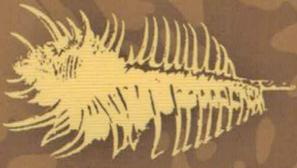


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CLUB CONCHYLIA

INFORMATIONEN

RARITÄTEN CYPRAEEN VON DEN AUSTRAL-INSELN

NEUE ARTEN **VEXILLUM, TURBOVULA**

NEUBÜRGER **HYGROMIA CINCTELLA**

AUSGESTORBEN **HIPPURITEN**

KLASSIKER **GELD-KAURIS**

Notes on Pacific Cypraeidae (Mollusca: Gastropoda) collected by the MNHN, Paris

By FELIX LORENZ, Buseck-Beuern

Figs. 1-13

Abstract

The variability of *Erosaria thomasi* (2) and *E. bernardi* (1) is discussed. *Erosaria engleri*, (3) *Palmulacypraea musumea* (7), *Nesiocypraea lisetae* (6) and *Luria tessellata* (4) are reported from the Austral Islands, a considerable range extension for these species. *Purpuradusta barbieri* (5) was collected in deep water off the Marquesas and the Austral Islands in fair numbers. The average length of *Nesiocypraea lisetae* (6) decreases gradually towards the eastern distribution-limit. The distributions and the diversity of the Pacific deep water Cypraeid fauna is greater than anticipated.

Zusammenfassung

Die Variabilität von *Erosaria thomasi* (2) und *E. bernardi* (1) wird diskutiert. *Erosaria engleri*, (3) *Palmulacypraea musumea* (7), *Nesiocypraea lisetae* (6) und *Luria tessellata* (4) werden von den Austral Inseln gemeldet. Damit erfährt das Verbreitungsgebiet dieser Arten eine beträchtliche Erweiterung. *Purpuradusta barbieri* (5) konnte in beträchtlicher Anzahl im Tiefwasser der Marquesas- und Austral-Inseln gesammelt werden. Die mittlere Länge von *Nesiocypraea lisetae* (6) nimmt zur östlichen Verbreitungsgrenze hin kontinuierlich ab. Die Verbreitung und Diversität der pazifischen Cypraeidenfauna ist weit größer als bisher vermutet wurde.

Introduction

The expeditions of Dr. PHILIPPE BOUCHET and his colleagues of the Muséum Nationale d'Histoire Naturelle, Paris (MNHN), to various sites between New Caledonia and the Marquesas Islands are famous for a vast number of zoological discoveries. Recently, the MNHN had a campaign in the Austral (or Tubai) Islands, a chain of small Atolls stretching south between Tahiti and Tuamotu. Dredging in moderately deep water has not been done in most areas of the southern Pacific, and it seems to be no surprise that the efforts of the MNHN have produced a number of interesting insights to the distribution and diversity of some Cypraeidae which will be discussed in the following.

Material and methods

For the comparisons and analysis the shells from the collections of the MNHN Paris and the collection of the author were used. Conchological features are expressed in the shell-formula: L(W-H)X:Y in which are L: average length (mm); W: average width/length ratio in %; H: average height/length ratio in %; X: normalized number of labral teeth; Y: normalized number of columellar teeth, following the formula proposed by F. A. SCHILDER & M. SCHILDER (1938, 1952).

- 1) *Erosaria bernardi* (RICHARD, 1974) and *E. kingae* (REHDER & WILSON, 1975)

Figs. 1 & 2

Material: 40 specimens of *E. bernardi*, with numerous conchological intermediates and typical shells of *E. kingae* from the Austral Islands, 17 *E. bernardi* from Tahiti, including a conchologically intermediate to *E. kingae* from the author's collection, one conchologically typical *E. kingae* from Tahiti in coll. JAN DEPREZ.

Discussion: *Erosaria bernardi* RICHARD, 1974 was described from Tahiti. The shell is small (10-15 mm), slender, from depth of 30-50 m. *Erosaria kingae* REHDER & WILSON 1975 was characterized as a medium sized (14-20 mm) shell with strong marginal callus, first found at 50-200 m off the Pitcairn Islands. Both cowries have an orange to brownish dorsal coat with numerous white spots. In *E. kingae*, there are two white dashes on either side of the dorsal line, which are found only in some *E. bernardi*. Both have a peculiarity in the dentition: the anterior columellar teeth are connected with a callus-bridge, a feature known from few other cowry species [*Erosaria beckii* (GASKOIN, 1836), *Cryptocypraea dillwyni* (F. A. SCHILDER, 1922) and *Nesiocypraea lisetae* KILBURN, 1975 (see below for a discussion of these species)]. Both names were accepted as valid species (e.g. WALLS 1979 and BURGESS 1985). LORENZ & HUBERT (1993) synonymized *E. kingae* with *E. bernardi*, an interpretation not adopted by most authors (L. RAYBAUDI, MEYER, pers. comm.). One reason for the negative feedback on our taxonomic evaluation was perhaps, that we did not illustrate a specimen of *E. kingae* from the type locality but a broad shelled *E. bernardi* from Tahiti with white callus-dashes dorsally, very



Fig. 1: *Erosaria bernardi* from Tahiti; **1st column:** 11.5 mm, Hitiaa, Tahiti, off 45 m, typical; **2nd column:** 12.5 mm, Papeete, Tahiti, off 50 m, typical; **3rd column:** 13.5 mm, Hitiaa, Tahiti, off 45 m, resembling variation *kingae*; **4th column:** 14.5 mm, Tahiti, variation *kingae*, coll. DEPREZ.



Fig. 2: *Erosaria bernardi* from the Austral Islands; **1st column:** 13.2 mm, Rurutu, off 212-450 m, typical; **2nd column:** 18.5 mm, President Thiers Bank, off 469-500 m, typical; **3rd column:** 13.8 mm, President Thiers Bank, off 50-90 m, typical; **4th column:** 13.6 mm, Rimatara, off 83-90 m, variation *kingae*; **5th column:** 16.9 mm, Lotus Bank, off 100-200 m, variation *kingae*; **6th column:** 17.5 mm, Arago Bank, off 100-107 m, variation *kingae*.

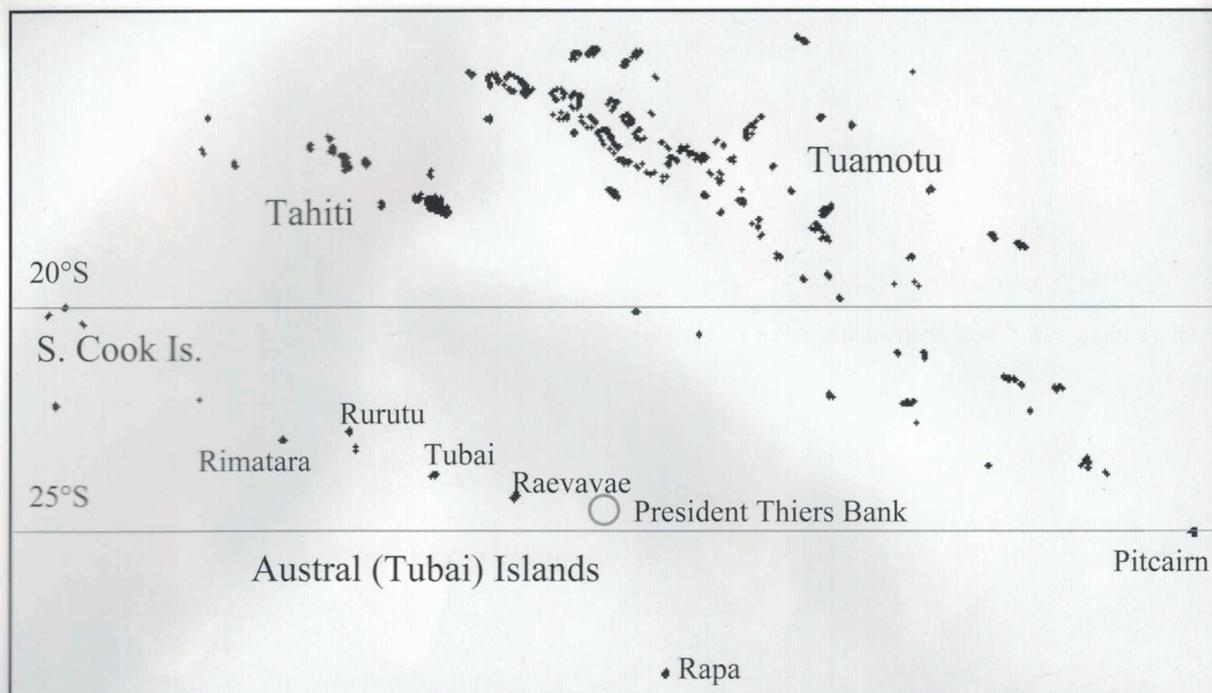


Fig. 3: The Austral (Tubai) Island group

closely resembling the types of *E. kingae*. We maintained this standpoint (LORENZ & HUBERT 2000) after examining a specimen from Pitcairn Island in coll. CHIAPPONI. Later, *E. kingae* was provisionally lifted to higher rank, as an eastern subspecies of *bernardi* differing by large size and strong marginal callus (LORENZ 2002).

Dead and living specimens of *E. bernardi* and conchologically typical *E. kingae*, along with a number of conchological intermediates, were found in the Austral Islands (Fig. 3) by the MNHN. Empty shells of all shapes and sizes were dredged from 50 m to 200 m. Dead, eroded shells that probably drifted down from shallower habitats were found as deep as 1.800 m. The transition from a slender *bernardi*-type (width/length ratio <68%) to a callused (width/length ratio >68%) could be observed in these shells. Living *kingae*-type shells were dredged at 100 m to 200 m in the Austral Islands, the type material from Pitcairn was found between 50-200 m. The development of marginal callosity is varying to a high degree. Conchological intermediates to *E. bernardi* were dredged alive at 83-90 m. Numerous dead shells showing intermediate stages in size and callosity were found alongside the extremes at various depth, often in a single dredge-sample. In a morphometric analysis comparing the shell formulae of all fully adult, complete specimens available, including the type set from Pitcairn Island, no consistent characteristics separating *E. kingae* from *E. bernardi* could be found:

The data in Fig. 4 allows the following conclusions: Shells from Tahiti are mostly smaller and more slender than those from Pitcairn. Specimens from the Austral Islands connect

the two extremes and scatter within Tahiti and Pitcairn specimens. The shell's length is no distinguishing feature for the distinction of *E. kingae* from *E. bernardi*. In Tahiti, *bernardi* is collected at 30-50 m, and even deeper. The callused type is moderately rare, white dorsal dashes are found in about half of the specimens, whereas the shells are somewhat smaller in average than those from the Austral Islands, a possible effect of the BERGMANN-rule (see F. A. SCHILDER 1957). Shells from that locality can be extremely callused, probably as an adaptation to deeper and colder water habitats [see also the discussion of *E. thomasi* (CROSSE, 1865) whose degree of callosity increases in a similar way]. A fresh dead specimen of *Erosaria bernardi* measuring 13.6 mm was dredged off Wallis Is. at 360 m by the MNHN (LORENZ 2002). It does not differ conchologically from the small-shelled population known from 30-70 m off Tahiti.

The number of teeth varies insignificantly between all populations, and the structure of the anterior columellar teeth (connected by a callus-bridge) varies in the same manner in both shell-types. Too few living shells have been collected in the Austral Islands to allow a statement on the consistency of the depth-size- and callosity-relation. No geographic pattern in the distribution of the *kingae*-type seems to exist as the Austral Islands which connect Tahiti and Pitcairn geographically, and both types occur in that area.

It is likely that a larger percentage of the callused *kingae*-type occurs around Tahiti, too, but at greater depths. Molecular analysis of the life-taken shells might add substance to the distinction of *E. kingae*, but looking at the conchological aspect alone, the earlier interpretation proposed by LORENZ

& HUBERT (1993) seems adequate: to consider *E. kingae* a spectacular ecological form of *E. bernardi*.

2) *Erosaria thomasi* (CROSSE, 1865)

Fig. 5

The MNHN campaign to the Marquesas has found a considerable number of *Erosaria thomasi* from Hiva Oa, at depths between 40 and 120 m, the shell length ranging from 11 to 18 mm. These shells demonstrate an extreme variability in size and callosity. Generally, specimens from deeper water are larger and more callused. This phenomenon is also observed in *E. bernardi*, a closely related species. There has been a lot of discussion about the identity of the small-shelled, slender population of *E. thomasi* from shallow water of 8 to 25 m, as the holotype of *E. thomasi* is a broader and larger specimen. A new name was created for the smaller shells: *E. philmarti* POPPE, 1993 whereas *E. thomasi* was claimed to be synonymous with *E. ostergaardi* (DALL, 1921) from Hawaii, which is easily distinguished from *E. thomasi* by the absence of darker pigmentation on the base (POPPE 1993, 1996, see also LORENZ & HUBERT 1993 and L. RAYBAUDI 1996).

3) *Erosaria englerti* (SUMMERS & BURGESS, 1965) and *E. cernica* (G. B. SOWERBY III, 1870)

Fig. 6

Material: 10 dead specimens of *E. englerti* measuring 15-24 mm, from 400 to 900 m (Rapa to President Tiers Bank, eastern Austral Islands).

Discussion: In the dredged material from the Austral Islands, a surprising number of dead but well recognizable *Erosaria englerti* was found at depth between 340 and 1.300 m. It is likely that these specimens dropped to great depth from shallower habitats, but in the dredged samples from shallower, no *E. englerti* were found. The newly discovered population does not show morphological differences to *E. englerti* from Easter Island. Finding this species outside Easter Island and Sala y Gomez is a big surprise and proves that it is not part of the endemic fauna of these remote islands as previously thought. *E. englerti* probably represents a widespread, hardly accessible deep water species in the Pacific. It became part of the littoral fauna and hence accessible for us when Easter Island rose above the sea level.

Numerous living and dead specimens of *E. cernica* belonging to the nominate subspecies were found throughout the Austral Islands, at depths from 120 - 200 m. The presence of *E. englerti* could suggest that also the Easter Island subspecies *E. cernica leforti* (SENDERS & MARTIN, 1987) might occur in the Austral Islands, but apparently that taxon really has evolved to an endemic subspecies at Easter Island, along with *Monetaria caputdraconis* (MELVILL, 1888), derived from *M. caputserpentis* (LINNAEUS, 1758), and *Cribrarula*

garciai LORENZ & RAINES, 2001, most likely derived from *Cribrarula cumingii* (G. B. SOWERBY I, 1832).

4) *Luria tessellata* (SWAINSON, 1822)

Fig. 7

Material: Two adult and two juvenile specimens from 95 to 770 m, all old and partly decayed, from Rimatara and President Tiers Bank, Austral Islands. Size range: 34-43 mm, formula (adult shells): 38(70-54)25:24

Discussion: A few dead but recognizable shells of *Luria tessellata* were found in the Austral Islands. The presence of large, white based *L. tessellata* in deep Taiwanese and Philippine waters has been known for a while, and the discovery of the MNHN supports the theory that, as in *E. englerti* discussed above, *L. tessellata* is probably widespread in deep waters in the Pacific and rose to accessible depth only in the Hawaiian Chain, when this group of volcanic islands rose above ocean-level less than five million years ago. The shells from the Austral Islands seem conchologically similar to those from Hawaii in size and dentition, but their poor state of preservation does not reveal enough features to discuss their possible subspecific status. Some of them were found at 95 m, a fairly shallow depth that suggests the species might occur elsewhere even at similar depths as in Hawaii.

5) *Purpuradusta barbieri* (RAYBAUDI, 1986)

Fig. 8

Material: several dead and one live collected specimen from Oa Hiva, Marquesas Islands and twelve dead specimens from the Austral Islands (Raivavae, Rimatara and Rurutu), size range from 9 to 14,1 mm.

Discussion: This rare species was previously known only from 50-70 m off Tahiti. The MNHN has dredged numerous dead and one living specimen at Hiva Oa, Marquesas Islands at 70 to 120 m, and also in quantity throughout the Austral Islands. Although all specimens from this area were found dead, their state of preservation suggests that *P. barbieri* is a moderately common species at 400 to 700 m. No specimens were found shallower in the Austral Islands, so that the habitat of *P. barbieri* in this area seems to be deeper than elsewhere.

6) *Nesiocypraea lisetae* KILBURN, 1975

Fig. 10

Material: 96 dead specimens from various locations in the Austral Islands, 6 from New Caledonia, 2 from Japan (coll. FRANZ HUBER), 27 from the Philippines, 5 from Wallis and Tonga, 5 from Natal.

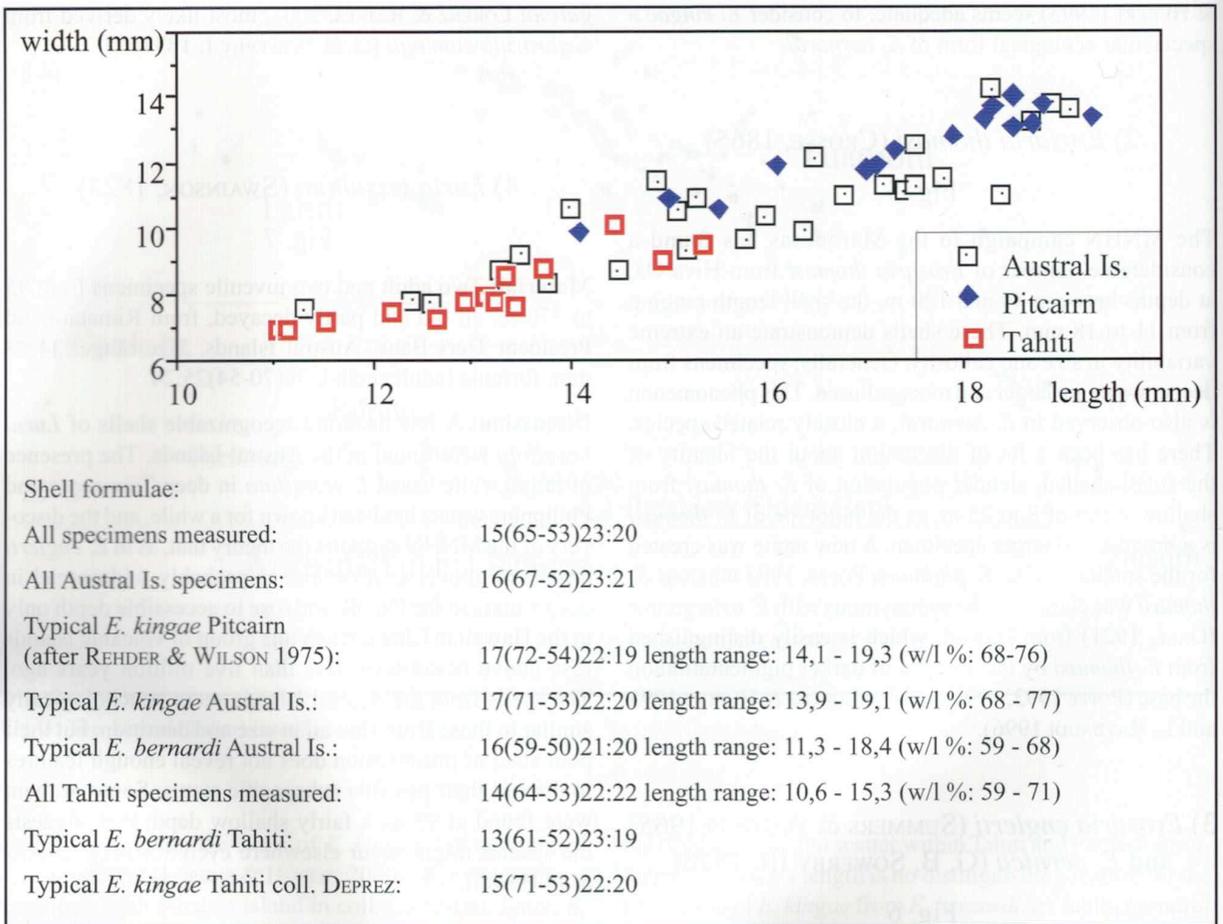


Fig. 4: The shell formulae, size ranges and the relation between length and width in *E. bernardi* from the Austral Islands, Tahiti and Pitcairn (type material of *kingae*)



Fig. 5: left: *Erosaria thomasi*, 15 mm, Hiva Oa, Marquesas Islands, off 50 m; right: *Erosaria thomasi*, callused specimen, 15 mm, Hiva Oa, Marquesas Islands, off 120 m.

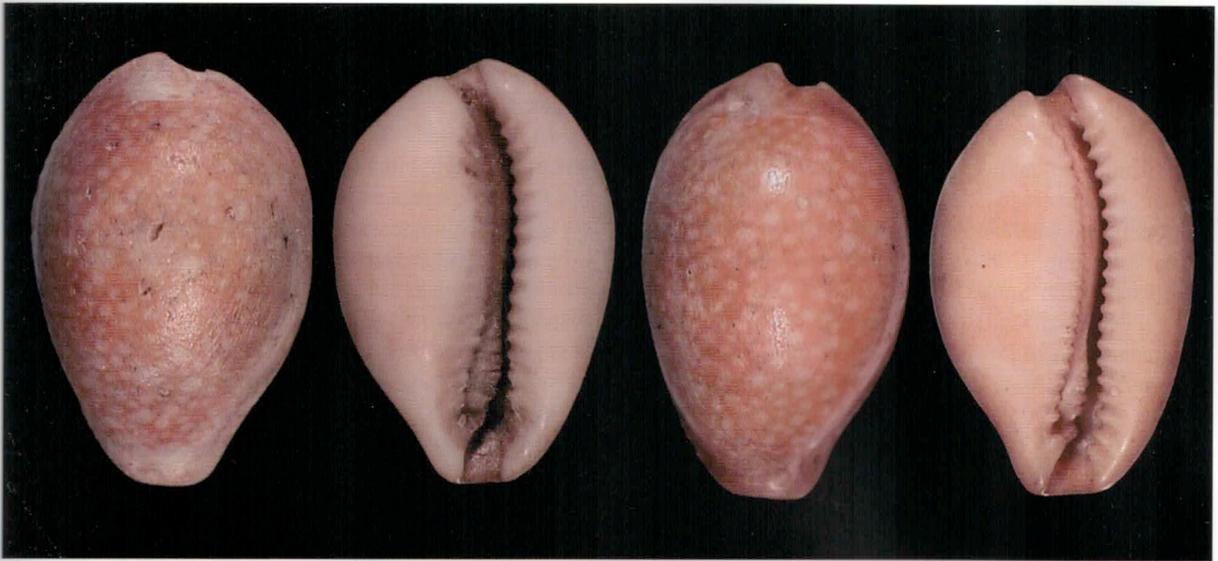


Fig. 6: *Erosaria engleri*, 24 - 25 mm, two specimens from the Austral Islands, off 500-600 m.

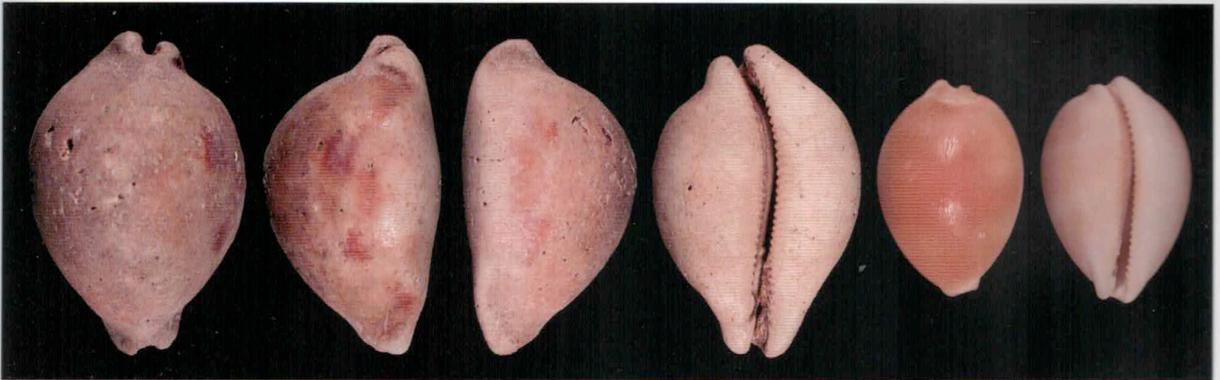


Fig. 7: *Luria tessellata*, 42 and 36 mm, Austral Islands, off 400-500 m.



Fig. 8: left: *Purpuradusta barbieri*, 10 mm, Hiva Oa, Marquesas Islands, off 90 m; right: *Purpuradusta barbieri*, 14 mm, Rurutu, Austral Islands, off 400 m.

Discussion: A surprising amount of *Nesiocypraea lisetae* was collected throughout the Austral Islands, from depths of 150 to 1.300 m. All specimens were dead. Only in those hauls from 200 m and shallower there were fresh specimens retaining the characteristic marginal spotting, those from great depths probably fell there from shallower habitats. The average size of the Austral Island specimens is 10 mm, the smallest specimen measuring 8.5 mm, the largest 14.3 mm. Comparing the average shell-length of the species from South Africa eastward one may note a gradual decrease (Fig. 10), a phenomenon also observed in specimens of *Pustularia* (LORENZ 1999). It is also apparent that the smaller Pacific specimens (var. *maricola* CATE,

1976) are more rostrate than western ones, a feature shared with *Pustularia margarita* (DILLWYN, 1817) whose eastern populations are smaller and more rostrated (var. *tuamotensis* LORENZ & HUBERT, 1993) whereas the western ones have short extremities (var. *africana* LORENZ & HUBERT, 1993), a feature shared with the nominate form of *N. lisetae* from Natal. The two species are not closely related and the reasons for the conchological parallels observed are so far poorly understood – *P. margarita* is found mainly in shallow coral reef habitats whereas *N. lisetae* is exclusively found in deep water so that a convergent development as an explanation seems unlikely.

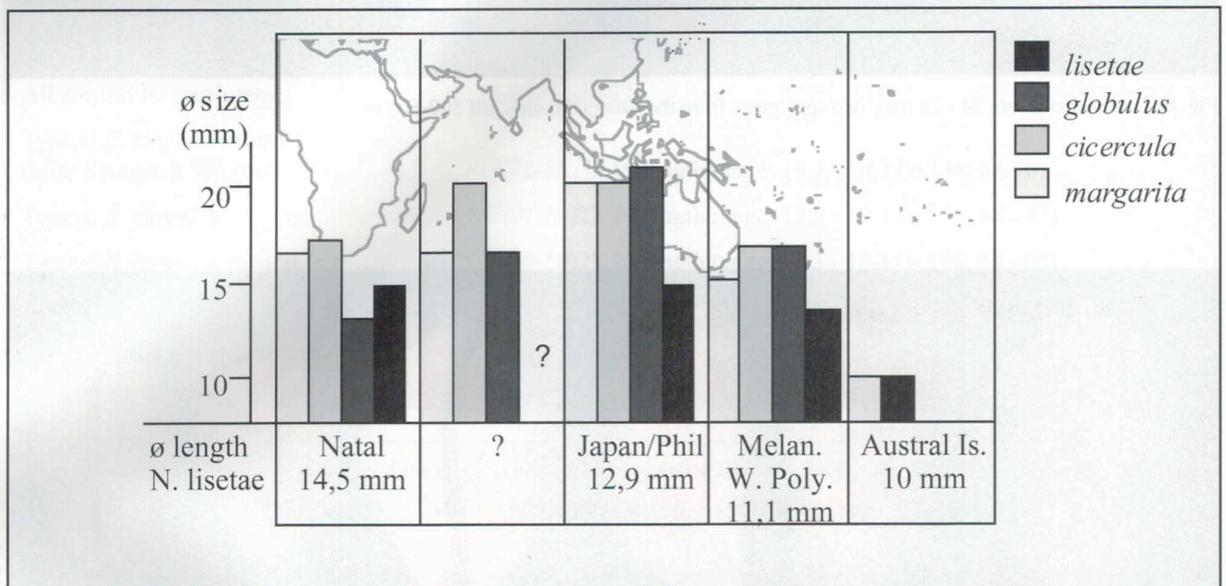


Fig. 9: The relation between origin and size in some species of *Pustularia* and in *Nesiocypraea lisetae*.

7) Other interesting finds and summary

The campaigns to western Polynesia, the Marquesas and the Austral Islands produced a number of range extensions: *Cryptocypraea dillwyni* (F. A. SCHILDER, 1922) was found at 100 m in the Marquesas (Hiva Oa) and also the Austral Islands (Rurutu and Rimatara). *Palmulacypraea musumea* (KURODA & HABA, 1961) was found alive at 50-120 m in the Austral Islands (Fig. 11), considerably extending the known range of this species formerly thought to be restricted to the China Sea and New Caledonia. The specimen measures 15.5 mm and belongs to the slender-shelled *P. omii* (IKEDA, 1998), an associated taxon whose systematic status is under study. Finally, a new species of *Nesiocypraea*, similar to *N. midwayensis* AZUMA & KUROHARA, 1967 (Fig. 12) was discovered in the Austral Islands. It will be described and discussed more comprehensively in a future publication (Fig. 13).

Apart from range extensions and the discovery of new species, the dredging campaigns of the MNHN give us an important insight. Certain elements of the Cypraeid fauna are much wider distributed throughout the Pacific than anticipated. At the time of F. A. SCHILDER & M. SCHILDER (1938-1971), many of these elements were unknown (*N. lisetae*, *E. bernardi*, *P. barbieri*) and still in the earlier days of BURGESS, only a few specimens of *Nesiocypraea*, *Palmulacypraea* and *Austrasiatica* were available - pieces of a puzzle that would not reveal its final picture. Only in the very recent past this picture gains contours. The species of *Nesiocypraea* and *Austrasiatica* are more widely distributed in the Pacific than formerly thought, with *N. lisetae* reaching across the Indian Ocean and nearly the entire Pacific. At greater depth, this former rarity becomes the most abundant cowry species, *P. barbieri* and *E. bernardi* likewise in the

Austral Islands. *Austrasiatica hirasei* (ROBERTS, 1913) and *A. langfordi* (KURODA, 1938) were formerly known from a few specimens from the China Sea and Queensland. This was interpreted as faunistic relationship between these far-apart regions (F. A. SCHILDER 1963, 1965b, 1966). Today we know that their distribution is reaching from Japan, the Philippines and Queensland across to Vanuatu, Tonga and Fiji, with considerable geographic diversity. In recent years the number of known taxa in the classic deep water genera has more than doubled (LORENZ 2002), also thanks to the comprehensive material of the MNHN. Former endemic species from the borders of Cypraeid distributions are found at great depth in far apart places. *L. tessellata* from Hawaii and *E. engleri* from Easter Island and Sala y Gomez, formerly believed to be classic island endemics, have now been found in the China Sea, the Philippines (*L. tessellata*) and in the Austral Islands (*L. tessellata* and *E. engleri*), so we may assume that these species distributions might cover vast areas of the Pacific.

The Austral Islands as a part of French Polynesia stretch along a southern limit of cowry distribution in the South Pacific. They bear a surprising account of species that are otherwise very rare or confined to a remote chain of islands, but there are also some of the typical species of Pacific deeper water habitats: *Erosaria cernica* (G. B. SOWERBY III, 1870), *E. helvola* (LINNAEUS, 1758), *Luria isabella* (LINNAEUS, 1758), *Pustularia margarita* (DILLWYN, 1817) and *Palmulacypraea musumea* KURODA & HABE, 1961. Other widely distributed species were missing: *Erosaria beckii* (GASKOIN, 1836), *Palmulacypraea boucheti* (LORENZ, 2002), *Palmadusta contaminata* (G. B. SOWERBY I, 1832), *Erosaria labrolineata* (GASKOIN, 1849) and *Purpuradusta microdon* (J. E. GRAY, 1828). These species probably have their distribution limits just west of the Austral Islands as they are also missing in the adjacent shallow waters of Tahiti and Tuamotu [with the exception of *P. contaminata* (G. B. SOWERBY I, 1832) which is common in shallow and deep water in the Marquesas and is occasionally found in the Tuamotus].

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Fig. 10: *Nesiocypraea lisetae*, dorsal and ventral aspect, from left to right; 16 mm, Durban, Natal, S. Africa, coll. CHIAPPONI; 14 mm, S. Japan, coll. HUBER; 12,5 mm, Philippines, off 250 m; 11,2 mm, Waterwich Bank, Wallis and Futuna, off 500 m; 10,8 mm, Arago Bank, Austral Islands, off 150 m.



Fig. 11: *Palmulacypraea musumea*, 15 mm, Austral Islands, 50-120 m.

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Fig. 12: *Nesiocypraea midwayensis*, 24 mm, S. Japan, off 450 m.



Fig. 13: *Nesiocypraea* sp. nov., 23.1 mm, Tubai, off 558-1.000 m.

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