibañez et al., 1997), no trace of *Canariella* was found so far, not even in Holocene sediments that often preserve shells of taxa extinct in historical times.

In 1989 the senior author accompanied Dr Luis Felipe López-Jurado, a resident biologist of Las Palmas, to a site where Macau-Vilar (1958) once discovered turtle eggs in "Miocene" sediments. At the time of our visit the former pit was used as a water basin and was thus no longer accessible. However, on a nearby slope in a village called "Hornos del Rey" we found an abandoned mine with rich travertine banks. It soon became clear that this was the place where Karl von Fritsch (1838-1906), on his voyage to the Canary Islands in 1863 (Fritsch, 1867), had taken shells and casts of fossil gastropods reported by Mousson (1872). Between 1989 and 2007 we paid several visits to this mine and accumulated representatives of a rich fauna of land and freshwater gastropods, to be documented in full at a later date. Based on the composition of this fauna, and by comparison with

(largely unpublished) Miocene and Pliocene faunas from Lanzarote and Fuerteventura, we follow Hirsch & López-Jurado (1987) and Hutterer et al. (1998) in considering the age of the fossil-bearing sediments as Pliocene. In this first report we document the former presence of genus *Canariella* in Gran Canaria and describe four new species.

Methods and terminology follow previous reports on this genus (Groh et al., 1994; Ibañez et al., 1995). Whorl counts were performed as previously described (Kerney & Cameron 1979). The comparison of the fossils with shells of extant species was mainly based on material from our working collections (CGH, CHB). The following acronyms are used: AIT, Alonso & Ibañez collection, Department of Animal Biology, University of La Laguna, Tenerife, Canary Islands, Spain; CGH, K. Groh private collection, Hackenheim, Germany; CHB, R. Hutterer private collection, Bonn, Germany; NMB, Naturhistorisches Museum, Bern, Switzerland; RGM, National Museum of Natural History (formerly Rijksmuseum van Geologie & Mineralogie), Leiden, The Netherlands; SMF, Forschungsinstitut Senckenberg, Frankfurt/Main, Germany; TFMC, Museo de Ciencias Naturales de Tenerife, Canary Islands, Spain.

SYSTEMATICS

Family Hygromiidae Tryon, 1866

Subfamily Canariellinae Schileyko, 1991

Canariella Hesse, 1918.

The four species described below are assigned to the genus *Canariella* because they exhibit a combination of shell characteristics found in many of the extant species, such as a discoidal or depressed shell, the presence of a keel, an open umbilicus, and a granulated and/or ribbed shell surface. Some species of the helicid genus *Hemicycla* Swainson, 1840, now also endemic to the Canary Islands, are superficially similar to the larger *Canariella* described in this study. Some *Hemicycla* species display a depressed shape and angulated to keeled periphery, as well as a similar surface sculpture. However, these species are either not umbilicated (*H. berkeleyi* (R.T. Lowe, 1861), *H. digna* (Mousson, 1872)), or are only narrowly umbilicated, similar to some distinct coastal forms of *H. bidentalis* (Lamarck, 1822) in which the sculpture is also dominated by strong ribs, or they have significantly fewer whorls and a partly covered umbilicus, such as *H. quadricincta* (Morelet, 1869) from La Gomera.

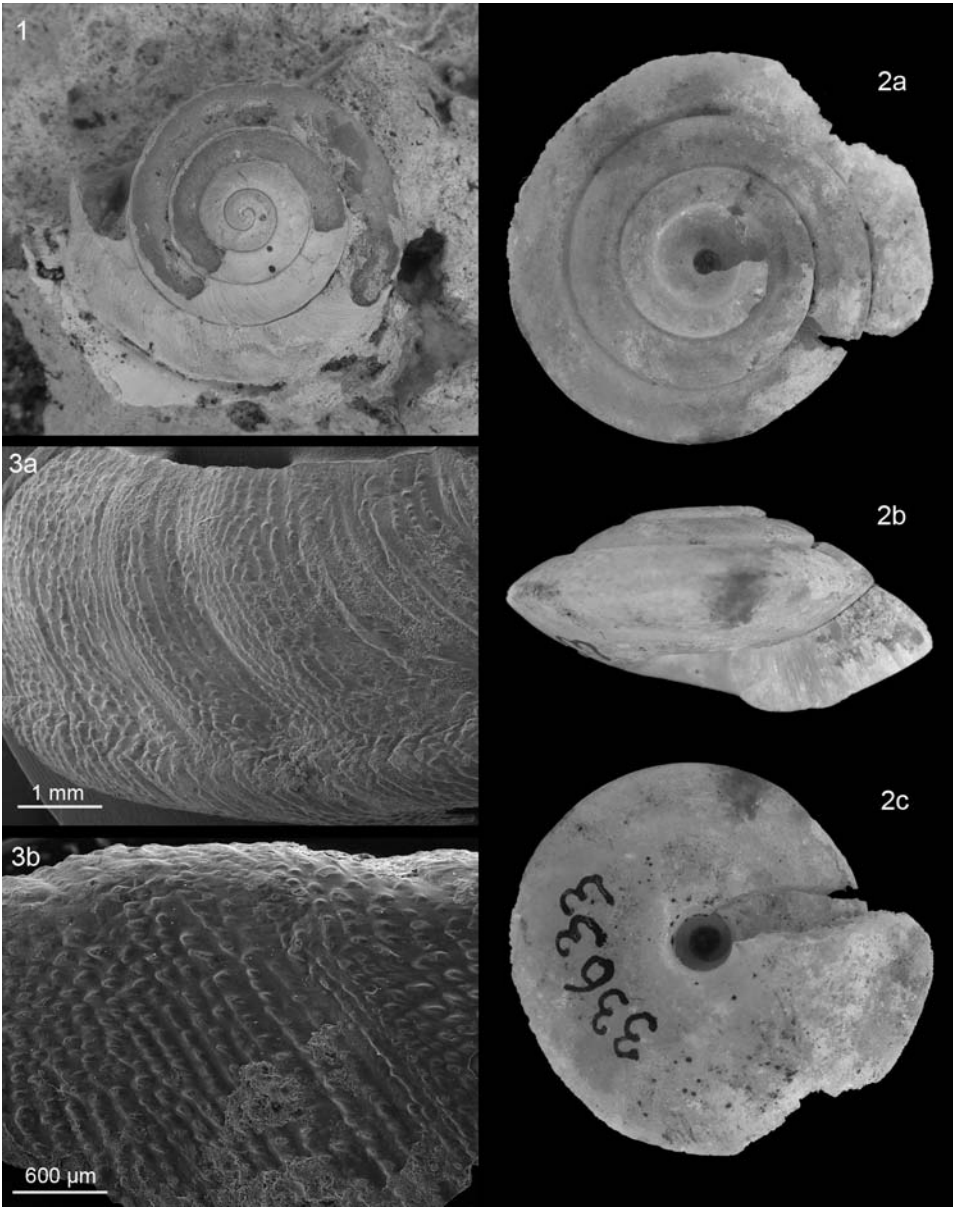
Canariella gittenbergeri spec. nov. (figs 1-3)

Material. – Fossil shell embedded in matrix, part of the shell surface preserved, terminal part of body whorl missing; leg. R. Hutterer 08.10.2007 (holotype, SMF 331 476); fairly complete nucleus, protoconch and part of aperture broken off, leg. K. von Fritsch 1863 (paratype, SMF 33 633); shell fragment in matrix with aperture preserved, leg. R. Hutterer 15.05.1990 (paratype, CHB).

Locus typicus. – Spain, Canary Islands, Gran Canaria, Valle de Jinamar, Hornos del Rey (UTM grid DS5801), travertine quarry.

Stratum typicum. – Pliocene, following Hirsch & López-Jurado (1987).

Derivatio nominis. – This striking species is named in honor of our friend and colleague Dr. Edmund Gittenberger in recognition of his work on the malacology of the Canary Islands.



Figs 1-3. *Canariella gittenbergeri* spec. nov.; 1, holotype (SMF 331 476) and 2, paratype (SMF 33 633), 3, paratype (CHB), surface of body whorl in dorsal and ventral view. Fig. 1 & 2 approx. $\times 2$; Figs 3a & 3b see scale

Diagnosis and description. – Large species of *Canariella* with a thickened discoidal shell, with a medium high domed spire of 4 $\frac{3}{4}$ to 5 narrowly coiled and keeled whorls; keel margin narrow, about 10% of total width of the last whorl; umbilicus slightly eccentric; aperture quadrangular, significantly angled at the shell periphery and smoothly rounded at its lower edge; visible surface of protoconch smooth, teleoconch covered with fine and radial riblets formed by irregularly packed lines of granules (4-5 lines per mm); ventral granules more regularly dispersed than dorsal ones (fig. 3); ribs are more prominent towards the aperture; lip somewhat thickened.

Measurements of holotype (SMF 331 476) and paratype (SMF 33 633): A (shell height) 6.5/8.8, B (shell diameter) 18.75/18.3, C (height of last whorl) -/7.5, D (height of aperture) -/5.6, E (length of aperture) -/4.3, F (width of aperture) -/8.5, G (umbilicus diameter) -/3.0.

Remarks. – In size, *C. gittenbergeri* spec. nov. is only similar to three species endemic to La Gomera, *C. discobolus* (Shuttleworth, 1852), *C. squamata* Alonso, Ibañez & Ponte-Lira, 2001, and *C. tenuicostata* Alonso, Ibañez & Ponte-Lira, 2001 (figured in Ibañez et al., 1995, and Alonso et al., 2001). None of these species shows a similar granulation of the shell surface as in the new species (fig. 3).

Distribution. – *Canariella gittenbergeri* spec. nov. is only known from its type locality.

Canariella lopezjuradoi spec. nov. (fig. 4)

Material. – An almost complete shell with intact surface, protoconch and first whorl broken and dislocated in matrix, aperture damaged; leg. R. Hutterer 15.05.1990 (holotype, SMF 331 477).

Locus typicus. – Spain, Canary Islands, Gran Canaria, Valle de Jinamar, Hornos del Rey, travertine quarry.

Stratum typicum. – Pliocene.

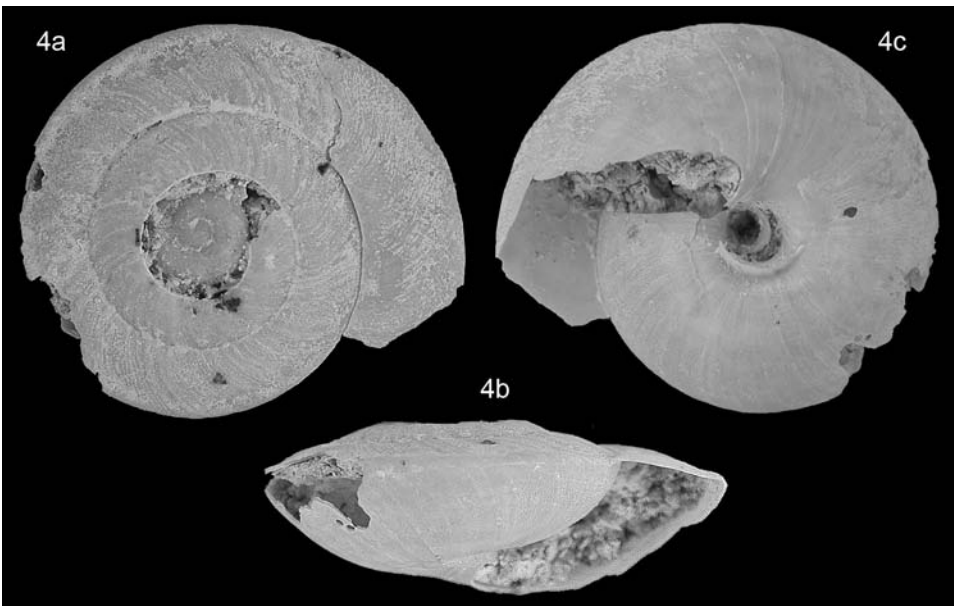


Fig. 4. *Canariella lopezjuradoi* spec. nov., holotype (SMF 331 477); approx. $\times 2.5$.

Derivatio nominis. – Named for Dr. Luis Felipe López-Jurado, biologist at the University of Las Palmas, whose investigations led to the rediscovery of the old quarry “Hornos del Rey”.

Diagnosis and description. – Medium to large species of *Canariella* with discoidal shell, with an almost flat spire of 4 ¼ keeled, overlapping and fast growing whorls; keel margin broad, about 20% of total width of the last whorl; umbilicus slightly eccentric; quadrangular aperture narrow and strongly angular at the shell periphery (lip not preserved); visible surface of protoconch smooth, teleoconch covered with fine and radial riblets formed by irregular lines of granules (ca. 10 lines per mm); ventral riblets slightly more regular than dorsal ones.

Measurements of holotype: A (shell height) 5.89, B (shell diameter) 14.32, C (height of last whorl) 5.56, D (height of aperture) 4.72, E (length of aperture) and F (width of aperture) not measurable, G (umbilicus diameter) 2.45.

Remarks. – In size and shape *C. lopezjuradoi* spec. nov. is similar to *C. planaria* (Lamarck, 1822), a species endemic to Tenerife (Ibañez et al., 1995, Alonso et al., 2003). This is distinguished from that species by a flatter spire, and by the strong granulation of the shell surface. Shells of *C. planaria* have almost no granulation. The shell of *C. gittenbergeri* spec. nov. is also larger, with a taller spire and narrower whorls. In the holotype of *C. lopezjuradoi* spec. nov., about ¼ of the body whorl is missing; the species is thus larger than the holotype and therefore probably belongs into the category of large species, as defined by Ibañez et al. (1995).

Distribution. – *Canariella lopezjuradoi* spec. nov. is only known from its type locality.

Canariella mecoi spec. nov. (fig. 5)

Material. – Fragments of shell consisting of the protoconch and first whorl, part of the body whorl, and part of the basal socket; leg. R. Hutterer 15.05.1990 (holotype, SMF 331 478).

Locus typicus. – Spain, Canary Islands, Gran Canaria, Valle de Jinamar, Hornos del Rey, travertine quarry.

Stratum typicum. – Pliocene.

Derivatio nominis. – Named for Dr. Joaquin Meco, University of Las Palmas, in recognition of his palaeontological work in the Canary Islands.

Diagnosis and description. – Small species of *Canariella* with discoidal shell, with a very flat spire of estimated 4 to 5 strongly keeled and narrow whorls (fig. 5a); keel margin moderately broad, about 14% of total width of the last whorl; visible surface of protoconch smooth, teleoconch covered with prominent radial riblets (ca. 5 per mm); ventral riblets indistinct; surface of shell not granulated (fig. 5b).

Measurements of holotype: A (shell height) est. 3-4, B (shell diameter) 11.9 mm.

Remarks. – The single specimen of *C. mecoi* spec. nov. broke when removed from a piece of travertine. The remaining fragments clearly document a very flat, sharp-keeled species of *Canariella*. The sharp keel and smooth, ribbed dorsal surface reminds on the extant *C. pontelirae* Hutterer, 1994, a species described from Quaternary fossils (Hutterer, 1994) and later found alive in Tenerife (Ibañez et al., 2006). Also *C. bimbachensis* Ibañez & Alonso, 2002 from El Hierro is somewhat similar in size and shape (Ibañez et al., 2002). However, both species have a higher spire, and differ in the frequency of riblets on the teleoconch (3-4 per mm in *C. pontelirae*, 2 strong ribs per mm in *C. bimbachensis*). *Canariella ronceroi* Ponte-Lira, 2002 (La Gomera) is also similar but its shell is larger, the body whorls are strongly overlapping, and the shell ornamentation (1-2 prominent ribs per mm) is different (see Ibañez et al., 2002, fig. 2). The latter three species were included in a new sub-

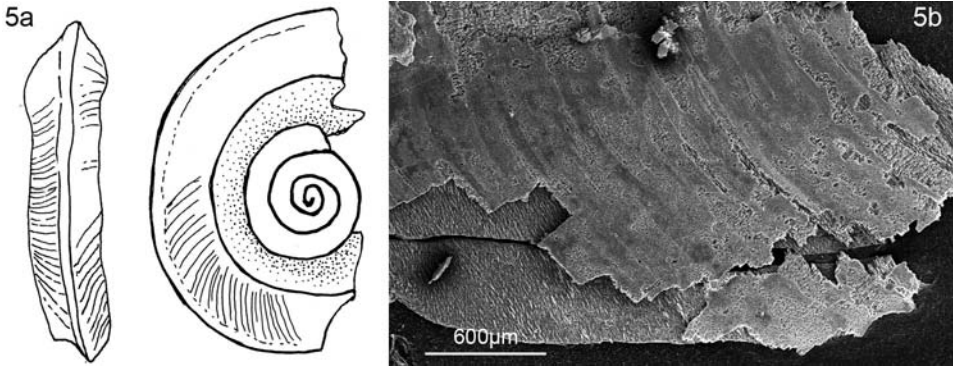


Fig. 5. *Canariella mecoi* spec. nov.; 5a left: drawing of the holotype (SMF 331 478), approx. $\times 4$; 5b right: periphery of the ultimate whorl, see scale.

genus *Gara* by Ibanez et al. (2002). Whether *C. mecoi* spec. nov. belongs to this subgenus is a matter of speculation, although not unlikely.

Distribution. – *Canariella mecoi* spec. nov. is only known from its type locality.

Canariella molinae spec. nov. (figs 6, 7)

Material. – Fairly complete shell, surface well preserved, leg. R. Hutterer 12.07.1989 (holotype, SMF 331 479); 4 almost complete shells, partly covered by matrix (paratypes AIT/1, TFMC/1, RGM 550331/1, NMB/1, CHB/1), 5 juvenile or fragmentary shells (CGH/1, CHB/3), all leg. R. Hutterer between 1989 and 2007.

Locus typicus. – Spain, Canary Islands, Gran Canaria, Valle de Jinamar, Hornos del Rey, travertine quarry.

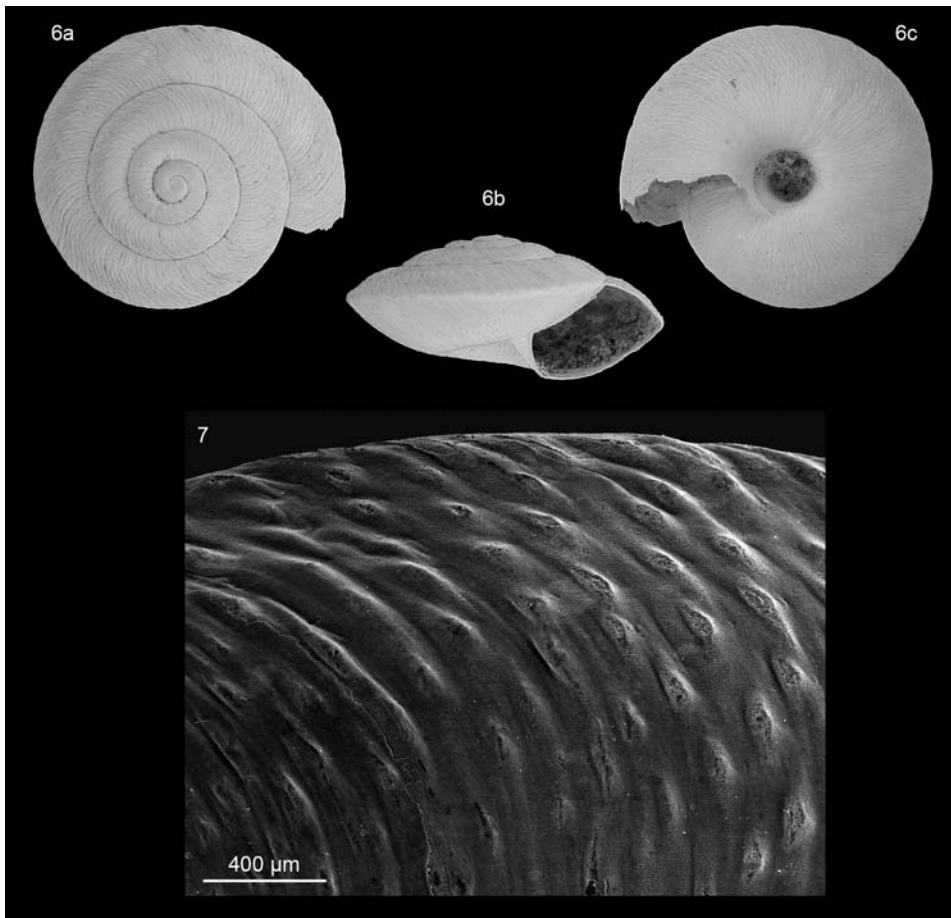
Stratum typicum. – Pliocene.

Derivatio nominis. – Named for Mrs. Obdulia M. Molina, biologist of Gran Canaria, who accompanied us at various times in the field in search of snails and shrews.

Diagnosis and description. – Small species of *Canariella* with a depressed globose shell, with a flattened spire of $4 \frac{1}{4}$ rounded, non-overlapping whorls; body whorl angular, umbilicus large and slightly eccentric; aperture quadrangular, significantly angulated at the shell periphery; visible surface of protoconch with fine granulation, teleoconch covered with fine radial riblets formed by regular lines of granules (9 lines per mm; fig. 7); ventral riblets similar to dorsal ones.

Measurements: A (shell height) 4.1-5.6, B (shell diameter) 9.6-10.3, C (height of last whorl) 3.9-4.0, D (height of aperture) 3.3-3.4, E (length of aperture) 3.7-3.9, F (width of aperture) 4.2-4.3, G (umbilicus diameter) 1.9-2.0 ($n = 2-6$).

Remarks. – *C. molinae* spec. nov. is much smaller than *C. gomeræ* (Wollaston, 1878) (holotype figured in Neubert & Gosteli, 2005) and *C. tillieri* Alonso, Ibañez & Ponte-Lira, 2001, both of which are similar in shape. The Tertiary *C. orzolaë* Gittenberger & Ripken, 1985 from Lanzarote is significantly smaller, has a more convex shape with an only inconspicuously angled periphery and an umbilicus partly covered by the significantly reflected columellar part of the lip (fig. 9). The shell ornamentation of *C. molinae* spec. nov. (fig. 7) reminds of several *Canariella* species of the subgenus *Alvaradoa* (Groh et al., 1994). While the phylogenetic relationship between the new species and this group remains obscure,



Figs 6-7. *Canariella molinae* spec. nov.; 6, holotype (SMF 331 479), approx. x 6; and 7, paratype (CHB), dorsal surface of body whorl, see scale.

this morphological similarity may indicate that *C. molinae* spec. nov. had a shell covered by small hairs, as is common in species of subgenus *Alvaradoa*.

Distribution. – *Canariella molinae* spec. nov. is only known from its type locality.

DISCUSSION

The new records confirm that the genus *Canariella* was once widely distributed in the Canary Islands, and that it was already diverse in the Pliocene of Gran Canaria (fig. 8). Besides *Canariella orzolae* (fig. 9) and another unnamed species from the Miocene of Lanzarote (Gittenberger & Ripken, 1985), the new species from the Pliocene of Gran Canaria represent the earliest occurrence of the genus in the Canary Islands west of Lanzarote. It is conceivable that the genus spread from Gran Canaria to the western

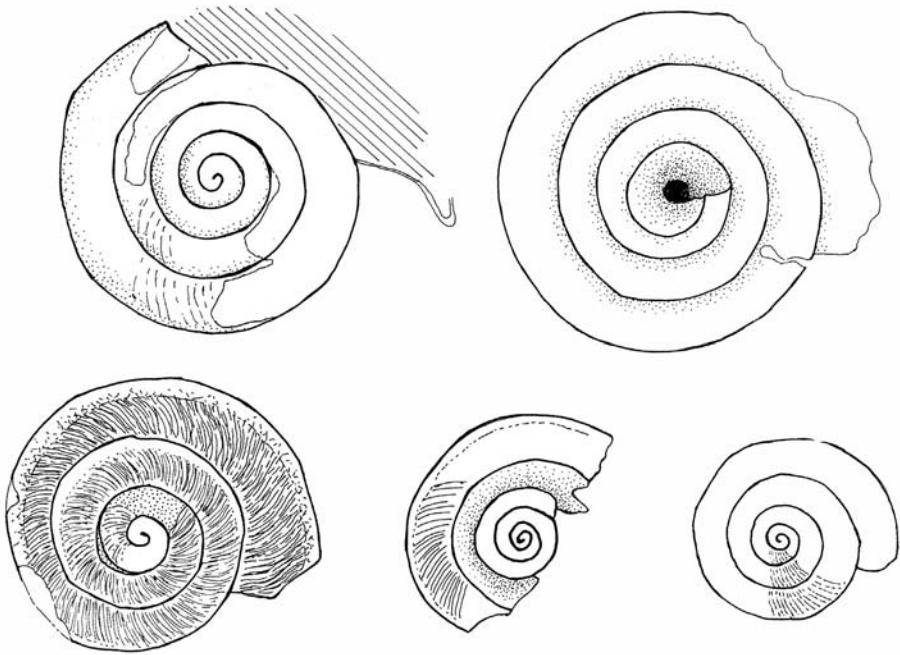


Fig. 8: Comparison of the four new species in dorsal view, all enlarged to the same scale. Top: *Canariella gittenbergeri* spec. nov. (holotype left and paratype right), bottom from left to right: *C. lopezjuradoi* spec. nov., *C. mecoi* spec. nov., and *C. molinae* spec. nov.

islands, particularly to Tenerife and La Gomera where most species occur today (Alonso et al., 2003, 2006; Groh et al., 1994; Ibañez et al., 1995, 1997, 2002, 2006; Ponto-Lira et al., 1997). However, Tertiary fossil sites are rare in the Canary Islands particularly in Gran Canaria (Macau-Vilar, 1958; Schmincke, 1967, 1968), and therefore only a small part of the former gastropod diversity is known. It remains a mystery why no extant *Canariella* species occur in Gran Canaria. The fact that no shell remains are found in the numerous Quaternary deposits of the island (Meco & Stearns, 1981) indicates that the genus already became extinct at the end of the Pliocene.

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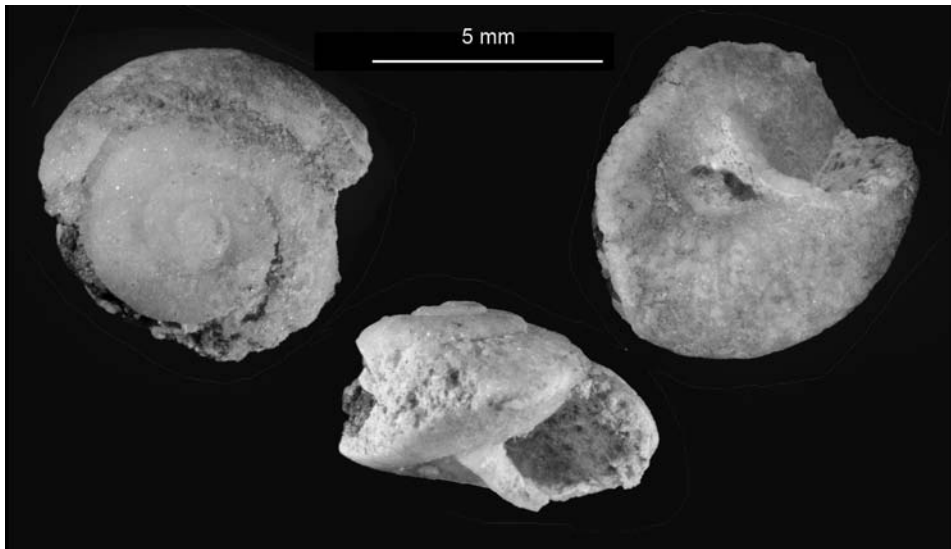


Fig. 9: *Canariella orzolae* Gittenberger & Ripken, 1985, holotype (RGM 396179) from the Tertiary of Orzola, Lanzarote. Scale = 5 mm.

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