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Two new species of *Cryptella* (Gastropoda: Parmacellidae) from Lanzarote and Alegranza, Canary Islands[1])

R. Hutterer & K. Groh

Abstract. Shell-bearing slugs of the Canary Islands, so far assigned to the genus *Parmacella*, were studied. The taxon *Cryptella*, currently considered as a subgenus of *Parmacella*, is regarded as a full genus, and two new species from Lanzarote and Alegranza are described, thus raising the number of Canarian taxa of *Cryptella* to seven. With a total of 8 species (*Cryptella* 7, *Parmacella* 1) the Canary Islands constitute one of the centers of diversity of the family Parmacellidae.

Key words. Gastropoda, Pulmonata, Parmacellidae, *Parmacella*, *Cryptella*, new species, zoogeography, Canary Islands.

Introduction

Shell-bearing slugs assigned to the genus *Parmacella* Cuvier, 1804 are currently distributed in the Caucasus (USSR, Iran), southern Europe (Spain, S. France), northern Africa (Morocco, Algeria, Libya) and the Canary Islands. Since 1833, when Webb and Berthelot described *Cryptella canariensis*, only one species was recognized to occur in these islands. However, a few years of systematic exploration of the gastropod fauna of the Canaries have increased the number of species from one to six (Alonso et al. 1985, Hutterer 1990, Groh et al. 1991). In this paper we describe two further species which have recently been discovered, and reconsider the rank of *Cryptella* Webb & Berthelot, 1833. The new taxa were first recognized by their shell morphology and subsequently their species status was corroborated by anatomical studies. With eight species so far, the Canary Islands form a center of diversity of the family Parmacellidae.

Material and Methods

This paper supplements previous studies on this group (Hutterer 1990, Groh et al. 1991) and the methods used have been described therein. New material was collected on Lanzarote, Graciosa and Alegranza from April 1990 to May 1991. Voucher specimens of the new materials have been deposited in the following collections (with acronyms in parentheses): Collection Alonso-Ibáñez, Departamento de Zoologia, Universidad de La Laguna, Tenerife (AIT), Museo de Ciencias Naturales de Tenerife (TFMC), Muséum National d'Histoire Naturelle, Paris (MNHN), Senckenberg-Museum, Frankfurt (SMF), Zoologisches Museum der Universität Zürich (ZMZ), Nationaal Natuurhistorisch Museum, Leiden (NNM), and in the study collections of K. Groh, Darmstadt (CGD) and R. Hutterer, Bonn (CHB).

[1]) Notes on the Malacofauna of the Canary Islands, no. 22; no. 21: Nuevas especies de moluscos terrestres (Gastropoda, Pulmonata) de la isla de Alegranza (Archipiélago Canario). — Bonn. zool. Beitr. 42: 325—338, 1991.

Systematic Part

Genus *Cryptella* Webb & Berthelot, 1833

Type species: *Cryptella canariensis* Webb & Berthelot, 1833, by original designation.

Emended diagnosis: Small shell-bearing slugs confined to the Canarian Archipelago. Body slender, sole narrow. Mantle broad, extending over almost half of the body length; in its posterior part the protoconch of the shell is visible. Embryonic shell not integrated into the spathula, not even in adult shells. Spathula narrow, elongated, and only slightly convex. Atrium without accessory appendices. Spermatophore simply curved, not spirally. Basal plate of central tooth of the radula without emargination.

Remarks: *Cryptella* was described by Webb & Berthelot (1833, 1835) as a full genus but subsequently synonymized with *Parmacella* by Fischer (1855), an action which was followed by authors such as Mousson (1872) and Wollaston (1878). Wiktor (1983) was the first to analyze the reproductive system of a Canarian species; as a consequence, he used *Cryptella* again as a subgenus of *Parmacella*, as did Alonso et al. (1985), Diaz et al. (1986), Hutterer (1990), and Groh et al. (1991). Hutterer (1990) recorded a species of *Parmacella* (*Cryptella*) from Pliocene sediments of Fuerteventura and stressed the long history of *Cryptella* in the Canary Islands. However, we regard the new data assembled in this paper as strong evidence for a full generic rank of *Cryptella*.

Table 1: Character differences between *Cryptella* and *Parmacella*.

Characters:	A	B	C	D	E	F	References
Cryptella							
alegranzae n. sp.	0	—	0	0	0	—	a
auriculata	0	0	0	0	0	32	b
canariensis	0	0	0	0	0	32	b, c, d
famarae n. sp.	0	0	0	0	0	28	a
parvula	—	—	—	0	—	—	d
susannae	0	0	0	0	0	26	b, d
tamaranensis	—	—	0	0	—	—	d
Parmacella							
festae	1	1	1	1	—	—	c, e, f
deshayesi	1	1	1	1	—	~12	c, e, g
ibera	1	—	1	1	—	—	c, e, h, f
olivieri	1	1	1	1	—	~16	c, i
tenerifensis	1	1	1	1	1	17	e, d
valenciennii	1	1	1	1	1	16	c, e, k

Characters:
A: Accessory appendices absent (0) or present (1)
B: Spermatophore simply curved (0) or spiral (1)
C: Embryonic shell not fully covered by mantle (0) or fully covered (1)
D: Embryonic shell not covered by spathula (0) or partially covered by spathula (1)
E: Basal part of central tooth of radula smooth (0) or with deep emargination (1)
F: Maximum number of hooks at the spermatophoral disc.

References:
a This study
b Groh et al. 1991
c Wiktor 1983
d Hutterer 1990
e Alonso et al. 1985
f Alonso et al. 1986
g Fischer 1855
h Likharev & Wiktor 1980
i Forcart 1959
k Alonso & Ibáñez 1981.

Parmacella differs from *Cryptella* in the characters enumerated in the above diagnosis. The species of *Parmacella* are regularly larger; have a broader sole; in adults the mantle completely covers the shell; often part of the embryonic shell is integrated into the spathula; the spathula is more rounded and convex; the atrium bears two accessory appendices; the spermatophore is spirally coiled. There may be further differences in the shape of the central teeth of the radula and the morphology of the spermatophoral disc (Tab. 1), however, only few species of *Parmacella* have been studied in this respect so far. The differences in the numbers of hooks of the spermatophoral disc (26—32 in *Cryptella*, 12—17 in *Parmacella*) are of particular interest. Wiktor (1987) has demonstrated for the Milacidae, the sister group of the Parmacellidae, that the complex structures of the spermatophores are highly characteristic on the species level and possibly also for higher categories.

In several aspects *Cryptella* is more similar to the Asiatic genus *Candaharia* Goodwin-Austen than to *Parmacella*, for example in the absence of accessory appendices of the reproductive system (Likharev & Wiktor 1980). However, we have not examined specimens of that genus and therefore are inclined to postpone further conclusions. Also the internal anatomy of the reproductive system, particularly of the penis and the female stimulator, may provide other characters useful for a comparison between *Cryptella*, *Parmacella*, and *Candaharia*; unfortunately, these structures have not yet been analyzed in any of these genera.

Cryptella famarae n. sp.

Parmacella (*Cryptella*) *canariensis canariensis* (Webb & Berthelot 1833): Hutterer 1990, p. 78, pl. 1, fig. 3; subfossil shells from Orzola [SMF 308432].

Material: Type series: Lanzarote, Riscos de Famara below Ermita de las Nieves, 600 m [UTM 28RFT4320], 12. V. 1986, A. Machado leg., 31 ex. in alcohol, shells isolated (AIT 633/20 + holotype; TFMC/5; SMF/1; MNHN/1; NNM/1; CGD/1; CHB/1).

Referred material: Same locality as holotype, 3. VIII. 1990, R. Hutterer leg., 159 shells (ZMZ/10; MHNH/10; SMF/10; CGD/10; CHB/119); Risco de Famara, near Las Bajas, 150 m, 12. VII. 1987, R. Hutterer leg., 3 shells (CHB); 1 km E Playa Famara, 28. IV. 1991, R. Hutterer & O. M. Molina leg., 9 shells (CHB); Galeria de Famara, c. 150 m, 12. II. 1991, M. R. Alonso & M. Ibáñez leg., 3 shells (AIT); Risco de Famara below Mirador del Rio, 3. VIII. 1990, R. Hutterer leg., 9 shells (CHB).

Referred subfossil shells: Lanzarote, Orzola, Playa de las Canteras, Quarternary slope deposits, 108 shells (Hutterer 1990). La Graciosa, Montaña Agujas, Quaternary slope deposits, 30. IV.—3. V. 1991, R. Hutterer & O. M. Molina leg., 96 shells (CHB); Playa de las Conchas, fossil dunes, 2. V. 1991, R. Hutterer & O. M. Molina leg., 33 shells (CHB).

Distribution: The species is presently confined to the steep slopes and the foothills of the Risco de Famara, Lanzarote, but in former times probably had a wider distribution, including the island of Graciosa (Fig. 1).

Diagnosis: A dark species of *Cryptella* from Lanzarote, shell large, reproductive organs with a free simple female stimulator and a complex S-shaped spermatophore.

Description: Animal: Medium size (sole-length 32 to 41 mm, mantle-length 17 to 23 mm in ethanol-preserved adult specimens). Coloration of body in preserved specimens greyish brown with many small black dots, turning into yellowish brown towards sole and tail; black dots are concentrated at the tail except for the keel; the sole is light brown with a darker greyish brown edge of c. 2 mm. Mantle reddish

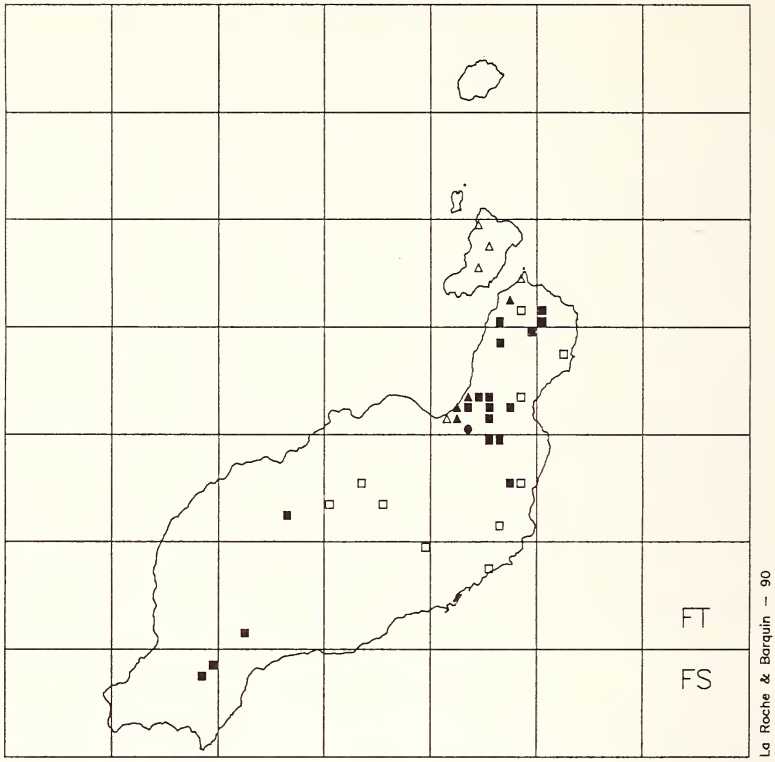
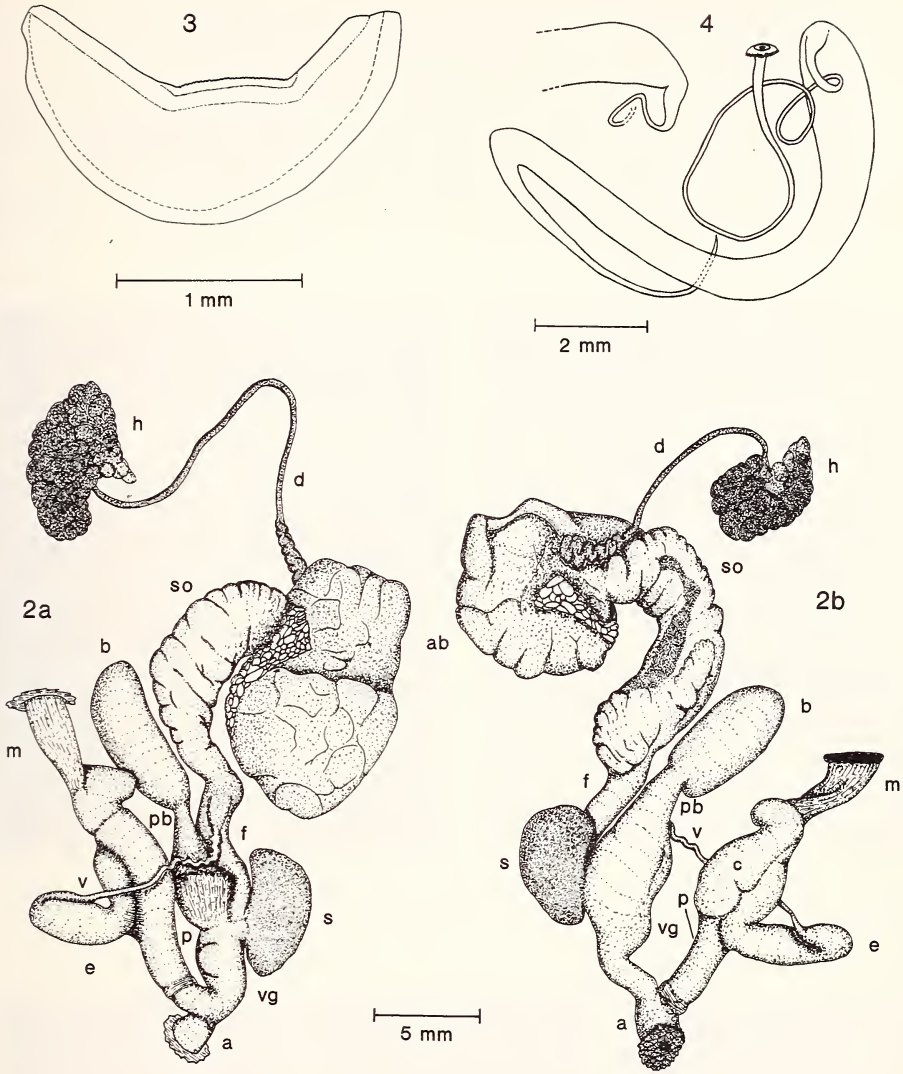


Fig. 1: Past and present distribution of *Cryptella canariensis* (squares) and *Cryptella famarae* n. sp. (triangles) in Lanzarote and Graciosa; black symbols represent living specimens, open symbols subfossil shells. The black circle indicates a locality where both species were found, *C. famarae* n. sp. in the cliff (= type locality) and *C. canariensis* on top of the cliff.

brown with broad black streaks in its posterior part, turning into an irregular web-pattern or more often into small, elongated blotches.

Genital anatomy (Fig. 2): The penis is of medium size; the penial sheath with the penis caecum is folded; the upper part of the epiphallus is strongly fastened by muscular fibres; the epiphallus has the same thickness as far as the origin of the vas deferens. At the base of the penis a narrow muscular ring is situated; the musculus retractor penis is short and moderately broad; at its insertion there is a significant protuberance which is probably formed by part of the caecum. The vagina is long, the small, reniform female stimulator is not attached to the sole; the bursa copulatrix is oblong-ovate, its duct short but longer than the free oviduct; the hermaphroditic gland is trilobate and very small; its duct relatively wide and only slightly coiled in its proximate sixth.

Spermatophore: The spermatophore is an S-shaped twisted tube with a wide distal part from where it tapers gradually to the needle-like proximal end; the filiform distal tube is branching off at an angle of 90°, then coiled and in the last fifth continuously widening until the spermatophoral disc (Fig. 4). The latter is large with a small aper-



Figs 2—4: *Cryptella famarae* n. sp.; genitalia in ventral (2a) and dorsal (2b) view; (3) jaw; (4) spermatophore. Abbreviations: a = atrium; ab = albumen gland; b = bursa copulatrix; c = penis caecum; d = ductus hermaphroditicus; e = epiphallus; f = free oviduct; h = hermaphroditic gland; m = musculus retractor penis; p = penis; pb = pedunculus of bursa copulatrix; s = female stimulator; so = spermoviduct; v = vas deferens; vg = vagina.

ture and a broad margin, exhibiting 28 medium-sized hooks (Fig. 5). Of three dissected adult specimens, two had 1 spermatophore each in their bursa copulatrix.

Radula: The central tooth is characterized by a narrow mesocone attached by two shorter but broader ectocones; the basal part is broadly bulged up. The lateral teeth

are longer than the central teeth, with heavy cylindrical mesocones, one of the two small ectocones is strongly reduced. Towards the lateral margins the small ectocones become more and more reduced, and the mesocone pointed (Fig. 6).

The radular formula is (C + 38L + 14M) x 114. The size of the central tooth is approx. 51 x 35 μm, of the inner lateral teeth approx. 60 x 33 μm, of the outer lateral teeth approx. 64 x 26 μm and of the marginal teeth approx. 47 x 15 μm.

Jaw: The oxignath jaw is small and simple (Fig. 3), with a very fine serration in its middle part.

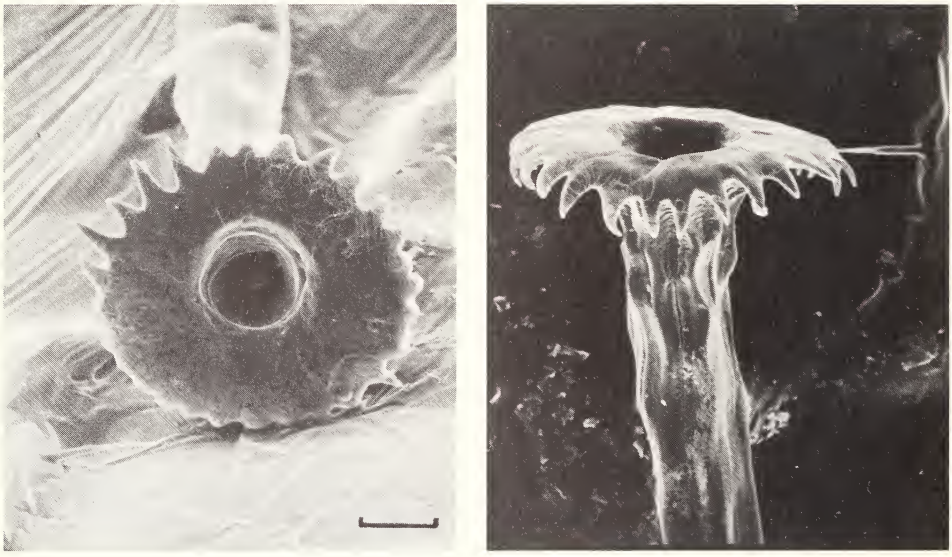


Fig. 5: *Cryptella famarae* n. sp.; spermatophoral disc. Scale = 0,1 mm [SEM photos: M. Ibáñez].

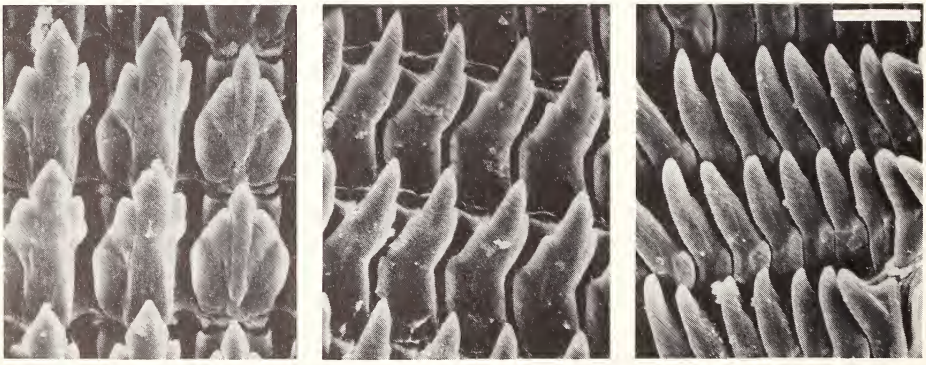


Fig. 6: *Cryptella famarae* n. sp.; radula; central, lateral and marginal teeth. Scale = 30 μm. [SEM photos: M. Ibáñez].

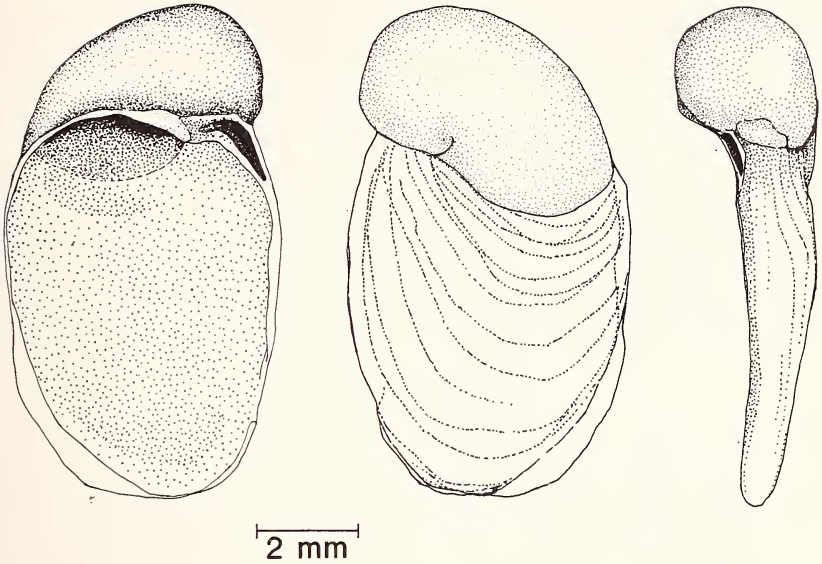


Fig. 7: *Cryptella famarae* n. sp.; shell in dorsal, ventral and lateral view.

Shell: Large shell with a large protoconch (length x width in the type series: 5,24 ± 0,29 x 3,32 ± 0,19, n = 9; for further measurements see Hutterer 1990: Tab. 1, sample "Lanzarote subf."). The nucleus of the latter is clearly visible, as the suture stays nearly uncalcified. The aperture of the protoconch is small, nearly round, its columellar margin with a significant callus. In lateral view the angle between apertural margin and spathula is approximately 110 to 120° (Fig. 7).

Ecology: *Cryptella famarae* was found only at the ridge and in the steep slopes of the Famara Cliffs in the north of Lanzarote. The few specimens found alive by A. Machado on 12 May 1986 were feeding on leaves of *Reichardia famarae*. Fresh shells were found in May 1990 at the bottom of almost vertical rocky cliffs entirely covered by lichens. The Famara Cliffs are famous for their rich vegetation (Kunkel 1982); they form a relict habitat for numerous plants and animals dependent on permanent moisture.

In May 1991 subfossil shells of *Cryptella* were found at three localities of Graciosa, which represent the first record of the genus for this island. The materials probably date from the Pleistocene and Holocene. The shells agree very well with shells of the living *C. famarae* from Lanzarote and we conclude that they represent the same species which, however, does no longer occur in Graciosa. The island is very arid today, and humid cliffs such as in Famara are no longer present.

Comparisons: *C. famarae* differs from the other species of which the anatomy is known (see figures in Groh et al. 1991; the unique holotype of the extinct *C. tamaranensis* [Hutterer, 1990] was not dissected) by the reproductive system, jaw, spermatophore, and radula. The most similar species is *C. canariensis* Webb & Ber-

thelot, 1833, of which *C. famarae* can be distinguished by the colour (dark brown without bluish tinge, as in *C. canariensis*), the smaller body size, and the relative size of the shell (49 % of mantle length, versus 33 % in *C. canariensis*). Differences in the reproductive system are: male and female genitalia are considerably smaller; the penis retractor muscle and epiphallus are shorter; the hermaphroditic gland is small and three-lobed (much larger and multi-lobate in *C. canariensis*); the spermatophore is S-shaped, the filiform part is thinner and breaking off with a strong constriction at a 90° angle; the terminal disc (Fig. 5) has a broad margin, a narrow opening and 28 hooks (narrow margin, wide opening and 32 hooks in *C. canariensis*); the jaw is a simple plate (with anchor plates on both sides in *C. canariensis*); the central and lateral teeth of the radula have a narrow mesocone, and the marginals are slimmer.

Cryptella alegranzae n. sp.

Type material: Canary Islands, Lanzarote, Alegranza Is., La Caldera, 30. IV.—5. V. 1990, R. Hutterer leg., dehydrated carcass with shell, reproductive organs, radula (SMF), 24 dried carcasses (CHB), 120 shells (TFMC/10; MNHN/10; NNM/10; SMF/10; ZMZ/10; CGD/10; CHB/50); same locality, 1. V. 1991, M. Ibáñez leg., 23 shells, 1 carcass (AIT/24); El Malpais, 4. V. 1990, R. Hutterer leg., 3 shells (CHB); El Veril, sand dunes, 30. IV. 1990, R. Hutterer leg., 7 shells (CHB); foot of Montaña Lobos [= type locality; UTM: 28RFT4552], 19. XII. 1990, M. Nogales leg., 4 juveniles and 1 subadult preserved in alcohol (AIT 1473/4 + holotype). All specimens besides the holotype are paratypes.

Distribution: Confined to the island of Alegranza (Fig. 8).

Diagnosis: A small brown species of *Cryptella* characterized by small shell measurements and anatomical details of the reproductive system.

Description: Animal: In the juveniles the ground colour of the mantle is reddish-brown; the rest of the body is light grey with a concentration of small black blotches along a lateral band running from the head to the tail; the tail is darkest. Colour of sole pure white, sharply contrasting against the lateral grey of the foot. The dark pigmentation is stronger in the remains of adult specimens, giving the full-grown animal a rather dark appearance. A subadult animal had a sole length of 28 mm and a mantle length of 14 mm; the species therefore appears to be rather small (Fig. 9).

Genital anatomy (Figs 10—11): Only two dried carcasses yielded parts of the reproductive organs after re-hydration, in addition, one complete subadult specimen was dissected; from these the following observations could be taken. The genital is small; the penis is long and the penial sheath folded; a striking circular structure is probably formed by the penis caecum; the long epiphallus (longer than the penis) is strongly fastened by muscular fibres in its uppermost part, then becoming more slender in its distal third. The musculus retractor penis is broad and relatively long. At the base of the penis there is a narrow muscular ring. The female stimulator is as large as the male reproductive organs; it is long-oval and bent in the middle. A part of the ductus hermaphroditicus is preserved; it is relatively wide and heavily coiled over a longer distance from its origin. The spermatheca is globular and has a short duct which is widest at its origin. The free oviduct is relatively long, nearly as long as the pedunculus of the spermatheca. The albumen gland is extremely large.

Spermatophore: The complete carcass contained a fragment of a spermatophore

representing the main body (Fig. 14). It measures only 3 mm in length and 0.25 mm in width, which is less than half the size of the spermatophore of *C. famarae* (Fig. 4) and the other species.

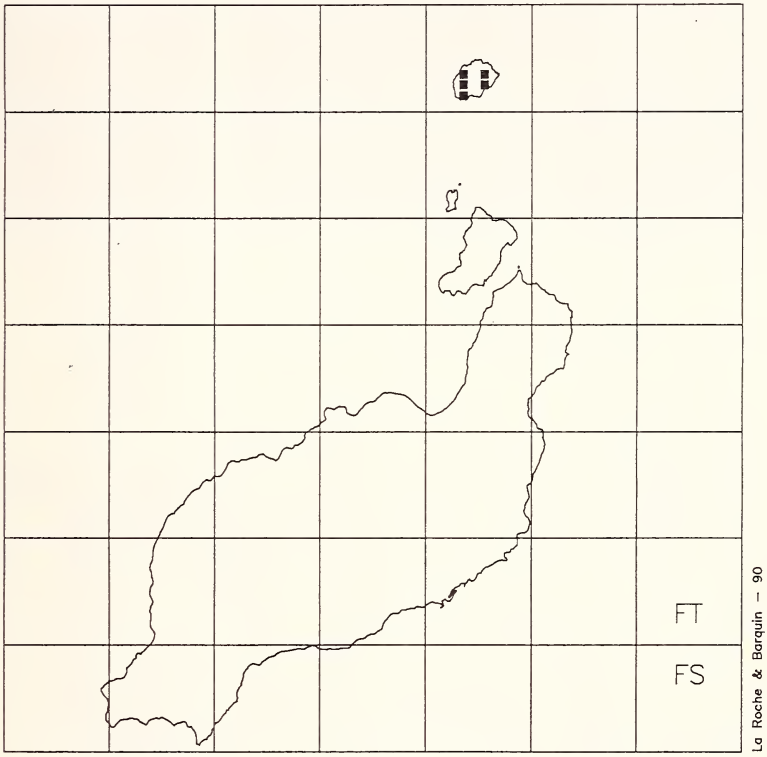


Fig. 8: Current distribution of *Cryptella alegranzae* n. sp.

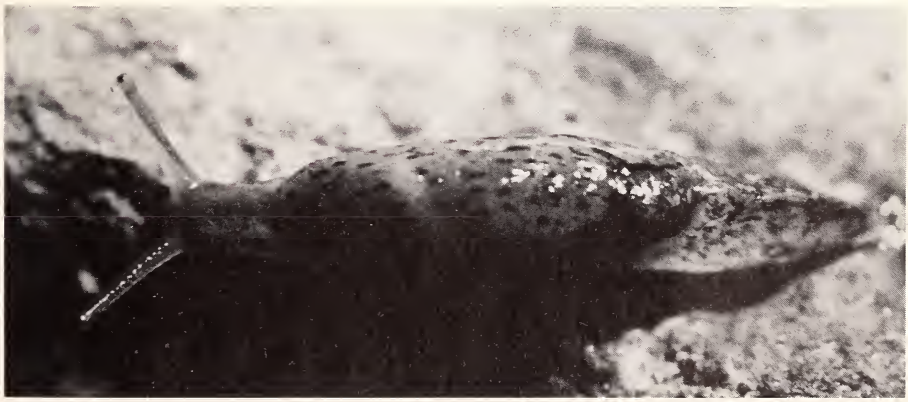
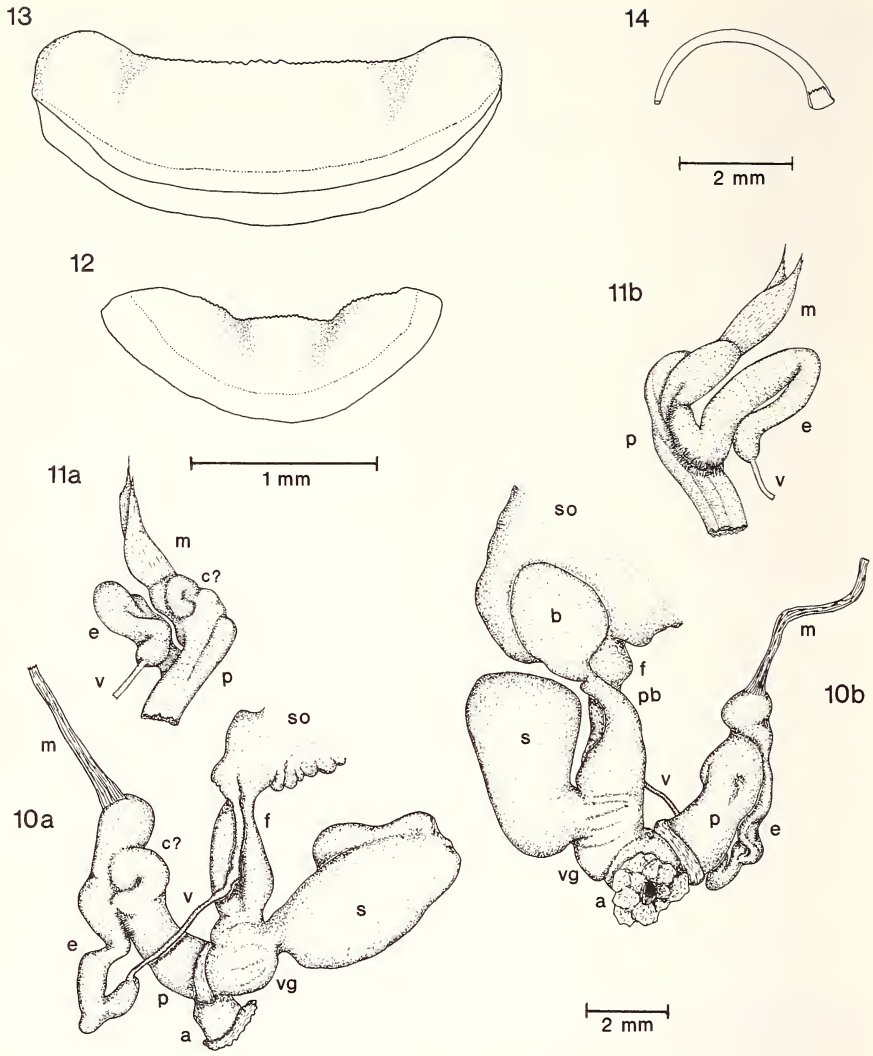


Fig. 9: Living juvenile of *Cryptella alegranzae* n. sp., sole length 20 mm [Photo: M. Ibáñez].



Figs 10—14: *Cryptella alegranzae* n. sp.; fragments of adult (10) and subadult (11) genitalia in ventro-lateral (a) and dorso-lateral (b) view; (12) subadult and (13) adult jaw; (14) fragment of spermatophore. Abbreviations as in Figs 2—4.

Radula: Central tooth (44 x 33 μm) with a broad mesocone and a broad basis, lateral (54 x 30 μm) and marginal (46 x 21 μm) teeth with pronounced ectocones (Fig. 15). The radular formula is (C + 33L + 10M) x 139.

Jaw: Oxignath, with an undulated cutting edge (Figs 12—13), about two-thirds of the cutting edge finely serrated.

Shell: Generally small; protoconch length 4,47 ± 0,27, protoconch width 2,86 ± 0,10, shell length 9,53 ± 0,52, shell width 5,21 ± 0,41 mm (n = 10). Protoconch in-

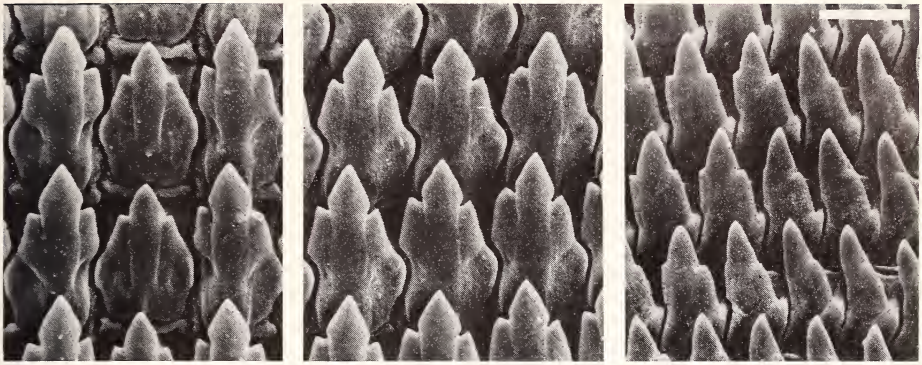


Fig. 15: *Cryptella alegranzae* n. sp.; radula, samples of central, lateral and marginal teeth. Scale = 39 μm. [SEM photos: G. Oleschinski].

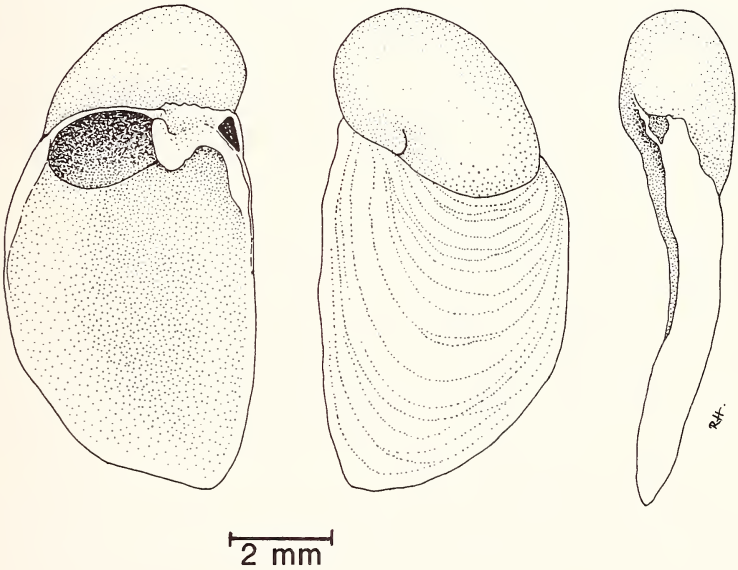


Fig. 16: *Cryptella alegranzae* n. sp.; shell in dorsal, ventral and lateral view.

termediate in size between *C. canariensis* and the Pliocene *C. parvula* (Hutterer, 1990) and rounder in shape than in *C. canariensis* and *C. auriculata* (Mousson, 1872) (Fig. 16). Out of 120 shells 25 % were malformed which is a rather high proportion (see Hutterer 1990: Tab. 2).

Ecology: On Alegranza the current distribution of *Cryptella alegranzae* is confined to the north-facing slopes of the caldera; fresh shells and carcasses were found under rocks in relict vegetation. Today the range of this species is extremely localized; fin-

dings of subfossil shells in dune deposits outside the crater show that the species had previously a wider distribution on the island. — One subadult specimen contained three tiny nematodes.

Comparisons: *Cryptella alegranzae* differs from all the extant species of the genus by the small size and the round shape of the shell; only *C. parvula* has a smaller shell.

Discussion

The new taxa raise the number of species of the genus *Cryptella* to seven, of which two (*parvula*, *tamaranensis*) are already extinct. Until recently, the Pliocene *C. parvula* represented the earliest record of the genus (Hutterer 1990). However, since then we have been able to study a shell fragment of *Cryptella* (Coll. Jaeschke) consisting of most of the protoconch, which Mrs. A. Jaeschke collected in the Miocene sediments of Orzola, Lanzarote. While the fragmentary condition of the specimen does not allow a proper identification, it is nevertheless rather similar in size to *C. alegranzae*; the protoconch measures 4,43 x 2.95 mm. This fragment shifts the origin of *Cryptella* further back into Miocene times. Fossils of *Parmacella*, however, are known with certainty from the Pliocene of Morocco (Jodot 1955), the Pleistocene of England (Cambridge 1981), and the Pliocene and Pleistocene of France (Wenz 1923), but not from the Canary Islands. The single extant Canarian species, *Parmacella tenerifensis* Alonso, Ibáñez & Diaz, 1985, therefore may have originated from a more recent introduction. In contrast, *Cryptella* seems to be a rather old and isolated group.

Wiktor (1984, 1989) discussed the polarity of a number of characters within the Zonitoidea, for example the stepwise reduction of the shell from *Oxychilus* to *Daudebardia*, *Parmacella* and *Milax*, where only a tiny shell fragment remains. Within the Parmacellidae a slight reduction of the shell from *Candaharia* to *Cryptella* and *Parmacella* can be observed. In contrast, the complexity of the spermatophores increases from *Cryptella* to *Parmacella* and is highest in the Milacidae (Wiktor 1987). The same counts for the accessory appendices or glands, which are absent in *Oxychilus*, *Candaharia* and *Cryptella*, but present in *Parmacella* and most complex in the Milacidae (Wiktor 1981).

If these polarities are applied to the slugs under study, then *Cryptella* shows a plesiomorphic and *Parmacella* an apomorphic condition in most of the characters listed in Table 1, which is in agreement with the palaeontological record. *Parmacella* seems to be a derived member of the Parmacellidae while *Cryptella* appears to be a more ancestral group with a relict distribution in the Canary Islands.

Although we know more about the Parmacellidae than a few years ago, this knowledge still remains a fragmentary mosaic. Further studies of fossil shells from various levels and islands, and the study of the biology and ecology of the extant forms will hopefully complement our view of the evolution of this interesting group.

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Zusammenfassung

Die Rucksackschnecken der Kanarischen Inseln werden bisher der weitverbreiteten Gattung *Parmacella* zugerechnet. Neue, in der vorliegenden Studie zusammengefaßte Erkenntnisse sprechen jedoch dafür, daß die meisten der kanarischen Arten einer seit dem Miozän getrennten monophyletischen Gruppe angehören, für die der Name *Cryptella* revalidiert wird. Mit zwei weiteren, hier erstmals beschriebenen Arten von Lanzarote und Alegranza sind nun 1 *Parmacella*- und 7 *Cryptella*-Arten von den Kanaren bekannt. Damit stellt diese Inselgruppe ein Diversitätszentrum der Parmacellidae dar.

Resumen

Se realiza un estudio comparativo de las especies de Parmacellidae presentes en las Islas Canarias, asignando al taxón *Cryptella* (que hasta ahora tenía la categoría de subgénero de *Parmacella*), la categoría de género independiente. Se describen dos especies nuevas de Lanzarote y Alegranza, elevando así a 7 el número de taxones canarios de *Cryptella* y a 8 el total de especies de la familia, por lo que se concluye que el archipiélago constituye uno de los centros de diversidad de la familia. Finalmente, se considera que *Cryptella* mantiene los caracteres ancestrales de la familia, con una distribución relíctica en Canarias, mientras que *Parmacella* parece ser, por sus apomorfías, un miembro derivado de la misma.

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