The Cowries of the Ryukyu Islands

BY

CRAWFORD N. CATE

12719 San Vicente Boulevard, Los Angeles, California 90049

(Plate 3; 2 Maps)

INTRODUCTION

In any discussion of the Cypraeidae of the Ryukyu Islands it would seem well to include a brief description of this semi-remote, curving chain of approximately 70 islands, for the area comprises roughly a 900 mile long continuous link between the Philippine and Japanese faunal regions.

These Islands have been known by various names. The Japanese refer to them as the Ryukyu Retto; they also are known as the Luchu or Loochoo Group; but, perhaps more correctly, they should be referred to as the Nansei or Ryukyu Islands. They form a natural broken land arc linking the Japanese island of Kyushu with Taiwan (formerly Formosa). In these islands are three important subdivisions: the Amami, the Sakishima, and the Okinawa groups. Altogether they represent an exposed land mass of approximately 847 square miles.

The sovereignty of the Ryukyus has changed many times. From a Chinese protectorate in 1372, successively, this island group became subsidiary to both China and Japan about 1451, eventually falling deeper under Japanese influence in 1609, then finally coming under full control of that country in 1879. As a result of World War II the island group became subject in 1945 to the United States military government. Civil government was returned to the inhabitants in 1951; in 1953 the Amami Group was returned to Japan; custody of Okinawa, the largest island, remains still with the United States.

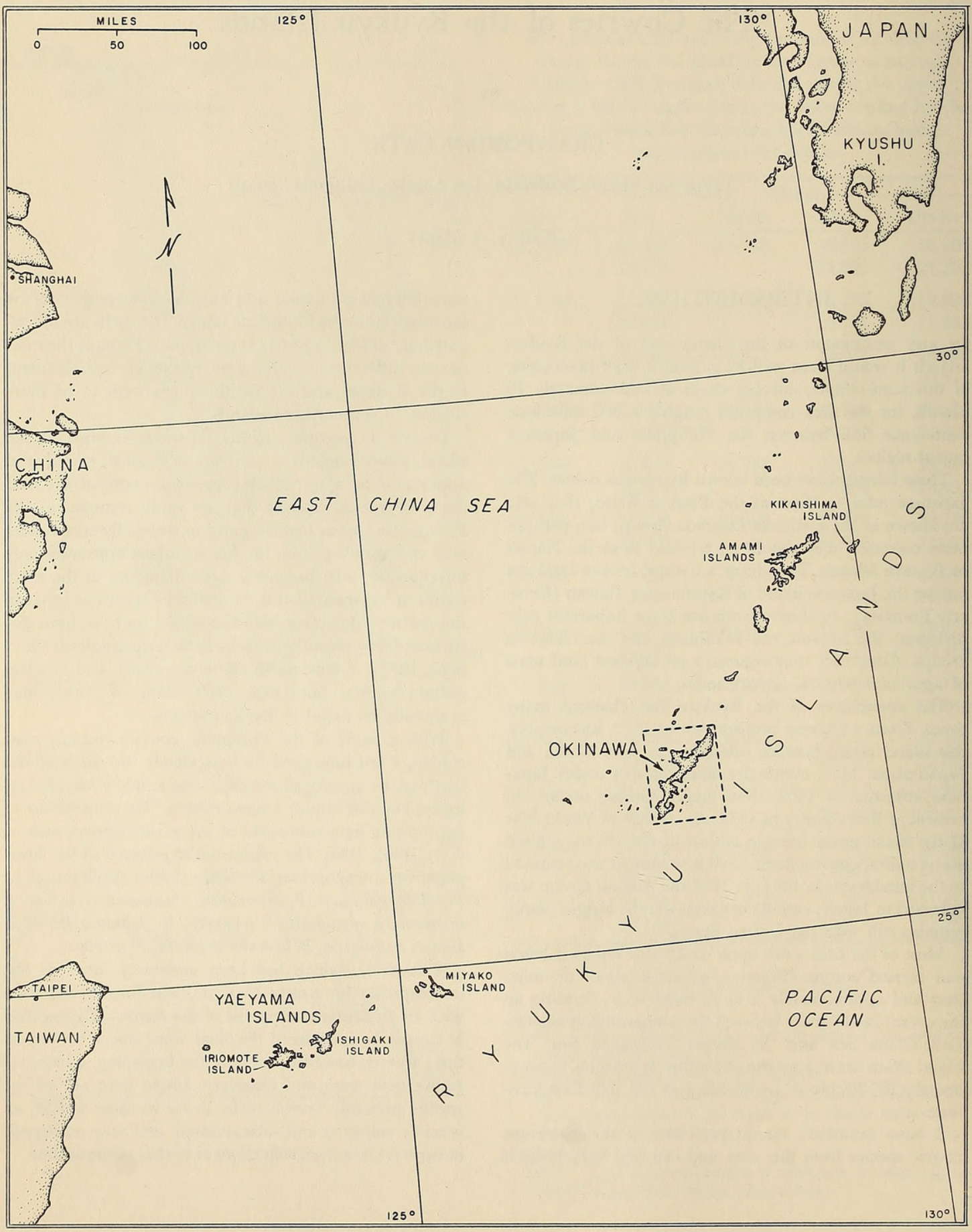
Most of the field work upon which this report is based was carried out on Okinawa, which is about 65 miles long and approximately 3 to 10 miles wide, forming an important land barrier between the comparatively shallow East China Sea and the deeper Philippine Sea. The island chain lies in a northeast-southwest attitude, approximately 26° 30′ North Longitude and 128° 00′ East Latitude.

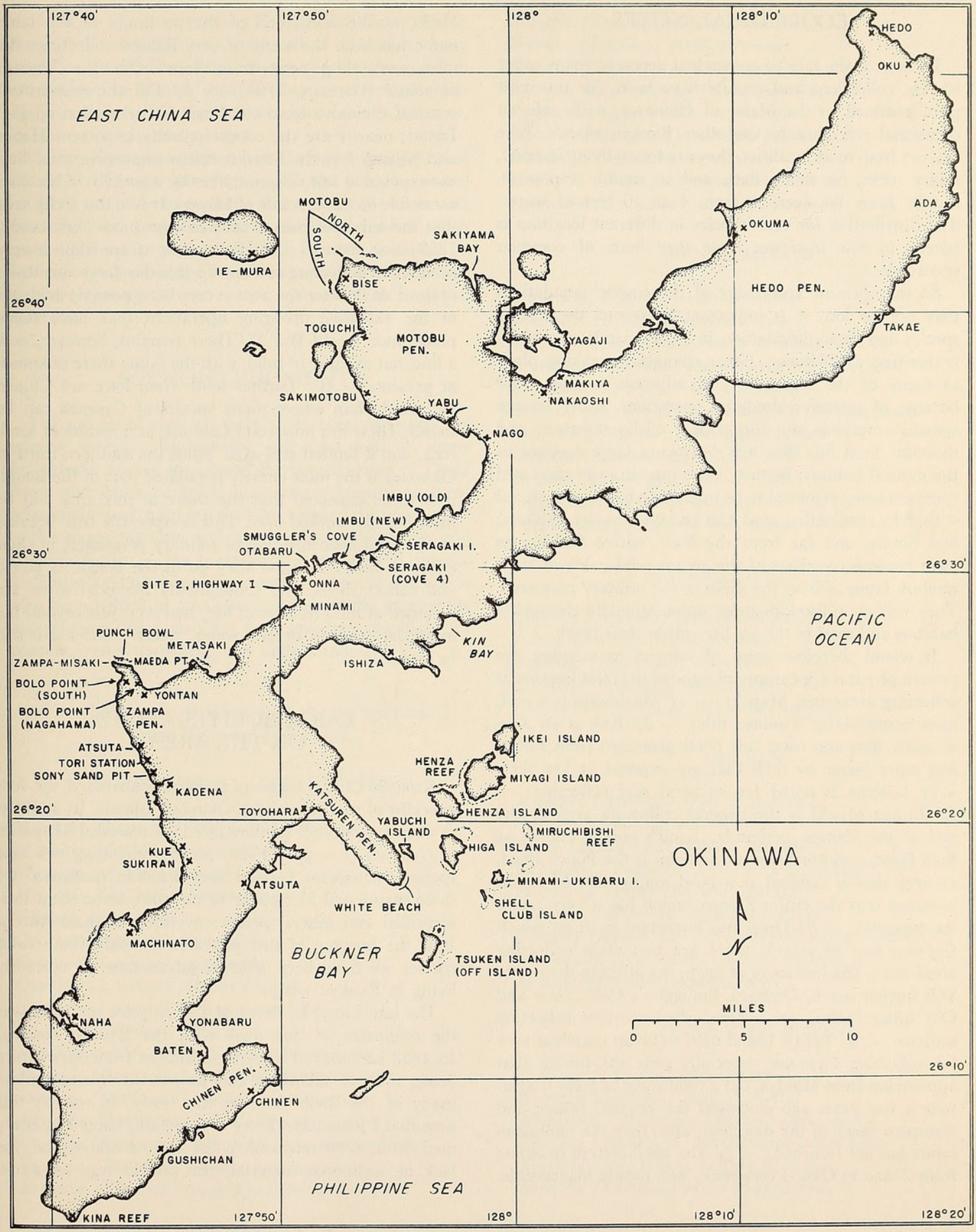
I have examined many specimens of the numerous cowrie species from this area and can find very little, if any, differences in color and form as compared with the same species in the Philippine fauna. The shells are indeed strikingly similar in nearly every respect. Perhaps the most obvious differences are that some species are less abundant in the Ryukyus and the depth ranges seem to be more shallow in the northern islands.

Despite its proximity to the Japanese Archipelago the island chain remains a separate ecological entity, and appears to be a transitional area for many of the east Asian cypraeids. Species that are quite common in the Philippines appear here as scarce or decidedly uncommon, even disappearing from the fauna; others appearing only infrequently, then becoming more abundant in the more northern Japanese islands. It should be mentioned that in the northern Japanese islands new species have been discovered fairly recently [such as *Schilderia langfordi* (Kuroda, 1938), *S. teramachii* (Kuroda, 1938), and *Erosaria guttata azumai* Schilder, 1960] some of which may eventually be found in Ryukyu waters.

With a study of the Philippine cowries recently concluded, I am impressed by how closely the shells of the two regions appear to resemble one another morphologically. For this reason I have referred for illustrations to appropriate figures in some of my earlier papers such as Cate, 1965, 1966. The reader is also referred to the latter paper for a comparison of certain similar species, such as *Bistolida pallidula, B. interrupta; Pustularia cicercula, P. bistrinotata mediocris, P. tetsuakii, P. globulus; Bistolida kieneri depriesteri, B. hirundo neglecta, B. ursellus.*

This study, which has been underway more or less interruptedly for nearly 15 years, will furnish collectors with an authentic modern list of the Ryukyu Cypraeidae. It cannot be considered the final word about cowries in these waters, however, but only the beginning, a basis for future field work and discovery. Listed here are all the species presently known to be living in these waters, all recently collected and substantiated, and now on deposit in various Okinawan collections or in that of the author.


MILES
0 50 100
125°
130°
JAPAN
KYUSHU I.
SHANGHAI
30°
CHINA
EAST CHINA SEA
KIKAISHIMA ISLAND
AMAMI ISLANDS
RYUKYU ISLANDS
OKINAWA
25°
TAIPEI
TAIWAN
YAEYAMA ISLANDS
IRIOMOTE ISLAND
ISHIGAKI ISLAND
MIYAKO ISLAND
PACIFIC OCEAN
125°
130°


127°40'
127°50'
128°
128°10'
26°40'
26°30'
26°20'
26°10'
EAST CHINA SEA
PACIFIC OCEAN
PHILIPPINE SEA
OKINAWA
BUCKNER BAY
KIN BAY
HEDO PEN.
MOTOBU PEN.
CHINEN PEN.
KATSUREN PEN.
ZAMPA PEN.
HEDO
OKU
ADA
OKUMA
TAKAE
YAGAJI
MAKIYA
NAKAOSHI
MOTOBU
NORTH
SOUTH
SAKIYAMA BAY
IE-MURA
BISE
TOGUCHI
SAKIMOTOBU
YABU
NAGO
IMBU (OLD)
IMBU (NEW)
SERAGAKI I.
SERAGAKI (COVE 4)
SMUGGLER'S COVE
OTABARU
SITE 2, HIGHWAY 1
ONNA
MINAMI
ISHIZA
PUNCH BOWL
METASAKI
ZAMPA-MISAKI
MAEDA PT.
BOLO POINT (SOUTH)
BOLO POINT (NAGAHAMA)
YONTAN
ATSUTA
TORI STATION
SONY SAND PIT
KADENA
TOYOHARA
YABUCHI ISLAND
IKEI ISLAND
HENZA REEF
MIYAGI ISLAND
HENZA ISLAND
MIRUCHIBISHI REEF
HIGA ISLAND
MINAMI-UKIBARU I.
SHELL CLUB ISLAND
KUE
SUKIRAN
ATSUTA
WHITE BEACH
MACHINATO
TSUKEN ISLAND (OFF ISLAND)
NAHA
YONABARU
BATEN
CHINEN
GUSHICHAN
KINA REEF
N
MILES
0
5
10

ECOLOGICAL NOTES

Because of the lack of convenient access to many other islands, collections and reports have been, for the most part, confined to the island of Okinawa, with only an occasional reference to the other Ryukyu islands. Like cowries from most localities, they are found living in coral, under rocks, on sandy flats, and in muddy exposures, usually here, however, in from 4 to 10 feet of water. The distribution for each species in different localities is noted; in few instances have they been of common occurrence.

So that present knowledge of the cowrie populations may not be lost, it is important to record the known species and their distribution in these islands; especially is this true at Okinawa. Great changes are taking place in many of the intertidal and adjacent marine areas because of extensive dredging operations, many sewage systems emptying into the critical offshore waters, and shoreline land fills that are destroying large sections of the natural habitat; further, large quantities of sand and coral are being removed to be made into building material – thereby eliminating sand flats and underwater habitats; and finally, and far from the least, native Okinawans have become conscious of the commercial value of their mollusk fauna, selling the shells to the military personnel. They collect indiscriminately, unintentionally destroying habitats and most of the sea life within their reach.

It would therefore seem of interest to mention the present physical appearance of some of the most important collecting areas (see Maps): – 1/ Machinato is a reef, most accessible at a minus tide; – 2/ Kue is an area of sandy flats and coral tide pools protected from turbulent outer water by reefs that are exposed at low tide; – 3/ Kadena is noted for its coral reef collecting; – 4/ Zampa-Misaki is the general collecting area at the end of the Zampa peninsula. Land's end is known as Bolo Point, and northeast of the point is the Punch Bowl, an area that is exposed at a good minus tide. It should be noted that the entire Zampa region has a very rough sea exposure. – 5/ Onna has important reefs on which *Cypraea* can be found; there are two main collecting areas there, one just south of town, the other to the north. Still further north, Otabaru, Smuggler's Cove, New and Old Imbu (Inbu) are successively important collecting stations. – 6/ Yagaji Island used to be an excellent area for collecting *Cypraea,* especially near the bridge that approaches from Makiya, but a tidal wave of great magnitude a few years ago destroyed the original bridge and disrupted much of the shoreline; since then the molluscan fauna has not returned. – 7/ The northeastern coastline from Takae to Oku is very rocky and mostly inaccessible. Hedo, at the north end of the peninsula of the same name has been the scene of very limited collecting; the most outstanding species from there is *Ovatipsa chinensis chinensis* (Gmelin, 1791). – 8/ Off the east-central coast of Okinawa is an old Coast Guard station on Ikei Island; nearby are the conchologically important Henza and Miyagi Islands. Between them impressive sand flats are exposed at low tide, and likewise a rocky reef becomes accessible on the east side of Miyagi. It is in this rocky area that the only specimen of *Adusta onyx onyx* (Linnaeus, 1758) was found. – 9/ Baten was at one time a very productive collecting station. To this day large quantities of dead shells litter the area everywhere, possibly evidence of the extensive dredging operations that have taken place since World War II. There remains, however, now a fine, flat expanse of mud, with the fauna there unknown at present. – 10/ Further south from here are Chinen and Gushichan where many species of *Cypraea* can be found. These are important habitats, and consist of sand, rock, and a limited reef area. Since the southern third of Okinawa is the most densely populated part of the island, it is to be expected that the shore in this area will be most heavily worked over. This is especially true because of the local concentration of military personnel; in their effort to find relaxation they go to the beach to picnic and collect shells, and consequently the tidal areas are denuded of most molluscan life; however, just beyond the intertidal zone, in deeper water, many cowries can still be found.

EARLIER LITERATURE ON THE AREA

Kuroda (1960) appears to have contributed the first checklist of mollusks of the Okinawa Islands. In addition to members of other families listed, he recorded 63 species of *Cypraea* (*l.c.*, pp. 21-23; plt. 3), including two new species, *Notadusta katsuae* and *Bistolida luchuana.* Of those mentioned 57 appear to be valid, some seem misidentified and others species unverified in these waters. It is the purpose of this paper to list only those valid species we have been able to substantiate as currently living in Ryukyu waters.

The late Lloyd E. Berry of Los Angeles probably was the originator of this work with the Ryukyu cowries. In 1952 he received his first specimens from Mrs. Anita Scott, then of Okinawa, and he started to accumulate many of the shells used in this study. It was at this time that I joined Mr. Berry in this work. Later Mr. Berry died, Mrs. Scott returned to the United States, and, for lack of additional material, the project was set aside.

However, in more recent years Bernice and Ernest Albert, Peter Way, and Barbara Keily, all of Okinawa, have joined in the field work to confirm the localities and to substantiate the species, thus assisting me in bringing this study to a close. The decision to 'close' here is arbitrary, for the work can never stop.

During November 1966 I had the opportunity to visit Okinawa. Through the kindness of the just mentioned friends I was able to examine their shell collections and determine the probable population density of a given species from the quantities noted in each instance, as well as to collect at several of the areas listed here and to observe many of the cowrie species in their native habitats.

ACKNOWLEDGMENTS

The success of such a report as this depends upon the interest, integrity, enthusiasm, and hard work of many individuals. I have mentioned the contributions of Lloyd Berry and Anita Scott; I must now acknowledge those whose field work has been the final word in the completion of this paper: Bernice and Ernest Albert, Peter Way and Barbara Keily – to them all I give heartfelt thanks. To Emily Reid who drew the excellent maps, and to others who have helped in many unseen ways I also express my appreciation. To Jean Cate goes my deep gratitude for continual encouragement and understanding.

A Summary of Ryukyu Cowrie Species from Selected Localities

ZAMPA-MISAKI (BOLO POINT)

Mauritia (Leporicypraea) mappa mappa
Mauritia (Arabica) arabica asiatica
Mauritia (Arabica) maculifera
Mauritia (Arabica) scurra indica
Talparia talpa talpa
Cypraea (Lyncina) argus argus
Cypraea (Lyncina) lynx vanelli
Cypraea (Lyncina) vitellus vitellus
Cypraea (Lyncina) carneola carneola
Luria (Basilitrona) isabella rumphii
Monetaria (Ornamentaria) annulus annulus
Erosaria (Ravitrona) labrolineata labrolineata
Erosaria (Ravitrona) cernica ogasawarensis
Erosaria (Ravitrona) helvola helvola
Erosaria (Ravitrona) caputserpentis caputserpentis
Erosaria (Erosaria) poraria scarabaeus
Erosaria (Erosaria) erosa phagedaina
Erosaria (Erosaria) miliaris miliaris
Erronea (Erronea) errones errones
Erronea (Erronea) caurica caurica
Erronea (Melicerona) felina pauciguttata
Purpuradusta fimbriata marmorata
Bistolida (Blasicrura) pallidula pallidula
Bistolida (Blasicrura) teres teres
Cribraria (Ovatipsa) chinensis chinensis
Cribraria (Cribraria) cribraria orientalis

HENZA-MIYAGI

Mauritia (Arabica) arabica asiatica
Mauritia (Arabica) scurra indica
Monetaria (Monetaria) moneta rhomboides
Erosaria (Ravitrona) labrolineata labrolineata
Erosaria (Ravitrona) helvola helvola
Erosaria (Ravitrona) caputserpentis caputserpentis
Erosaria (Erosaria) erosa phagedaina
Erronea (Adusta) onyx onyx
Erronea (Erronea) errones errones
Purpuradusta gracilis japonica
Purpuradusta fimbriata marmorata

SMUGGLER'S COVE

Cypraea (Lyncina) carneola carneola
Palmadusta clandestina moniliaris
Bistolida (Blasicrura) teres teres
Bistolida (Bistolida) stolida stolida
Cribraria (Cribraria) cribraria cribraria

CHINEN

Mauritia (Arabica) arabica asiatica
Cypraea (Lyncina) vitellus vitellus
Luria (Basilitrona) isabella rumphii
Pustularia (Pustularia) cicercula cicercula
Pustularia (Ipsa) childreni samurai
Erosaria (Erosaria) erosa phagedaina
Erosaria (Ravitrona) caputserpentis caputserpentis
Staphylaea (Nuclearia) nucleus nucleus
Erronea (Erronea) ovum ovum

ONNA TIDE FLAT

Cypraea (Lyncina) lynx vanelli
Cypraea (Lyncina) vitellus vitellus
Monetaria (Monetaria) moneta rhomboides
Erosaria (Ravitrona) labrolineata labrolineata
Erosaria (Ravitrona) helvola helvola
Erosaria (Erosaria) erosa phagedaina

Staphylaea (Staphylaea) staphylaea staphylaea
Staphylaea (Staphylaea) limacina limacina
Erronea (Erronea) errones errones
Erronea (Erronea) cylindrica cylindrica
Notadusta punctata atomaria
Palmadusta asellus vespacea
Palmadusta clandestina moniliaris
Purpuradusta gracilis japonica
Purpuradusta fimbriata marmorata
Bistolida (Blasicrura) luchuana
Bistolida (Derstolida) hirundo neglecta
Cribraria (Cribraria) cribraria orientalis

METASAKI REEF FLAT

Talparia talpa talpa
Cypraea (Lyncina) argus argus
Cypraea (Lyncina) lynx vanelli
Cypraea (Lyncina) carneola carneola
Luria (Basilitrona) isabella rumphii
Erosaria (Erosaria) poraria scarabaeus
Staphylaea (Nuclearia) nucleus nucleus
Palmadusta asellus vespacea

MINAMI-UKIBARU

Erronea (Melicerona) felina pauciguttata
Purpuradusta gracilis japonica
Bistolida (Derstolida) kieneri depriesteri

MACHINATO REEF

Mauritia (Arabica) arabica asiatica
Cypraea (Lyncina) carneola carneola
Erosaria (Ravitrona) caputserpentis caputserpentis
Erosaria (Erosaria) erosa phagedaina
Staphylaea (Staphylaea) staphylaea staphylaea
Erronea (Erronea) errones errones

OTABARU REEF

Mauritia (Arabica) eglantina couturieri
Erosaria (Ravitrona) caputserpentis caputserpentis
Staphylaea (Staphylaea) limacina limacina
Palmadusta clandestina moniliaris
Cribraria (Cribraria) cribraria orientalis

GUSHICHAN

Talparia talpa talpa
Luria (Basilitrona) isabella rumphii
Pustularia (Pustularia) cicercula cicercula
Staphylaea (Staphylaea) staphylaea staphylaea
Staphylaea (Nuclearia) nucleus nucleus

MIYAKO REEF

Mauritia (Leporicypraea) mappa mappa
Mauritia (Arabica) eglantina couturieri
Cypraea (Cypraea) tigris pardalis
Erronea (Erronea) cylindrica cylindrica

Locality Index

1. Ada
3. Atsuta
7. Baten
7a. Bise
9. Bolo Point (South)
9a. Bolo Point (Nagahama)
11. Buckner Bay
13. Chinen
14. Cove 4 (adjacent Seragaki)
15. Gushichan
17. Hedo
19. Henza-Miyagi
20. Henza Reef
20a. Ie-Mura
21. Ikei Island
23. Imbu (Inbu)-old
25. Imbu (Inbu)-new
27. Iriomote Island
29. Ishigaki Island
31. Ishiza
33. Kadena
35. Kikaishima Island
35a. Kin Bay
35b. Kina Reef
37. Kue
39. Machinato
39a. Maeda Point
41. Metasaki (Maeda saki)
42. Minami
43. Minami-Ukibaru Isld.
44. Miruchibishi Reef
45. Miyako Island
47. Motobu (north)
48. Motobu (south)
49. Nago
51. Naha
51a. Nakaoshi
52. Off Island
53. Okinawa
55. Okuma
57. Onna (Onna Flat)
57a. Onna (outer reef)
59. Otabaru
61. Punchbowl
62. Ryukyu Islands
62a. Shell Club Island
63. Sakiyama Bay
63a. Seragaki Island
63b. Site 2, Highway 1
65. Smuggler's Cove
65a. Sony Sand Pit
67. Sukiran
69. Toguchi
69a. Tori Station
71. Taiwan
73. Takae
75. Toyohara
75a. Ueno (Miyako Isld.)
75b. White Beach
77. Yabu
79. Yaeyama Island
81. Yagaji
82. Yonabaru
83. Yontan
85. Zampa-Misaki

INDEX OF SPECIES

[s] = synonym; [N] = *nomen nudum*

Systematic List of the Ryukyu Cowries

CYPRAEIDAE FLEMING, 1828
Hist. Brit. Anim., 330 (em.) (Edinburgh)

CYPRAEINAE STOLICZKA, 1867
Pal. Ind. (5), **2**: 45

Cypraeini SCHILDER, 1927
Arch. Naturgesch. **91/A**: 92

Mauritia TROSCHEL, 1863
Das Gebiß der Schnecken **1**: 205

> Type Species: *Cypraea mauritiana* LINNAEUS, 1758 <

(Leporicypraea) IREDALE, 1930
Mem. Queensld. Mus. **10** (1): 83

> Type species: *Cypraea mappa* LINNAEUS, 1758 <

1. *Mauritia (Leporicypraea) mappa mappa* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 718

(Arabica) JOUSSEAUME, 1884
Naturaliste **1884**: 414

> Type species: *Cypraea arabica* LINNAEUS, 1758 <

2. *Mauritia (Arabica) eglantina couturieri* (VAYSSIÈRE, 1905))
Journ. Conchyl. **53**: 13; plt. 1, fig. 3

3. *Mauritia (Arabica) arabica asiatica* SCHILDER & SCHILDER, 1939
Proc. Malacol. Soc. London **18** (4): 183

4. *Mauritia (Arabica) maculifera* SCHILDER, 1932
Zool. Anz. **100** (7/8): 165

5. *Mauritia (Arabica) scurra indica* (GMELIN, 1791)
Systema Naturae, ed. 13: 3412

(Mauritia) TROSCHEL, 1863
Das Gebiß der Schnecken **1**: 205
> Type Species: *Cypraea mauritiana* LINNAEUS, 1758 <
Systema Naturae, ed. 10: 721

6. *Mauritia (Mauritia) mauritiana calxequina* (MELVILL & STANDEN, 1899)
Journ. Conchol. **9**: 236

Talparia TROSCHEL, 1863
Das Gebiß der Schnecken **1**: 204
> Type Species: *Cypraea talpa* LINNAEUS, 1758 <

(Talparia) TROSCHEL, 1863
7. *Talparia (Talparia) talpa talpa* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 720

Cypraea LINNAEUS, 1758
Systema Naturae, ed. 10: 718
(em.) MONTFORT, P. DENYS DE, 1810
Conchyl. Syst. **2**: 630

(Cypraea) LINNAEUS, 1758
> Type Species: *Cypraea tigris* LINNAEUS, 1758 <

8. *Cypraea (Cypraea) tigris pardalis* SHAW, 1795
Vivar. Natur. Misc. **6**: plt. 193

(Lyncina) TROSCHEL, 1863
Das Gebiß der Schnecken **1**: 205
> Type Species: *Cypraea lynx* LINNAEUS, 1758 <

9. *Cypraea (Lyncina) argus argus* LINNAEUS, 1758
Systema Naturae, ed. 10: 719

10. *Cypraea (Lyncina) lynx vanelli* LINNAEUS, 1758
Systema Naturae, ed. 10: 721

11. *Cypraea (Lyncina) vitellus vitellus* LINNAEUS, 1758
Systema Naturae, ed. 10: 721

12. *Cypraea (Lyncina) schilderorum* IREDALE, 1939
Austral. Zool. 9 (3): 303

13. *Cypraea (Lyncina) carneola carneola* LINNAEUS, 1758
Systema Naturae, ed. 10: 719

14. *Cypraea (Lyncina) kuroharai* (KURODA & HABE, 1961)
Col. Illust. Shells of Japan **2**: 42; plt. 19, fig. 17

Luriini SCHILDER, 1932
Fossil. Cat. **1**: Animalia, pars 55, Cypraeacea

Chelycypraea SCHILDER, 1927

(Chelycypraea) SCHILDER, 1927
Arch. Naturgesch. **91A** (10): 92
> Type Species: *Cypraea testudinaria* LINNAEUS, 1758 <

15. *Chelycypraea (Chelycypraea) testudinaria testudinaria* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 719

Luria JOUSSEAUME, 1884
Bull. Soc. Zool. France **9**: 92
(Naturaliste 1884: 414, *nom. nud.*)
> Type Species: *Cypraea lurida* LINNAEUS, 1758 <
Systema Naturae, ed. 10: 720

(Basilitrona) IREDALE, 1930
Mem. Queensld. Mus. **10** (1): 83
> Type Species: *Cypraea isabella* LINNAEUS, 1758 <
Systema Naturae, ed. 10: 722

16. *Luria (Basilitrona) isabella rumphii* SCHILDER & SCHILDER, 1938
Proc. Malacol. Soc. London **23** (3): 177

Nariini SCHILDER, 1932
Fossil. Cat. **1**: Animalia, pars 55, Cypraeacea

(Pustulariini SCHILDER, 1932)
Fossil. Cat. **1**: Animalia, pars 55, Cypraeacea

Pustularia SWAINSON, 1840
LARDNER's Encycl., p. 324

(Annepona) IREDALE, 1935
Austral. Zool. **8** (2): 114
> Type Species: *Pustularia mariae* SCHILDER, 1927 <

17. *Pustularia (Annepona) mariae* (SCHILDER, 1927)
Arch. Naturgesch. **91A** (10): 104

(Pustularia) SWAINSON, 1840
LARDNER's Encycl., p. 324
> Type Species: *Cypraea cicercula* LINNAEUS, 1758 <

18. *Pustularia (Pustularia) cicercula cicercula* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 725

19. *Pustularia (Pustularia) bistrinotata mediocris* SCHILDER & SCHILDER, 1938
Proc. Malacol. Soc. London **23** (3): 126

20. *Pustularia (Pustularia) globulus globulus* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 725

(Ipsa) Jousseaume, 1884
Naturaliste **1884:** 415

> Type Species: *Cypraea childreni* Gray, 1825 <

21. *Pustularia (Ipsa) childreni samurai* Schilder, 1940
Arch. Molluskenk. **72:** 42

(Narinii Schilder, 1932)
Fossil. Cat. **1:** Animalia, pars 55, Cypraeacea

Monetaria Troschel, 1863
Das Gebiß der Schnecken **1:** 205

(Ornamentaria) Schilder & Schilder, 1936
Proc. Zool. Soc. London **1936:** 1120

> Type Species: *Cypraea annulus* Linnaeus, 1758 <

22. *Monetaria (Ornamentaria) annulus annulus* (Linnaeus, 1758)
Systema Naturae, ed. 10: 723

(Monetaria) Troschel, 1863
Das Gebiß der Schnecken **1:** 205

> Type Species: *Cypraea moneta* Linnaeus, 1758 <

23. *Monetaria (Monetaria) moneta rhomboides* Schilder & Schilder, 1933
Zool. Meded. Leiden **16:** 163

Erosaria Troschel, 1863
Das Gebiß der Schnecken **1:** 205

> Type Species: *Cypraea erosa* Linnaeus, 1758 <

(Ravitrona) Iredale, 1930
Mem. Queensld. Mus. **10** (1): 82

> Type Species: *Cypraea caputserpentis* Linnaeus, 1758 <

24. *Erosaria (Ravitrona) labrolineata labrolineata* (Gaskoin, 1849)
Proc. Zool. Soc. London **1849:** 97

25. *Erosaria (Ravitrona) cernica ogasawarensis* Schilder, 1944
Arkiv Zool. **36 A** (2): 23

26. *Erosaria (Ravitrona) helvola helvola* (Linnaeus, 1758)
Systema Naturae, ed. 10: 724

27. *Erosaria (Ravitrona) caputserpentis caputserpentis* (Linnaeus, 1758)
Systema Naturae, ed. 10: 720

(Erosaria) Troschel, 1863
Das Gebiß der Schnecken **1:** 205

> Type Species: *Cypraea erosa* Linnaeus, 1758 <

28. *Erosaria (Erosaria) poraria scarabaeus* (Bory, 1827)
Encycl. Méth. **3:** 164; atlas (Valenciennes MS)

29. *Erosaria (Erosaria) erosa phagedaina* (Melvill, 1888)
Mem. Manchest. Lit. Soc. **4** (1): 223; fig. 11

30. *Erosaria (Erosaria) miliaris miliaris* (Gmelin, 1791)
Systema Naturae, ed. 13: 3420

Staphylaea Jousseaume, 1884
Naturaliste **1884:** 415

(Staphylaea) Jousseaume, 1884

> Type Species: *Cypraea staphylaea* Linnaeus, 1758 <

31. *Staphylaea (Staphylaea) staphylaea staphylaea*
Systema Naturae, ed. 10: 725

32. *Staphylaea (Staphylaea) limacina limacina* (Lamarck, 1810)
Ann. Mus. Nat. Hist. Paris **15:** 101

(Nuclearia) Jousseaume, 1884
Bull. Soc. Zool. France **9:** 98

> Type Species: *Cypraea nucleus* Linnaeus, 1758 <

33. *Staphylaea (Nuclearia) nucleus nucleus* (Linnaeus, 1758)
Systema Naturae, ed. 10: 724

(Erroneini Schilder, 1927)
Arch. Naturgesch. 91/A **10:** 109

Erronea Troschel, 1863
Das Gebiß der Schnecken **1:** 205

> Type Species: *Cypraea errones* Linnaeus, 1758 <

(Adusta) Jousseaume, 1884
Naturaliste **1884:** 414

> Type Species: *Cypraea adusta* Lamarck, 1810 <
Ann. Mus. Hist. Nat. **16:** 92

= *Cypraea onyx* Linnaeus, 1758

34. *Erronea (Adusta) onyx onyx* (Linnaeus, 1758)
Systema Naturae, ed. 10: 722

(Gratiadusta) Iredale, 1930
Mem. Queensld. Mus. **10** (1): 82

> Type Species: *Cypraea pyriformis* Gray, 1824 <
Zool. Journ. **1:** 371

35. *Erronea (Gratiadusta) pulchella pulchella* (Swainson, 1823)
Tilloch's Phil. Mag. **61:** 376

(Erronea) TROSCHEL, 1863
Das Gebiß der Schnecken **1:** 205
> Type Species: *Cypraea errones* LINNAEUS, 1758 <

36. *Erronea (Erronea) errones errones* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 723

37. *Erronea (Erronea) ovum ovum* (GMELIN, 1791)
Systema Naturae, ed. 13: 3412

38. *Erronea (Erronea) cylindrica cylindrica* (BORN, 1778)
Index Mus. Caes. Vindob. **1:** 169

39. *Erronea (Erronea) caurica caurica* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 723

(Melicerona) IREDALE, 1930
Mem. Queensld. Mus. **10** (1): 83
> Type Species: *Cypraea listeri* GRAY, 1824 <
Zool. Journ. **1:** 384
= *Cypraea felina* GMELIN, 1791
Systema Naturae, ed. 13: 3412

40. *Erronea (Melicerona) felina pauciguttata* (SCHILDER & SCHILDER, 1938)
Proc. Malacol. Soc. London **23** (3): 161

Notadusta SCHILDER, 1935
Proc. Malacol. Soc. London **21** (4): 350
> Type Species: *Notadusta victoriana* SCHILDER, 1935 <
Proc. Malacol. Soc. London **21** (4): 350

41. *Notadusta punctata atomaria* (GMELIN, 1791)
Systema Naturae, ed. 13: 3412

42. *Notadusta katsuae* (KURODA, 1960)
Cat. Moll. Fauna Okinawa **1960:** 74; plt. 3, figs. 32 - 34

43. *Notadusta musumea* (KURODA & HABE, 1961)
Color Illust. Shells Japan **2:** 42; plt. 19, fig. 18

Palmadusta IREDALE, 1930
Mem. Queensld. Mus. **10** (1): 82
> Type Species: *Cypraea clandestina* LINNAEUS, 1758 <

(Palmadusta) IREDALE, 1930

44. *Palmadusta (Palmadusta) asellus vespacea* (MELVILL, 1905)
Journ. Conchol. **11:** 192

45. *Palmadusta (Palmadusta) clandestina moniliaris* (LAMARCK, 1810)
Ann. Mus. Hist. Nat. Paris **16:** 98

46. *Palmadusta (Palmadusta) lutea lutea* (GMELIN, 1791)
Systema Naturae, ed. 13: 3414

47. *Palmadusta (Palmadusta) ziczac ziczac* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 722

(Purpuradusta) SCHILDER, 1939
Arch. Molluskenk. **71:** 165
> Type Species: *Cypraea fimbriata* GMELIN, 1791 <
Systema Naturae, ed. 13: 3420

48. *Palmadusta (Purpuradusta) gracilis japonica* (SCHILDER, 1931)
Zool. Anz. **96:** 67 - 68

49. *Palmadusta (Purpuradusta) fimbriata marmorata* (SCHRÖTER, 1804)
Wiedem. Arch. Zool. 4 (1): 14

Bistolida COSSMANN, 1920
Rev. Crit. Paléozool. **24:** 83
> Type Species: *Cypraea stolida* LINNAEUS, 1758 <

(Blasicrura) IREDALE, 1930
Mem. Queensld. Mus. **10** (1): 84
> Type Species: *Cypraea rhinoceros* SOUVERBIE, 1865 <
Journ. Conchyl. **13:** 156; plt. 511

50. *Bistolida (Blasicrura) quadrimaculata quadrimaculata* (GRAY, 1824)
Zool. Journ. **1:** 376

51. *Bistolida (Blasicrura) pallidula pallidula* (GASKOIN, 1849)
Proc. Zool. Soc. London **1849:** 97

52. *Bistolida (Blasicrura) luchuana* KURODA, 1960
Catal. Moll. Fauna Okinawa 74; plt. 3, fig. 40

53. *Bistolida (Blasicrura) teres teres* (GMELIN, 1791)
Systema Naturae, ed. 13: 3405

(Bistolida) COSSMANN, 1920
Rev. Crit. Paléozool. **24:** 83
> Type Species: *Cypraea stolida* LINNAEUS, 1758 <

54. *Bistolida (Bistolida) kieneri depriesteri* (SCHILDER, 1933)
Journ. Conchol. **19:** 355

55. *Bistolida (Bistolida) hirundo neglecta* (SOWERBY, 1837)
Catal. Rec. Cypraeidae, London **1:** 6

56. *Bistolida (Bistolida) stolida stolida* (LINNAEUS, 1758)
Systema Naturae, ed. 10: 724

Cribraria JOUSSEAUME, 1884
Bull. Soc. Zool. France **9**: 94

> Type Species: *Cypraea cribraria* LINNAEUS, 1758 <
Systema Naturae, ed. 10: 723

(Ovatipsa) IREDALE, 1931
Rec. Austral. Mus. **18** (4): 219

> Type Species: *Cypraea chinensis* GMELIN, 1791 <

57. *Cribraria (Ovatipsa) chinensis chinensis*
(GMELIN, 1791)
Systema Naturae, ed. 13: 3421

(Cribraria) JOUSSEAUME, 1884
Bull. Soc. Zool. France **9**: 94

> Type Species: *Cypraea cribraria* LINNAEUS, 1758 <
Systema Naturae, ed. 10: 723

58. *Cribraria (Cribraria) cribraria orientalis*
SCHILDER & SCHILDER, 1940
Arch. Molluskenk. **72** (2/3): 43

DISCUSSION AND STATISTICAL NOTES

1. *Mauritia (Leporicypraea) mappa mappa*
(LINNAEUS, 1758)

– CATE, 1966: plt. 34; figs. 7 a, 7b –

Localities: 41, 45, 48, 69, 79, 85

(6)[2] r[3]	L	W	H	Lip	Col[1]
Largest shell:	88.2	58.0	48.3	42	35
Smallest shell:	70.3	44.0	37.5	34	34

At present, this species has to be considered rare in the Ryukyu Islands, particularly so in the littoral area of Okinawa. Reports of its being found at the southern islands of Miyako and Yaeyama are made occasionally; however, only 3 other shells are presently known to have been found at Okinawa (all at Zampa-Misaki), 2 of these being dead shells. Sometimes the local market has a specimen for sale, but these are thought to have been brought from the Philippine Islands. The 2 specimens whose measurements are listed above were collected in 1952, one at Zampa-Misaki, the other at Yaeyama Island. The Ryukyu shells, like those from Japanese waters, can usually be easily distinguished from the Philippine shells by the pale coloring on the base of the shell; the Okinawa shells are mostly light beige, sometimes exhibiting a faint flush of very pale brown, only occasionally pale pink. The southern Philippine shells, in contrast, usually are some shade of pink or rose. It is interesting to note that the base of the Japanese shell approaches an almost off-white color in many instances.

The shell is large, of medium weight, often more humped; base has a hint of flatness, gently convex abapically toward higher margins; terminals produced, acutely and strongly formed; apex never completely covered; margins thickened, evenly calloused, becoming vaguely flanged adapically, conspicuously so on either side in front; aperture fairly wide, almost straight; teeth fine (for a shell of this size), numerous, and not too heavily formed; columella broad, finely ribbed adaxially; fossula wide, fairly deep, with an upraised central ridge within, ribbed with teeth overall; primary shell color is ivory brown; the dorsal covering is a curious pattern of fine chestnut-brown, wavering, longitudinal lines; a wide tributary mantle pattern covers a large portion of the central dorsal surface (the species name is derived from this unique pattern); large, brown, diffused spots recede to obscurity from the sides to the base; base and terminals pale pink-brown blush to off-white, teeth, columella, fossula, and interstices ivory; there may be a large dark brown blotch at the spire. It is interesting to note that this species emits an intense red fluorescence when exposed to short-wave ultra violet light.

2. *Mauritia (Arabica) eglantina couturieri*
(VAYSSIÈRE, 1905))

– CATE, 1966: plt. 35; figs. 8 a, 8 b –

Localities: 55, 59, 85

(6) u	L	W	H	Lip	Col
Largest shell:	58.8	32.6	26.9	39	33
Smallest shell:	56.3	31.3	25.2	33	31

This species is somewhat difficult to find at Okinawa. As far as I know the shell is presently found only at Otubaru and Zampa-Misaki reefs, living hidden in coral crevices.

The shell is long, narrow, cylindrically-ovate, base somewhat flattened; terminals produced; aperture long, narrow, wider in front; teeth numerous, fine, short; margins rounded, lightly calloused, right side sub-angled;

[1] Shell measurements (in millimeters):
L = length of shell; W = width of shell; H = height of shell; Lip = number of teeth on outer lip; Col = number of teeth on columella, excluding terminal ridge.

[2] The numbers in parentheses indicate the number of specimens examined in each case.

[3] The abbreviations refer to the relative abundance of the species in the Ryukyus: vr = very rare; r = rare; u = uncommon; rc = relatively common; c = common.

basic dorsal color greenish-grey, overlaid with an irregular network of chestnut-brown lines; there is a wide mantle line; numerous small (as compared with *Mauritia (Arabica) arabica asiatica*) dark brown spots thickly decorate sides; most spots are obscurely visible through thin callus; base and interstices smoky beige, teeth red brown.

3. *Mauritia (Arabica) arabica asiatica* SCHILDER & SCHILDER, 1939

– CATE, 1966: plt. 35: figs. 9 a, 9 b –

Localities: 3, 9, 13, 19, 20, 20 a, 33, 48, 51, 55, 57, 62 a, 65, 82, 85

(25) c	L	W	H	Lip	Col
Largest shell:	67.2	40.2	31.3	32	28
Smallest shell:	38.0	22.2	17.0	31	25

This is one of the most common cowrie species occurring in the Ryukyu intertidal zone. It is usually found wedged within algae-covered coral crevices, in reef pools, and under rocks and rocky ledges. The frequency of this species in the adjacent outer islands is comparable to that at Okinawa. The shell varies a great deal in both size and shape, from short and wide to elongate and narrow, approaching the shell character of *Mauritia (Arabica) eglantina couturieri*. The large black spots on the heavy, calloused margins and the teeth on the columellar lip identify this species. Because of the similarity in general shape and color of the shells of this species to those of *M. (A.) arabica grayana* (SCHILDER, 1930) it has often been confused with this species (SCHILDER, 1966, p. 7). *Mauritia arabica asiatica* differs by having larger and fewer teeth, and by being more round, less pyriform; the elongate form of *M. arabica asiatica* poses no problem. The Erythraean shell is noticeably more abrupt, as well. The species seems to attain its largest dimensions at Yonabaru.

One form of this species is oblong-ovate, another stunted, short, broad, somewhat elevated, semi-cylindrical, swollen, and solid; base weakly convex, appearing flattened; apex prominent; terminals not produced, well formed; teeth numerous, fine on columella, larger, more widely spaced on outer lip; columella broad, channeled, ribbed; fossula long, broad, deeply concave, ribbed, denticles prominent on adaxial ridge; aperture straight, wide, more so and constricted in front; dorsal color covering dark, chestnut-brown, with longitudinal, closely parallel, broken brown lines and light-grey lacunae; a light-grey mantle line is also present; light-grey to beige margins are thickly covered with large, black spots; terminals grey-black to beige; base and interstices beige, teeth red-brown.

4. *Mauritia (Arabica) maculifera* SCHILDER, 1932

Syn.: [*Cypraea*] *reticulata* MARTYN, 1784 (non-binomial) The Universal Conchologist 1: fig. 15. London

– CATE, 1965: plt. 8; figs. 26 a, 26 b –

Localities: 9, 29, 48, 85

(8) u	L	W	H	Lip	Col
Largest shell:	59.8	37.9	29.6	27	25
Smallest shell:	41.5	28.3	20.9	24	20

The generic name for the synonym cited above has been placed in square brackets because MARTYN did not list a genus for this species; it became necessary to infer the name *Cypraea* from the preceding line in the text.

This species, in my experience, has the center of population in the Hawaiian Islands. Hawaii and Japan appear to be the northwestern limits of its living range. HABE (1961) listed and illustrated this species correctly; however he listed also *Arabica depressa* (GRAY, 1824), possibly in error (plt. 19, fig. 25). From the appearance of his illustration it would seem that his shell is a stunted form of this species. The range of GRAY's species apparently does not extend north of the Fiji Islands, it being a more southern, warmer water species, ranging to Cocos Keeling Island and elsewhere in the northeastern Indian Ocean.

The Ryukyu shells seem to be smaller on an average than the Polynesian form. The shell is comparatively small, solid, compact, oblong-ovate; margins heavily caloused, thick, bumpy; terminals short, restricted; aperture narrow, curving; columella broad, semi-denticulate; fossula long, wide, deep; base perceptibly swollen; teeth short, well defined on both lip and columella; primary shell color light beige, appearing as lacunae on dorsum; dorsum conspicuously red-brown, with a narrow mantle line on the right side; margins heavily speckled with large, black spots whose dilution in the nacre give the margins, terminals, and part of the base a dark blackish-grey cast; areas of the base, interstices, columella, and fossula light beige; teeth dark red-brown.

5. *Mauritia (Arabica) scurra indica* (GMELIN, 1791)

Syn.: *Cypraea amarata* MÖRCH, 1852 Cat. Conch. YOLDI, p. 114

– CATE, 1966: plt. 35; figs. 10 a, 10 b –

Localities: 19, 33, 85

(3) u	L	W	H	Lip	Col
Largest shell:	44.5	23.2	18.9	39	35
Smallest shell:	38.3	20.1	15.8	43	32

This is not a common species, found only at three presently known locations, Zampa-Misaki, Kadena, and the dual island locality Henza-Miyagi. There seems to be no logical explanation for the greater number of teeth on the lip of the smaller shell listed above. The species is collected on algae covered dead coral outcroppings and under coral boulders.

The shell is cylindrically-oblong, solid, strong; terminals produced, heavily formed; aperture long, straight, narrow; teeth numerous, fine, somewhat longer on the central base; margins barely thickened, rounded; basic dorsal color is greyish-beige, overlaid with a network of yellow-brown lines, broken with numerous large lacunae; mantle line also present; margins, sides, base, interstices smoky-brown, teeth red-brown; large brown spots decorate the sides; terminal edges smudged with dark brown.

6. *Mauritia (Mauritia) mauritiana calxequina* (Melvill & Standen, 1899)

– Cate, 1966: plt 34; figs. 5 a, 5 b –

Localities: 20, 23, 25, 27, 33, 45, 57, 63, 65, 85

(9) u	L	W	H	Lip	Col
Largest shell:	97.4	68.5	50.3	28	21
Smallest shell:	82.5	58.7	42.3	27	20

This species probably seems uncommon because of its more or less isolated habitat. The animal is restricted to the outer surfaces of the reef and inaccessible headland promontories, living on the exposed rocky-slab surfaces facing the open ocean. At one locality on Miyako Island it was almost impossible to walk due to the number of these mollusks living on the substrate. It seems best suited to living in water 6 to 25 feet deep, in pounding, swirling surf, and even so it is difficult to find and collect. Yet at another island to the south, Iriomote, at a minus tide, 32 specimens were counted on a single reef-flat.

Shell medium sized, roundly-ovate, terminals inconspicuous, base and lip wide, concave overall; aperture somewhat narrow, curving left sharply adapically; margins sharply angled, solid; teeth strong, large, long; primary shell color very light beige-brown, appearing as lacunae in dark red-brown dorsal surface – sides solid, deep red-brown halfway up shell; base and teeth deep red-brown, interstices and terminals orange beige; mantle line sometimes present.

7. *Talparia (Talparia) talpa talpa* (Linnaeus, 1758)

– Cate, 1966: plt. 35; figs. 11 a, 11 b –

Localities: 3, 9 a, 15, 35 b, 41, 63 a, 65, 85

(11) u	L	W	H	Lip	Col
Largest shell:	82.5	44.4	36.1	53	47
Smallest shell:	46.5	25.2	20.8	41	36

Although this species has been found living at several localities around the island of Okinawa, it is not commonly encountered at any of them. MacNeil (1960) reported: "fragments, internal molds, and otherwise poorly preserved specimens of Cypraeids were obtained from many localities." He suggests that *Talparia talpa talpa,* as indicated by the appearance of the shell fragments, may have been recovered from at least 8 localities in the Okinawan fossil beds. One recent collection of a living specimen was made at the edge of the reef off Gushichan; 2 or 3 beach specimens have also been recovered at Zampa-Misaki and Metasaki.

The shell is of medium size for the species, light weight, cylindrically elongate; base long, fairly narrow, vaguely convex; terminals produced, thickly, solidly formed; aperture long, narrow, nearly straight; margins thickened, more so on the right, gently angled; teeth numerous, fine, distinct, short; basic shell color ivory-yellow, with 4 wide transverse bands of light chestnut-brown; interstices lighter in color, nearly off-white; wide, partially ribbed columella yellow-brown; short, wide, deep, off-white fossula is ribbed and denticulate adaxially.

8. *Cypraea (Cypraea) tigris pardalis* Shaw, 1795

– Cate, 1966: plt. 34; figs. 6 a, 6 b –

Localities: 27, 33, 35 a, 48, 51, 57, 57 a, 59, 63 a, 65, 65 a, 81, 85

(5) u	L	W	H	Lip	Col
Largest shell:	87.5	64.4	51.6	27	20
Smallest shell:	81.2	59.5	44.9	27	19

This species is not very plentiful, being found only now and then. It lives on coral shelves just below low tide mark. Fishermen most often, in diving operations, bring shells of this species in and offer them in the market place. The Naha limestone formation has yielded a fossil fragment, according to MacNeil (1960), of a large *Cypraea* that seems related to *C. tigris pardalis,* but appears to differ from it by possessing a depressed area on the right lip just adjacent to the base of the teeth. From his excellent figure (*l. c.,* plt. 17, fig. 1) it is impossible to determine whether the depressed area is there because of a loss in shell material, or is the morphological character of a different species. The base on the left side appears to exhibit signs of surface attrition as well. It is conceivable that the sloughing away of the thick marginal callus on

either side and on the base could leave the shell's teeth elevated in a manner such as this figure illustrates. Fragmentary evidence of this marginal callus still clings to the right side of the MacNeil shell. The visible apertural teeth seem to conform with those of the species as we know it today. The Ryukyu *C. tigris pardalis* that I have examined seem to be of smaller dimension than those seen from the more southern Philippine area. A recent discovery (Way) shows the species to be actually quite common half a mile off shore at Kin Bay, in 35 to 40 feet of water.

The shell is of medium size, medium weight, solid, subpyriform; base and lip swollen, concave to aperture; aperture wide, fairly straight; terminals barely protruding; margins rounded, thickened; columella unribbed adapically, ribbed abapically to and including the broad, shallow fossula; basic shell color on dorsum varies in shades of brownish-orange, overlaid with large, diffused black spots that continue over the sides and margins to the base; columella marked with vague orange-brown; base, teeth, and interstices are white.

9. *Cypraea (Lyncina) argus argus* Linnaeus, 1758

– Cate, 1966: plt. 33; figs. 3 a, 3 b –

Localities: 1, 33, 35 a, 41, 85

(4) u	L	W	H	Lip	Col
Largest shell:	80.5	43.5	35.6	40	37
Smallest shell:	61.3	30.8	24.4	35	38

The large shell, whose measurements are recorded here, was collected in early December, 1954, at Metasaki. Live-collected shells of this species are rare, although beach shells in good condition are found from time to time at this locality and at Zampa-Misaki. MacNeil (1960) describes a related species from the Naha Pliocene lime formation, *Aristorides nahaensis*. He says, that although closely related to *Aristorides argus argus* (Linnaeus, 1758), it differs most importantly in that the columellar teeth do not extend into the aperture, apparently not crossing the columella or fossula. Its length and width are given as 40 mm and 24 mm, respectively. The holotype is in the U. S. National Museum with the catalogue number 563023.

Shell of medium size, relatively light weight, cylindrically elongate, abruptly elevated front and back, central dorsal surface almost horizontal; base and lip convexly rounded; terminals inconspicuous; aperture wide, nearly straight; margins lightly calloused, more so, but narrowly restricted, on the right side, thickly enveloping the terminal openings; teeth numerous, short, well defined; columella broad, fossula long, becoming deeper in front, both strongly ribbed with teeth; primary shell color creamy-cocoa, overlaid dorsally with 3 wide, transverse pale cocoa-colored bands, and over all, numerous "eyes" or ocellae; many are thin-lined rings, others, less numerous, are larger, thick-lined, heavier ocellae; 4 large, brown, ventral blotches at either quarter of the base – sometimes the right rear blotch is incomplete or missing; terminals, base, teeth, and interstices creamy-cocoa; teeth outlined on either side with a fine broken line.

10. *Cypraea (Lyncina) lynx vanelli* Linnaeus, 1758

Syn: *Cypraea lynx* var. *michaelis* Melvill, 1905
Journ. Conchol. 11: 192

– Cate, 1966: plt. 35; figs. 12 a, 12 b –

Localities: 17, 33, 37, 39 a, 41, 55, 57, 65, 85

(4) u	L	W	H	Lip	Col
Largest shell:	41.6	24.7	21.8	27	21
Smallest shell:	30.7	17.8	15.1	22	18

This species is uncommonly found on the coral reefs, living on ledges, in cavernous tunnels, and in algae covered tide pools. The invasion of this species into these islands seems to be of relatively recent date, as there appears to be no reference to its being found in the lime formations as late as the Pleistocene. Although comparing very favorably morphologically with the shells found in the Philippines, the Ryukyu shells seem to be generally smaller in size and narrower, with a distinctly deeper dorsal coloring.

Shell narrowly ovate, solid; margins thickened, more so on the right side, somewhat angled; terminals semi-produced, well developed; aperture narrow, only slightly curving; columella broad, fossula shallow, both heavily denticulate; base flattened, sloping sharply adaxially, lip rounded; primary shell color light beige, overlaid dorsally with light yellow-brown, with large and small dark brown spots irregularly dotting the upper surface, becoming obscure in the marginal callus; teeth short, well defined, fine on columella, heavier on inner edge of outer lip; margins, base, and teeth light cream color, interstices bright orange.

11. *Cypraea (Lyncina) vitellus vitellus* Linnaeus, 1758

– Cate, 1966: plt. 36; figs. 17 a, 17 b –

Localities: 1, 9, 13, 33, 37, 39, 57, 65, 81, 85

(7) rc	L	W	H	Lip	Col
Largest shell:	38.9	26.3	21.1	23	18
Smallest shell:	31.5	19.8	17.0	21	19

This species is relatively common, occupying crevices and the underside of coral ledges. Most of the shells I have examined appear to be uniformly small for the species. The coloring is richly dark grey-brown, the smudge of which darkens the normally beige colored base. This species seems to be equally common at each of the localities listed.

Shell relatively small, abruptly humped, pyriformly-ovate, strong, solid; margins thickened, especially the right side; terminals prominent, thickly formed; base and lip swollen; aperture somewhat narrow, fairly straight; teeth do not extend onto base, are semi-fine, long, crossing the broad columella and the long, shallow fossula; teeth on lip somewhat longer, heavier, more numerous; dorsal color dark grey-brown, copiously marked with large and small spots; margins fawn, with the characteristic numerous, fine transverse striae, sweeping from the outer line of the base teeth to well up onto either side of the dorsum; teeth pale ivory, most of the base and interstices pinkish-fawn to light grey.

12. *Cypraea (Lyncina) schilderorum* Iredale, 1939

Syn.: *Cypraea arenosa* Gray, 1824
Zoolog. Journ. 1: 147; plt. 7, fig. 6; plt. 12, fig. 6
– Cate, 1965: plt. 9; figs. 31 a, 31 b –

Localities: 49, 51, 77

(2) r	L	W	H	Lip	Col
Largest shell:	35.3	23.0	17.5	32	25
Smallest shell:	31.0	22.0	16.3	29	22

In the synonym cited above, Dillwyn (1823) invalidated this name by publishing Solander's name *arenosa* (Index Lister Hist. Conch., p. 33, 1823) and no other names were available; a new name, therefore, became necessary.

This species is rare in the Ryukyu Islands. The smaller shell recorded above was collected in 1952 on the beach at Nago. Broken beach-worn shells have been collected at the same locality, and it is probable that SCUBA-diving will some day produce live-collected specimens. The larger shell, also a beach specimen, was found at Yabu. Both shells appear to be typical representatives of the species. MacNeil (1960, p. 50) recorded a single, imperfect specimen from the Pliocene limestone at Naha. His figures (*l. c.*, plt. 17, figs. 4 - 8) are well defined and clearly seem to represent this species.

Shell ovate, perceptibly flattened, solid, heavy; terminals inconspicuous, especially adapically; aperture straight, narrow; margins thickly calloused, sharply angled; teeth short, fine, numerous; base generally convex; primary shell color beige to off-white; dorsum dark beige, overlaid transversely with 4 somewhat narrow reddish-beige bands; marginal beige callus covers sides well up onto shell; conspicuous grainy texture and numerous vertical striae in the lateral callus; portion of base, teeth, and interstices off-white.

13. *Cypraea (Lyncina) carneola carneola* Linnaeus, 1758

– Cate, 1966: plt. 36; figs. 16 a, 16 b –

Localities: 9, 39, 41, 65, 85

(5) rc	L	W	H	Lip	Col
Largest shell:	33.0	21.7	18.2	27	21
Smallest shell:	25.0	14.7	12.1	27	22

This species is rather uncommon, although it has been collected at several localities. When it is found it is usually on coral ledges of the reef adjacent to deep water. At Zampa-Misaki it was found nestling in crevices around the circumference of a littoral area locally referred to as the Punchbowl. It was living under clusters of a certain species of sea anemone that nearly covered that portion of the reef floor. These shells, like so many other cowrie species in the Okinawa area, are comparatively smaller in size than those from Philippine waters. Nearly all of the specimens I have observed appear to have broken lips that subsequently have been mended in the process of continued growth.

Shell oblong-ovate, solid, small; margins heavily calloused, somewhat bumpy in fully adult shells; terminals inconspicuous, though strong and thickly formed; base semi-rounded, uneven; aperture fairly straight, curving left only slightly; teeth well developed, but not lengthened onto base or lip; columella broad, fossula long, deep, and prominently ribbed adapically by the inner teeth; primary shell color pale grey-blue, overlaid with 4 bands of pale tomato-red; margins have a grainy texture of deep beige, base and terminals somewhat lighter in color; teeth and interstices bright violet.

14. *Cypraea (Lyncina) kuroharai* (Kuroda & Habe, 1961)

(Plate 3, Figures 2 a, 2 b)

Localities: 53, 62

(1) vr	L	W	H	Lip	Col
Shell measurements:	41.2	27.6	22.4	28	27

This is an extremely rare species and is supposed to have been taken only in Ryukyu waters. Specimens that I know of are as follows: Akibumi Teramachi, Kyoto, a live-collected specimen and one from the Ryukyu Islands; in

another collection there is one allegedly from Kyushu (Koshik Islands), one from Kii and two from Tosa Bay. Kurohara has one specimen, Sugatani has one, and one live-collected one is in the author's collection (Cate no. C3214) (Plate 3, Figures 2a, 2b). SCHILDER (1963) mentions two specimens, one in the Habe collection (L = 42 mm), and one (subfossil) in his own collection (Schilder no. 15820). The specimen whose measurements are listed here for comparative purposes was live-collected in 70 fathoms by trawling off Tosa, Japan, in 1962. It compares favorably with the holotype in mensurable characters. Although shells of this species have been in Japanese collections for many years, it was only recently recognized as being different from *Cypraea (Lyncina) arenosa* GRAY, 1824 (= *C. schilderorum* IREDALE) for which it had previously been mistaken; it had also been compared with *C. (L.) sulcidentata* GRAY, 1824, by some workers.

Shell pyriformly ovate, heavy, solid; margins thickened, though not prominently so; terminals prominent, openings narrow, thickly formed; base and outer lip swollen, rounded; aperture narrow, curving left adapically; teeth short, not extending onto base or lip, very fine, sharp; those on columella larger, extending pointedly into aperture; columella fairly broad, fossula short and deep, both ribbed with columellar teeth; terminal ridge straight; primary shell color beige, base lighter beige, margins darker beige and grained; dorsum faintly marked with 4 broad, deep tan transverse color bands; lower terminal surface, base, teeth and interstices light creamy-beige.

15. *Chelycypraea (Chelycypraea) testudinaria testudinaria* (LINNAEUS, 1758)

– CATE, 1966: plt. 33; figs. 4a, 4b –

Localities: 45, 47, 62, 63

(7) u	L	W	H	Lip	Col
Largest shell:	112.8	56.4	44.0	45	43
Smallest shell:	105.5	50.0	44.5	46	45

The shells used in this study were sent from Okinawa on various dates during 1952 and 1953 without specific locality data, the accompanying labels simply reading "Okinawa". This is regrettable; however, a report from Bernice Albert of Okinawa states: "... we have one we found with some tiger cowries the fishermen had brought in, but they are rather vague as to where they had found it. We have known of others brought in by fishermen, but none by divers or collectors." Further exploration will be needed in this area to ascertain the extent of the distribution of this species here.

Shell large, ponderous, solid, strong, cylindrically elongate; base somewhat swollen, yet because of its size seems flattened; terminals prominent, apex a part of left side; aperture long, straight, wide; rear half of columella smooth, front half and the long, wide, deeply concave fossula ribbed with teeth; teeth on both lips comparatively small, weakly formed, very short; margins only barely calloused, rounded; primary shell color café-au-lait to beige, overlaid with large, irregular areas of brown, including many various sized large brown spots – additionally a thick haze of fine white specks is spread over all; base, inner terminals, and interstices of primary shell color, teeth light beige.

16. *Luria (Basilitrona) isabella rumphii* SCHILDER & SCHILDER, 1938

– CATE, 1966: plt. 35; figs. 13a, 13b –

Localities: 9, 13, 15, 33, 41, 57, 85

(5) u	L	W	H	Lip	Col
Largest shell:	26.7	14.8	12.2	36	29
Smallest shell:	25.9	14.9	12.0	32	26

This is not a common species, though it is relatively well distributed throughout the island's waters. Adult shells are not very large and are fairly well characterized by a distinctly wide, flattened upper shell surface traversing the central dorsal area from side to side. This species grows comparatively larger in the Philippines and still larger in Hawaii.

Shell cylindrically ovate, narrow, solid; margins only barely thickened; terminals blunt, weakly formed; base area narrow, semi-flattened, lip rounded as is left marginal surface; aperture long, narrow, slightly angled abapically; teeth very short, extremely fine, though well developed, extending neither onto base nor lip; columella long, fossula deep, smooth, adaxial edge of fossula denticulate; primary shell color white, overlaid dorsally with fawn-grey; two narrow, lighter beige-colored bands divide the upper surface transversely, and numerous irregular, fine, black horizontal lines over all lengthwise; terminals orange, faintly quadrimaculate with dark brown; lower margins, base, teeth and interstices stark white.

17. *Pustularia (Annepona) mariae* (SCHILDER, 1927)

Syn.: *Cypraea annulata* GRAY, 1825 (*nom. nud.*)
Zool. Journ. **1**: 518

Cypraea annulata GRAY, 1828
Zool. Journ. **4**: 88

– CATE, 1966: plt. 36; figs. 18a, 18b –

Localities: 7, 49, 55

This species is rare in the Ryukyu Islands as it is at all other localities. Indications are that it lives in deep water as it is almost never found intertidally, only occa-

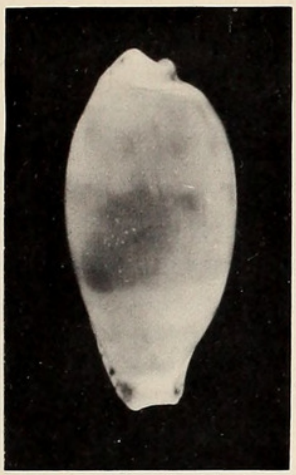


Figure 1 a

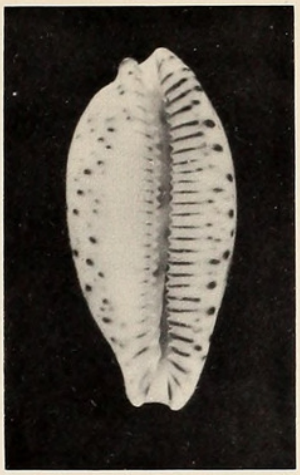


Figure 1 b

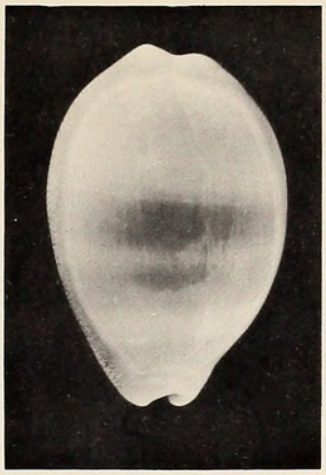


Figure 2 a

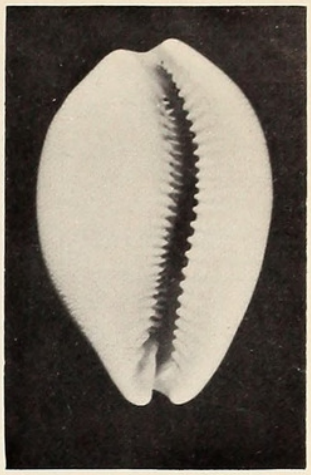


Figure 2 b

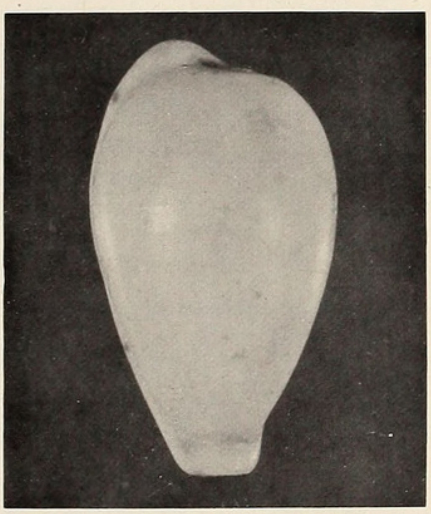


Figure 3 a

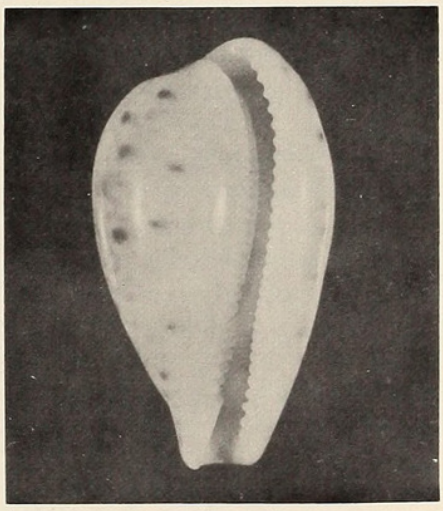


Figure 3 b

Figures 1 a, 1 b:
Notadusta katsuae (KURODA, 1960), *ex* C. N. Cate Coll. no. 3392; (x 2)

Figures 2 a, 2 b:
Cypraea (Lyncina) kuroharai (KURODA & HABE, 1961), *ex* C. N. Cate Coll. no. 3214; (natural size)

Figures 3 a, 3 b:
Notadusta musumea (KURODA & HABE, 1961), *ex* P. Clover Coll. (x 1½)

photographs by TAKEO SUSUKI

(2) r	L	W	H	Lip	Col
Largest shell:	15.2	10.2	9.0	35	23
Smallest shell:	11.0	7.4	6.7	31	22

sionally as beach rolled shells. The two shells, whose measurements are recorded here, and a broken fragment of a shell were collected as dead beach specimens at Okinawa by Anita Scott in 1952. Recently another dead beach shell was found at Baten, a second shell was picked up on the beach just south of Nago. Nothing more can be reported on this species at this time.

Shell thin, lightweight, bulbously ovate; base narrow on either lip, peculiarly flattened; terminals barely visible; aperture long, exceedingly narrow, curving gently; teeth very fine, weak, poorly developed, almost obscure on inner lip; margins not thickened, a rounding continuation of the dorsum; primary shell color milk-white, upper surface and sides thickly covered with ocellated, irregularly shaped and sized straw-colored spots; base, teeth, and interstices milk-white.

18. *Pustularia (Pustularia) cicercula cicercula* (Linnaeus, 1758)

– Cate, 1966: plt. 36; figs. 19 a, 19 b –

Localities: 13, 15, 43, 75

(10) u	L	W	H	Lip	Col
Largest shell:	18.9	11.5	9.9	31	25
Smallest shell:	14.5	8.8	8.0	26	22

Gushichan has been a productive locality for this species. More recently, however, freshly dead shells have been found at Chinen and Toyohara. I have live-collected specimens from Minami-Ukibaru Island, northern Buckner Bay, collected in 1953. MacNeil (1960, p. 50; plt. 19, figs. 1, 2) seems to have mistaken this species for *Pustularia g. globulus* (see discussion of this shell here under the title of that species). It would therefore follow that *P. c. cicercula* has not been found in the fossil deposits of Okinawa.

Shell pyriformly-ovate, numerously, completely, pustulate dorsally; grooved mantle line originates within small, deep umbilicus; terminals extended, beaked, delicately formed; aperture long, narrow, straight; margins not thickened; base semi-inflated, convexly arched longitudinally; teeth numerous, fine, distinct, extending to both margins inclusive of terminal beaks; shell uniformly lemon-beige, glossy though pustulate.

19. *Pustularia (Pustularia) bistrinotata mediocris* Schilder & Schilder, 1938

– Cate, 1966: plt. 37; figs. 20 a, 20 b –

Localities: 33, 49, 59

(19) u	L	W	H	Lip	Col
Largest shell:	20.4	12.9	11.7	30	24
Smallest shell:	15.7	9.4	8.7	27	23

The largest shell whose measurements are recorded here was picked up on the beach at Kadena, and two others, including the small one recorded here, were collected on the beach about a mile south of Nago. Other beach-rolled shells have been found at the latter locality and at Otabaru. I know of no live-collected specimens in Okinawan collections. Further field work may disclose the habitat of these mollusks.

Shell semi-ovate, globularly humped, lightweight, and strong; terminals extended; beaked; mantle line originates in shallow, vague umbilicus; margins thickened, upswept, smooth; aperture long, narrow, straight; base flattened, convexly elevated at either end; central dorsal area smooth (pustules absent), glossy; sides and ends of dorsal area thickly covered with pustules; teeth numerous, fine, distinct, extending out to either margin; primary shell color pale yellow-beige, dorsum with a light brown blush, with pustule crests darker brown and a large brown spot centrally situated, as well as one at each end.

20. *Pustularia (Pustularia) globulus globulus* (Linnaeus, 1758)

– Cate, 1966: plt. 37; figs. 21 a, 21 b –

Localities: 31, 47, 69, 83

(8) r	L	W	H	Lip	Col
Largest shell:	20.6	13.2	11.5	38	25
Smallest shell:	18.5	11.2	10.0	34	23

This species is quite rare at Okinawa. Few specimens are to be found in local collections. The shells listed here (Cate coll. no. C3390) were collected in the beach drift at Ishiza by Anita Scott in 1953; the most recent collections were made by Bernice Albert at Onna tide flat in 1965.

MacNeil (1960, p. 50; plt. 19, figs. 1, 2) records "*Pustularia* cf. *P. cicercula* (Linné) *s. l.*," and illustrates the shell. It seems to me that the shell shown in the figures cited rather clearly represents the nominate species, *P. g. globulus*. He states, "It lacks dorsal granules, has no indi-

cation of sulcus, and the teeth tend to become weak or absent towards the central part of the aperture." The lack of dorsal granules would appear to eliminate *P. c. cicercula,* and the weakening or shortening of the columellar teeth rather emphatically indicate *P. g. globulus.* This weakening of the central columellar teeth can be easily observed in a series of these shells, never in *P. c. cicercula,* and it is visible in the specimen illustrated in CATE, 1966 (plt. 37; fig. 21 b). The columellar teeth of all other species in the genus *Pustularia* are long and strong, extending to the margins; this species appears to be the exception.

Shell pyriformly ovate, humped, bulbous; margins defined, though barely perceptibly thickened, and upswept on the right side; terminals protrude, beaked; aperture long, narrow, curving slightly to the rear; teeth fine, numerous centrally on columella somewhat shortened; the columella and the deep fossula half-ribbed, half-smooth adaxially; shell color yellow-beige, copiously spotted with medium sized brown spots; base and interstices yellow-beige; teeth darkened, some light brown; faint brown marks at either quarter on the base. (It should be stressed that these color descriptions are taken from dead, though fairly fresh beach shells and do not represent the natural color of live-collected shells.)

21. *Pustularia (Ipsa) childreni samurai* SCHILDER, 1940

– CATE, 1966: plt. 37; figs. 22 a, 22 b –

Localities: 3, 13, 49, 57, 82

(13) u	L	W	H	Lip	Col
Largest shell:	21.4	13.7	10.6	35	25
Smallest shell:	16.3	10.6	8.5	37	24

This cowrie species throughout its Indo-Pacific range seems always to be difficult to collect alive. The animals from the Ryukyu Islands are no exception, as those in most of the local collections have been gathered dead on the beaches. Onna, Nago, and Chinen are the localities where the species is most commonly found.

Shell rectangularly inflated, abruptly terminated at either end, base flattened, peculiarly flanged at the side of either terminal; terminals barely projecting adapically, hardly more so in front; aperture narrow, nearly straight; right margin thickened, upswept; mantle line grooved, originating from small, shallow umbilicus; teeth numerous, fine, sharply defined, each denticle a continuous ridge from columellar tooth across base and over dorsum, terminating as a tooth on the outer lip; shell color a deep, rich, faintly brown honey-yellow, color darker only on small spot at center of umbilicus.

22. *Monetaria (Ornamentaria) annulus annulus* (LINNAEUS, 1758)

Syn.: *Monetaria harmandiana* ROCHEBRUNE, 1884
Bull. Soc. Malacol. France 1: 90; plt. 2, fig. 5

– CATE, 1966: plt. 37; figs. 23 a, 23 b –

Localities: 9, 13, 17, 19, 23, 25, 33, 37, 39, 41, 65, 81, 85

(15) c	L	W	H	Lip	Col
Largest shell:	27.6	20.0	14.3	12	11
Smallest shell:	15.0	10.3	7.8	9	9

This is one of the most common cowrie species living in Ryukyu tidal waters. It can be found plentifully on nearly all tide flats and shallow reefs. Adult shells seem to have a wide range in size variation, yet shells of a particular locality being fairly uniform; at Metasaki, for example, they are noticeably large. Especially observable in these shells are the numerous very fine central white lines that traverse the median, smoky-grey dorsal section of the shell; although perceptible in the shells from other localities, it seems more evident here.

Shell rhomboid-ovate, flat, broad, solid; margins solidly thick, angled, perceptibly upswept; terminals blunt, a continuation of the margins; base swollen, lip less so, flattened; aperture straight, widening to the front; teeth large, strong, well defined, lengthening slightly onto base and lip; columella smooth, fossula weak or missing entirely; primary shell color creamy-beige, central dorsal section light grey, transversely marked with numerous fine white lines, an orange line encircles the central dorsal area; sides, margins, terminals, base, teeth, and interstices of primary shell color.

23. *Monetaria (Monetaria) moneta rhomboides* SCHILDER & SCHILDER 1933

– CATE, 1966: plt. 37; figs. 24 a, 24 b –

Localities: 1, 3, 7, 11, 13, 15, 20, 33, 37, 39, 39 a, 51, 62 a, 65, 73, 75, 75 a

(18) c	L	W	H	Lip	Col
Largest shell:	25.9	20.0	12.8	13	13
Smallest shell:	15.0	9.0	7.0	11	10

This is a common species at Okinawa, but not as plentiful as *Monetaria annulus annulus.* Like the latter species, it can be found on most of the tide flats. The shell's shape indicates that this subspecies is well named. The shells appear to be nearly identical with those from the Philippine area.

Shell rhomboid, flattened, margins protruding prominently adapically; margins thick, narrow, sharply angled;

terminals and openings thickly formed; base and lip convexly swollen; aperture straight, broadening slightly abapically; teeth well defined, finer on the columellar edge than on the lip; columella smooth, fossula weak or absent; primary shell color off-white to light ivory, central dorsal area yellow-green, with two distinct darker green narrow bands traversing dorsum from side to side; sides, terminals light ivory, becoming lighter in color on inner half of base, teeth, and interstices.

24. *Erosaria (Ravitrona) labrolineata labrolineata* (Gaskoin, 1849)

Syn.: *Cypraea flaveola* Gray, 1825

Zool. Journ. **1**: 502

– Cate, 1966: plt. 38; figs. 27 a, 27 b –

Localities: 19, 20, 41, 57, 61, 65, 82, 85

(7) u	L	W	H	Lip	Col
Largest shell:	20.3	10.6	8.8	20	20
Smallest shell:	14.4	8.8	6.8	15	13

This uncommon species is occasionally found on the tide flats at low tide. The shells seem to have quite a wide size range in adults. MacNeil (1960, p. 52; plt. 2, figs. 17, 18, 25) lists a species "*Cribraria (Talostolida)* aff. *C. (T.) cincta* (Martin, 1899)," from the Miocene clay of Yonabaru, Okinawa. The shell compares favorably morphologically with *Erosaria (Ravitrona) l. labrolineata,* and may indeed be this species.

A dead shell, without animal, was found in 110 feet of water at Metasaki.

Shell pyriform to oblong-ovate, sometimes cylindrical, base swollen; terminals prominent; margins thickened, mostly on the crenulated right side, angled, shouldered; aperture wide, more so abapically; teeth prominent, medium sized, shorter in the central columella area, larger, evenly dispersed on outer lip; columella smooth, fossula absent; primary shell color white, overlaid dorsally with greyish-white to dark grey (as seen in the mantle line), upon which is a covering of tawny, light-brown, broken with numerous large and very small light-grey lacunae; margins, more particularly the terminal collars, spotted and marked with chestnut-brown; terminals, base, teeth, and interstices white.

25. *Erosaria (Ravitrona) cernica ogasawarensis* Schilder, 1944

Syn.: *Erosaria tomlini maturata* Kira, 1954

Japan. Shells Col. **1954**: 39; plt. 19, fig. 11

– Cate, 1960: plt. 1; figs. 5, 5 a –

Localities: 20 a, 35, 85

(3) r	L	W	H	Lip	Col
Largest shell:	31.9	20.7	16.7	22	17
Smallest shell:	27.6	17.7	13.7	21	16

This species, whose type locality is given as the Ogasawara Islands, is found in both Japanese and Ryukyu waters and may be said to belong equally to these two areas because of the proximity of the type locality to each. Even so, it is rare at Okinawa, only one specimen having been found there. This specimen was collected on the Zampa-Misaki reef flat on April 7, 1966 by Bernice Albert. This particular specimen, the fourth I have examined (23.2 15.3 12.0 19 15), appears to have just attained maturity as the shell is comparatively thin and lightweight.

Shell ovately pyriform, solid; terminals faintly produced; aperture wide, gently curving; teeth well defined, strong; right margin thickly calloused, upswept, angled, shouldered, pitted, left side barely thickened; primary shell color off-white, dorsum covered with light brownish-yellow and numerous faint off-white spots, a vague mantle line also present; both sides thickly covered with brown spots; terminals, base, teeth, and interstices off-white; narrow columella smooth, shallow fossula ribbed.

26. *Erosaria (Ravitrona) helvola helvola* (Linnaeus, 1758)

– Cate, 1966: plt. 38; figs. 30 a, 30 b –

Localities: 33, 35, 37, 39, 47, 51, 57, 61, 63 b, 65, 67, 85

(7) u	L	W	H	Lip	Col
Largest shell:	22.1	15.5	11.0	18	13
Smallest shell:	21.6	13.7	10.4	20	14

Though not at all common, the species is widely distributed. It is usually collected in reef areas, in coral recesses and on protected ledges. The Ryukyu shells are of average size for the species. MacNeil (1960, p. 51; plt. 17, figs. 2, 6) reports finding the species in the Pliocene layer of the Naha limestone.

Shell ovate, short, broad, strong, base swollen; terminals short, well formed; margins thickened on either side, upswept, shouldered, crenulated; aperture narrow, curving; teeth large, bold, heavily formed, extending up onto base and lip, longer toward the rear on base; columella narrow, smooth, fossula long, shallow, ribbed; shell color light caramel-brown, overlaid dorsally with deep, rich brown; a faint grey mantle line and numerous, various sized off-white spots are exposed; terminal collars, spire pale lavender; margins, base, teeth, and interstices rich light caramel-brown, base slightly darker.

27. *Erosaria (Ravitrona) caputserpentis caputserpentis* (Linnaeus, 1758)

Syn.: *Ravitrona caputserpentis mikado* Schilder & Schilder, 1938
Proc. Malacol. Soc. London **13** (3): 135

– Cate, 1966: plt. 38; figs. 31 a, 31 b –

Localities: 1, 3, 9, 13, 20 a, 37, 39, 39 a, 51, 59, 81, 85

(30) c	L	W	H	Lip	Col
Largest shell:	36.0	26.9	17.7	19	15
Smallest shell:	26.9	19.8	12.9	14	12

This species is plentiful, living on reef flats, seemingly always adjacent to deep water. One specimen had a red streak of color along one side of the shell. In my experience the species appears to be most commonly found at Smuggler's Cove. In a study of series, involving at least 25 specimens each from three localities (Japan, Philippines, and Ryukyus), I was unable to detect any morphological or color differences. From my observations that this species has a more or less continuous distribution from the Sulu Sea and Tosa Bay, I have come to the conclusion that *Ravitrona caputserpentis mikado* Schilder & Schilder, 1938 must be considered a synonym of the nominate species. MacNeil (1960, p. 51; plt. 17, figs. 2, 6) records shells of this species from the Naha layer of Pliocene limestone.

Shell rhomboidally-ovate, strong, heavy, wide, appearing flattened; margins well developed, sharply angled, curving, perceptibly upswept; terminals obscure, though well formed within; base and lip somewhat convex; aperture long, narrow, curving abruptly adapically; teeth large, of equal size on each lip, pointedly so on the apertural edge; sides and outer surface of base dark brown, remainder of base and interstices pastel shades of light brown and beige; central dorsal area light brown broken with numerous off-white spots of various sizes; a thin mantle line may be present.

28. *Erosaria (Erosaria) poraria scarabaeus* (Bory, 1827)

– Cate, 1966: plt. 39; figs. 32 a, 32 b –

Localities: 9, 41, 57, 59, 61, 77, 83, 85

(8) rc	L	W	H	Lip	Col
Largest shell:	20.2	13.6	10.5	19	17
Smallest shell:	16.0	11.0	8.3	17	16

While seldom collected alive, shells of this species are quite often seen in the beach drift, especially at Zampa-Misaki. MacNeil (1960, p. 52; plt. 18, figs. 19, 22) appears to have recorded this species under the name *Palmadusta asellus* (*"Cypraea"* sp. aff. *"C." asellus* Linné), from the Yontan limestone of Okinawa (see species 43 below for a discussion of this identification).

Shell ovate, longer than wide, strong; base convexly swollen, lip curving; margins heavily calloused, upswept, sharply angled, shouldered, and crenulated on the right side; terminals inconspicuous; aperture narrow, nearly straight; teeth fine, well developed, short, barely extending onto base and lip; dorsal color medium brown, with numerous darker lacunae having off-white centers; terminals and base deep lavender, teeth and interstices pale lavender.

29. *Erosaria (Erosaria) erosa phagedaina* (Melvill, 1888)

– Cate, 1966: plt. 39; figs. 33 a, 33 b –

Localities: 3, 9 a, 13, 19, 33, 37, 39, 48, 51, 57, 62 a, 63 b, 65, 69 a, 81, 82, 83, 85

(11) c	L	W	H	Lip	Col
Largest shell:	34.6	19.4	15.0	21	18
Smallest shell:	25.0	14.7	11.1	18	13

This species is quite common at several localities. It is found in coral pockets, under rocks, and under overhanging submerged ledges. It has been established in these islands for many centuries; MacNeil (1960, p. 51; plt. 19, figs. 9, 12) records this species from the Pliocene (Naha limestone) and Pleistocene (Yontan limestone), Okinawa. The adult shells vary in size, though only occasionally becoming as large as the Philippine specimens, Yonabaru seeming to produce the exceptions.

Shell oblong-ovate, semi-umbilicate, solid, base convexly swollen; terminals produced, thickly formed; margins thickened, shouldered, and pitted on the right side, pitting extending over and around terminal collars; teeth coarse, well formed on outer lip, finer and shorter on the columella, receding to mere pustules centrally; aperture wide, straight, somewhat constricted adapically; basic shell color ivory with tannish-grey-green covering the dorsum; numerous off-white spots of various sizes, some encircled by a darker ring, speckle the upper surface, a faint mantle line is also present; base, teeth, and interstices ivory; both margins have the large brown marginal banding characteristic of this species; lateral divisions of margin pitting crested with a short, fine brown line.

30. *Erosaria (Erosaria) miliaris miliaris* (Gmelin, 1791)

Syn.: *Cypraea inocellata* Gray, 1828

Zool. Journ. 1: 504

– Cate, 1966: plt. 39; figs. 34 a, 34 b –

Localities: 57, 81, 85

(5) r	L	W	H	Lip	Col
Largest shell:	41.6	24.8	19.4	18	12
Smallest shell:	31.2	20.0	15.5	16	14

The largest shell, whose measurements are recorded here, was collected alive by Anita Scott in 1957. It is completely adult and heavily calloused. The locality is cited simply as "Okinawa". Since then the species is known to have been found in at least three localities, most recently by Ernest Albert at Yagaji, Okinawa. His comments were: "Yagaji is sandy, with some areas supporting sea grass, while at the end of one edge of the locality it is gravelly and rocky. Although the sand flat is, for the most part, barren of rock I found this shell living under one near the gravel area. It seems to be of a deeper color than those we have seen from the Philippines, and the base is more pinkish. We searched for more but could find none."

Shell large, heavy, thickly calloused, pyriformly ovate; terminals prominent, fully developed; aperture fairly straight, wide, especially so abapically; margins heavily calloused, upswept, angled, crenulated along both sides and over terminal collars; teeth large, strong, short; dorsal color pale grey-green, lightened in shade by a thin white film of nacreous callus over all; terminals, base, teeth, and interstices white.

31. *Staphylaea (Staphylaea) staphylaea staphylaea* (Linnaeus, 1758)

– Cate, 1966: plt. 39; figs. 35 a, 35 b –

Localities: 15, 39, 44, 57, 62 a, 75 b, 81

(5) u	L	W	H	Lip	Col
Largest shell:	17.8	10.2	8.1	20	16
Smallest shell:	17.6	10.2	8.2	19	17

This species is not at all common. At Onna, on the east (China Sea) side of Okinawa, the two specimens whose measurements are recorded here, were found on a sand flat under a bush-like, green, spongy algal growth, whose base was embedded in a viscous black substance. The habitat of this species seems to be restricted to this type of alga in the Ryukyus. The shell seems to be typical in appearance for the species, but generally not as large as the Philippine specimens.

Shell comparatively small, oblong-ovate, solid, base somewhat flattened; terminals conspicuous, sharply formed; aperture straight, widening abapically; margins apparent, though scarcely projecting; teeth fine, prominent, extending across base and lip to margins; a fine, white lateral surface at the margins separates the dorsum from the base, dorsum pale grey-brown, with numerous fine, light grey-white pustules; a grooved, lateral mantle line bisects the right dorsum; terminals and teeth bright burnt-orange; base and interstices off-white; columella narrow, semi-concave; fossula long, narrow, more deeply concave; columella and fossula ribbed adaxially with a continuation of the base teeth.

32. *Staphylaea (Staphylaea) limacina limacina* (Lamarck, 1810)

– Cate, 1966: plt. 39; figs. 36 a, 36 b –

Localities: 33, 44, 48, 52, 57, 59, 62 a, 75 b, 85

(7) u	L	W	H	Lip	Col
Largest shell:	26.6	15.0	12.0	20	21
Smallest shell:	20.8	11.4	9.2	17	15

This species, like the preceding one, is not very common here. The larger shell, whose measurements are recorded here was collected at Off Island. This is a large rock pile, with accompanying reef, located on the outer periphery of Buckner Bay on the Philippine Sea side of Okinawa. The specimen was found on a +0.5 foot daytime tide, with its purple-black mantle and the animal fully extended. The smaller shell was collected from under a rock at the Onna tide flat at night on a +0.6 foot tide. Both shells are typical examples of *Staphylaea l. limacina,* though of smaller size than the comparable Philippines shells. An interesting observation regarding this species that may clarify past confusion as to its identification is that the shell seems to attain maturity through at least three separate, distinct stages of development. The first stage has a solid, smooth, dark brown shell; the middle stage has numerous white spots on the smooth brown dorsum; in the final stage, in completely adult shells, the smooth white spots become white raised pustules, and a grooved mantle line is added.

Shell elongately ovate, somewhat light in weight, base convex; margins distinct, though not overly thickened; terminals sharply produced; apex depressed; aperture long, narrow, more or less straight; teeth distinct, finely formed, short, not extending to margins, sometimes even shorter centrally on the base; dorsal color battleship grey, marked overall with numerous white spots which may or may not be pustulated; a grooved mantle line usually present; margins, base and lip are white; terminals deep

burnt-orange, teeth and interstices pale orange, each denticle peculiarly, characteristically outlined on either side with dark burnt-orange lines; columella and shallow fossula ribbed by extension of base teeth.

33. *Staphylaea (Nuclearia) nucleus nucleus* (Linnaeus, 1758)

– Cate, 1966: plt. 39; figs. 37 a, 37 b –

Localities: 13, 15, 41, 47, 83, 85

(10) u	L	W	H	Lip	Col
Largest shell:	20.4	12.4	10.1	25	17
Smallest shell:	17.5	10.8	9.2	25	18

An uncommon species in the Ryukyu Islands, it has been collected at Zampa-Misaki and Metasaki. Beach drift shells have also been found at Gushichan and Chinen. MacNeil (1960, p. 51; plt. 19, figs. 5, 6) reports finding a fossil shell of this species in the Pleistocene limestone of Yontan.

Shell of medium size, ovate, granular-pustulate, strong; terminals produced, semi-beaked; aperture narrow, curving; base and margins thickened, the latter upswept; teeth fine, long, sharply defined, numerous, extending from aperture edge to either margin and up onto sides; grooved mantle line originates from a small, weak umbilical depression adapically; shell color uniform, except that dorsum reflects a light grey; granular surface, terminals, margins, base, teeth, and interstices medium beige.

34. *Erronea (Adusta) onyx onyx* (Linnaeus, 1758)

– Cate, 1966: plt. 40; figs. 38 a, 38 b –

Localities: 19, 69, 75 b

(2) r	L	W	H	Lip	Col
Largest shell:	36.0	21.3	17.8	20	18
Smallest shell:	32.6	19.6	15.9	19	17

This species, although occasionally found on tide flats, must be considered rare in the Ryukyu Islands at present. The two specimens listed here were found at Taguchi; another shell has been reported from Henza-Miyagi. Of this latter shell Bernice Albert says: "I found the only one of these that I know of having been found at Okinawa. It was stranded on a sandy tide flat here at Henza- Miyagi. I had the feeling it did not come from the sandy area and decided to investigate further, but the water toward the reef [was] so full of long-spined urchins and the water was so shallow to swim in we had to give up trying. We've looked in this area since and have never seen another. The animal was jet black and the animal sort of bubbly."

Shell medium sized, pyriformly-ovate, somewhat light in weight; terminals prominent; aperture straight, wide; margins well calloused, angled; teeth short, finer on inner lip, extending weakly onto broad columella, fossula interrupting the teeth that cross it, labial teeth larger, well formed; base swollen; dorsal coloring a succession of various shades of light brown (the characteristic light grey-white not present) superimposed upon one another, exhibiting the effect of mantle action; narrow band of the sides, margins, terminals, base, and interstices dark brown, teeth red-brown; interior of shell off-white.

35. *Erronea (Gratiadusta) pulchella pulchella* (Swainson, 1823)

– Cate, 1966: plt. 40; figs. 40 a, 40 b –

Localities: 27, 39, 71

(1) r	L	W	H	Lip	Col
Shell measurements:	41.3	23.0	20.0	31	27

During the last few years trawling operations by fishermen in the Taiwan-Ryukyu Islands area have confirmed the occurrence of this species in these waters. There have been reports of collections off Iriomote Island, though this has not been substantiated. The specimen reported here was trawled in 48 fathoms off the island of Miyako, southern Ryukyu Sakishima Group; this is, to my knowledge, the first authenticated shell of this species from the Ryukyu Islands.

Shell large for the species, pyriform, inflated adapically; terminals prominent, sharply formed, front almost beaked; aperture straight in front, curving sharply left to the rear; teeth fine, long on the base, short on outer lip; margins barely thickened, subangled on the right; basic dorsal color whitish-beige, with small, scattered flecks of light-brown; white margins numerously spotted with medium brown spots, base and interstices off-white, teeth red-brown (cracks and condition of shell indicate the specimen may have been dead when trawled from the ocean bottom).

36. *Erronea (Erronea) errones errones* (Linnaeus, 1758)

– Cate, 1966: plt. 40; figs. 42 a, 42 b –

Localities: 1, 19, 33, 39, 48, 51, 57, 65, 69 a, 75 b, 81, 85

(14) c	L	W	H	Lip	Col
Largest shell:	26.2	14.0	11.5	17	14
Smallest shell:	18.3	10.0	8.0	15	13

This species is common and widely distributed. It is almost never found out in the open, at least in the daytime, but is seen under rocks and in dark coral crevices.

Shell elongately ovate, sub-pyriform, strong, lightweight in structure; dark brown apex visible in shallow umbilicus, base convexly swollen; terminals somewhat prominent; margins thickened, right side particularly so; aperture wide, becoming wider in front; teeth weak on both lips, often nearly absent to the rear on the base; columella perceptibly denticulate in front, fossula absent; dorsum pale greenish-grey, tribanded, over which are numerous fine flecks of lighter brown, while usually a larger dark brown blotch adorns the central area; terminals, margins, base, teeth, and interstices light to dark ivory.

37. *Erronea (Erronea) ovum ovum* (Gmelin, 1791)

– Cate, 1966: plt. 40; figs. 43 a, 43 b –

Localities: 7, 82

(5) u	L	W	H	Lip	Col
Largest shell:	25.0	14.8	12.2	17	15
Smallest shell:	23.6	14.0	11.6	18	16

The two shells listed here were collected at Baten, on the southern rim of Buckner Bay. This species has also been collected at Onna on the south (China Sea) side of Okinawa. An interesting feature of the Ryukyu shells is the very pale yellow coloring of the interstices; usually it is much darker and a more obvious identifying character. The shells of this species are more pyriform than those of *Erronea e. errones,* lack the brown dorsal blotch, base and terminal coloring is darker, and the aperture is wider, but more constricted abapically.

Shell pyriform, somewhat bulbous; terminals prominent; aperture straight, wide, openly constricted in front; margins calloused, semi-angled on the right side; teeth short, fine on the inner lip, larger, heavier on outer lip; columella smooth, fossula almost flat, ribbed; dorsal surface covered evenly with small, irregular pale brown spots (flecks), undercoloring off-white, creating a greenish appearance; margins, terminals, base, and teeth light beige, interstices very pale yellow.

38. *Erronea (Erronea) cylindrica cylindrica* (Born, 1778)

– Cate, 1966: plt. 41; figs. 46 a, 46 b –

Localities: 37, 45, 57, 75 b, 79, 85

(4) u	L	W	H	Lip	Col
Largest shell:	27.3	12.1	10.0	17	22
Smallest shell:	22.6	11.0	8.8	16	20

Although these shells are found more commonly at the southern islands of Miyako and Yaeyama, they are also collected on the tide flats at Onna, Kue, and Zampa-Misaki. The narrowness of these shells seems, more than usual, to emphasize their length.

Shell long, narrow, cylindrical, somewhat lightweight; terminals protrude awkwardly; aperture straight, wide, openly constricted in front; left margin barely thickened or not at all, and perceptibly flanged abapically; right side narrowly thickened and angled; umbilicate, with black apex therein; dorsal color grey, irregularly blotched with chestnut-brown on top; large brown spots at each terminal (quadrimaculate); umbilicus, terminals, margins, base, teeth, and interstices off-white; columellar teeth long, fine, weak, heavier in front, crossing fossula; labial teeth short, strong, widely separated.

39. *Erronea (Erronea) caurica caurica* (Linnaeus, 1758)

– Cate, 1966: plt. 41; figs. 44 a, 44 b –

Localities: 39, 41, 57, 85

(2) r	L	W	H	Lip	Col
Largest shell:	39.9	19.7	16.1	20	19
Smallest shell:	38.7	20.0	16.3	16	17

This species is very scarce here, only 3 specimens at present being known from Okinawa. Two of these were found at Zampa-Misaki, one by a SCUBA diver in deep water, the other at nearby Bolo Point; the third specimen was picked up on the Onna tide flat by Ernest and Bernice Albert.

Shell long, narrow, with rounded base; terminals prominent, apex depressed; aperture wide, generally straight; teeth strong, bold, though finer on rear half of base; margins well calloused, more so on right side, angled and shouldered; basic dorsal color greenish-ivory, with 3 wide transverse bands of light brown, overall thickly flecked with light brown; large brown spots line both sides; margins, terminals, base, and teeth light beige, interstices brownish-beige.

40. *Erronea (Melicerona) felina pauciguttata* (Schilder & Schilder, 1938)

– Cate, 1966: plt. 41; figs. 47 a, 47 b –

Localities: 9, 21, 33, 41, 43, 57, 81, 85

(4) u	L	W	H	Lip	Col
Largest shell:	18.9	11.0	8.2	13	12
Smallest shell:	15.0	8.2	6.0	12	14

This species has been collected intertidally at several locations at Okinawa; the most notable of these are Zampa-Misaki, Onna, Metasaki, and Yagaji. It may be

found fairly frequently at the offshore islands of Ikishima (on the reef flats), and Minami-Ukibaru (intertidally).

Shell oblong-ovate, with a suggestion of flatness; terminals obscure; aperture straight, comparatively wide; right margin thickened, angled; base flatly concave; teeth short, weakly developed on the rear half of base, stronger in front, prominent on outer lip; fossula flat, ribbed; dorsal color grey-green, overlaid with 4 (3 prominent) broken transverse bands of darker color, with a yellow wedge of color just to the rear of the front terminal collar; large, dark brown spots at either side of terminals and in a line along the right margin, scattered along the left margin; base, lip, teeth, and interstices pale ivory.

41. *Notadusta punctata atomaria* (GMELIN, 1791)

– CATE, 1966: plt. 41; figs. 48 a, 48 b –

Localities: 39 a, 41, 57, 65, 85

(8) u	L	W	H	Lip	Col
Largest shell:	18.6	11.1	8.9	20	21
Smallest shell:	14.6	8.4	6.8	19	18

To the best of my knowledge this is a rare mollusk in Ryukyu waters. The specimens measured were collected in 1950 on the reef just north of Onna on the west coast, and at Metasaki in 1952 by Anita Scott. Shells also are known to have been collected at Zampa-Misaki.

Shell generally fairly large, pyriformly-ovate, light in weight, umbilicate; terminals produced; aperture wide, curving; margins barely formed on the left, thickened, minutely shouldered, and angled on the right, semi-flanged in front; shell color off-white to ivory-beige, teeth and terminal openings slightly darker beige; dorsum and margins numerously speckled with medium dark brown spots.

42. *Notadusta katsuae* (KURODA, 1960)

(Plate 3, Figures 1 a, 1 b)

Localities: 53, 62

(2) r	L	W	H	Lip	Col
Largest shell:	20.5	11.0	8.8	30	28
Smallest shell:	20.1	9.9	8.6	31	24

KURODA cites only "Okinawa" as the type locality of this relatively newly discovered species. The fact that it was trawled in 80 m (presumably by fishermen) precludes the fixing of an exact locality for it. Fernando Dayrit, Diliman, Rizal, Philippines reports that practically all of the fishing for Manila markets is done off the eastern coast of Palawan Island, a possible general locality for this specimen. SCHILDER (1963, p. 127) records the holotype as in the Teramachi collection (Kyoto). The smaller shell, whose measurements are listed here (Cate coll. no. C3392) was taken from the stomach of a fish in a Manila fish market, thus the exact locality for this shell is also unknown. It is conceivable that a migrating fish transported this specimen to the Philippine area from Japanese waters. Dr. Schilder (*in litt.*) mentions the species as coming from the Sulu Sea also.

Shell narrow, elongately ovate, thin, lightweight though strong; base convexly rounded, swollen; terminals beaked delicately though strongly, sharply defined; aperture long, narrow; inner columella narrow, smooth; fossula almost without depression; teeth numerous, very fine, somewhat long on lip, very short on inner edge of base; margins perceptibly thickened, more so on outer lip where sub-angled, shouldered; slightly flanged at either side in front; primary shell color dark beige, tri-banded with a darker shade dorsally, terminal beaks lighter color, margins covered thickly with various sized chestnut-brown spots, narrow base and interstices ivory-beige, teeth ivory within, chestnut-brown on the ridges without.

It should be emphasized that my description was made from an *ex pisce* specimen, although one in excellent condition; there is none of the dorsal spotting as seen in *Notadusta musumea*.

43. *Notadusta musumea* (KURODA & HABE, 1961)

(Plate 3, Figures 3 a, 3 b)

Locality: uncertain in Ryukyu waters

(1) r	L	W	H	Lip	Col
Shell measurements:	22.8	12.7	10.6	30	28

This is a rare species, occurring in Ryukyu and southern Japanese waters. The specimen whose measurements are recorded here was trawled in 50 fathoms off Kochi, Shikoku, Japan (in the Tosa Sea). The species has also been obtained by trawling off Amami-O-Shima, in 40 fathoms. However, I have been unable to get any further information about the Ryukyu shell. SCHILDER (1963) believes this species to be synonymous with *Notadusta katsuae* (KURODA, 1960), but it appears to me to be distinct. I am tentatively listing *N. musumea* with the Ryukyu fauna until further field work brings the information on the species here into better perspective.

Shell light-weight, strong, pyriform, shallowly umbilicate; base broad, convexly swollen; terminal in front semi-beaked, obscure at rear except that right extremity of lip is flared; aperture straight, wide; columella smooth adapically, increasingly ribbed toward the front; fossula long, narrow, shallow, ribbed, prominently denticulate

along either side; teeth numerous, very fine; though distinct, interstices are shallow; teeth larger on lip, finer and more indistinct on base; left margin rounded, scarcely calloused, thickened, broadly upswept on right side, weakly shouldered; primary shell color light ivory, with a faint, narrow band transversely bisecting the dorsum; margins thickly flecked with medium-brown spots, the left side more thickly so, the dorsum is more sparingly flecked, somewhat methodically with very small brown spots; a large chestnut-brown spot covers a portion of apex and umbilicus which latter is partially obscured with opaque nacre.

44. *Palmadusta (Palmadusta) asellus vespacea* (Melvill, 1905)

– Cate, 1966: plt. 42; figs. 50 a, 50 b –

Localities: 7 a, 9, 33, 41, 57, 85

(8) u	L	W	H	Lip	Col
Largest shell:	17.4	10.1	8.0	20	15
Smallest shell:	13.7	8.1	6.2	19	14

This species is often found living on coral ledges and under rocks at Zampa-Misaki, Bolo Point, and Metasaki. The animals seem to migrate more or less seasonally; one or two may be found on a collecting trip, then it may be a long time before another is seen. MacNeil (1960, p. 52; plt. 18, figs. 19, 22) lists and illustrates a shell from the Yontan limestone of Okinawa that may belong to this species, though to me it seems more probably to be *Erosaria poraria scarabaeus* (Bory, 1827) (see Cate, 1966, plt. 39, figs. 32 a, 32 b). The shape of the shell, the lack of teeth on the front half of the columella, and the presence of an exaggerated umbilical area all tend to eliminate *Palmadusta asellus vespacea* from consideration here.

Shell oblong-ovate, solid, strong, umbilicate; terminals somewhat produced; aperture fairly narrow, straight; margins thickened, heavily so on the right side, upswept, shouldered, angled; primary shell color white; three wide dark brown bands traverse the dorsum from right side to adaxial edge of columella, bands partially obscured by thin layer of white callus on left margin and base; umbilicus, terminals, margins, base, teeth, and interstices white.

45. *Palmadusta (Palmadusta) clandestina moniliaris* (Lamarck, 1810)

– Cate, 1966: plt. 42; figs. 51 a, 51 b –

Localities: 14, 23, 25, 33, 37, 57, 59, 62 a, 65, 85

(5) u	L	W	H	Lip	Col
Largest shell:	15.7	9.3	7.4	17	17
Smallest shell:	13.2	7.8	6.6	17	16

This species is far from common. At Imbu it has been collected under rocks, at Onna out on the tide flats. It has also been obtained at Kue and Zampa-Misaki.

Shell narrowly ovate, small but strong; terminals prominent; aperture nearly straight, curving gently adapically; margins thickened, semi-angled on the right side; teeth small, distinct, short on outer lip, longer on the base; primary shell color white, overlaid dorsally with light grey-beige, bisected by a narrow transverse band of off-white; a yellow-beige spot toward the front, overall fine straw-colored lines mark a zigzag pattern on upper surface; terminals, margins, base, teeth, and interstices white.

46. *Palmadusta (Palmadusta) lutea lutea* (Gmelin, 1791)

– Cate, 1966: plt. 42; figs. 54 a, 54 b –

Localities: 9, 53, 85

(1) r	L	W	H	Lip	Col
Shell measurements:	13.5	8.0	6.2	16	14

As this paper was nearly completed, a personal communication from Peter W. Way, Okinawa, was received which lists a species hitherto unknown in Ryukyu waters. It states in part:

"*Cypraea lutea* (Gmelin) was found by myself yesterday morning about 3:30 AM on the outer reef at Zampa-Misaki (Bolo). To my knowledge another has not been found on Okinawa before, at least there are none in any of the collections that I have seen.

"I took it to the Alberts last night and we cleaned it together. I wanted them to verify my claim, as I was by myself at the time I found it. Naturally, we were all in 'seventh heaven' about finding this item.

"The tide for 27 January, 1967 was –0.5 ft. at 0154 hours. About 0430, I made one last quick sweep of the dry outer reef and saw the *lutea*; it looked as if it had just crawled out of a hole in the reef. When I came upon the animal it was high and dry and was still moving.

"The animal: the foot was a bright orange-red; it had minute black marks /// or lines on the dorsal side; the mantle was a dark red (not intense) and had numerous, simple papillae which gave it a fuzzy appearance; the tentacles were also the same color as the foot, with black eyes. (The mantle was not as brilliant a red as the foot.)

"Other shells found were *Cypraea hirundo neglecta, C. helvola, C. cribraria, C. arabica, C. teres, C. asellus, C.*

nucleus, C. punctata, C. maculifera, C. fimbriata, C. poraria, C. isabella, C. caputserpentis, C. carneola, C. vitellus, C. vanelli (lynx), C. erosa, C. pallidula, Conus geographus and *Conus distans.* Another fellow found two *Cypraea punctata* and one *C. scurra.*"

47. *Palmadusta (Palmadusta) ziczac ziczac* (Linnaeus, 1758)

– Cate, 1966: plt. 42; figs. 55 a, 55 b –

Localities: 57, 65, 85

(1) r	L	W	H	Lip	Col
Shell measurements:	11.1	10.6	8.6	16	15

Until about a year ago this species had been thought extinct in Ryukyu waters. Since then one specimen has been collected in shallow water on the reef just north of the village of Onna; another has been found in the same locality in deeper water by a SCUBA diver; still more recently a specimen was collected at Bolo Point.

Shell short, wide, pyriformly ovate, umbilicate, with a swollen base; terminals weakly produced; aperture wide, gently curving left adapically; margin thickened only on right side; teeth short, well defined, finer on the base; basic dorsal color light grey, overlaid with light olive-brown in a zigzag manner, thereby exposing the light grey primary color; base, teeth, and interstices burnt-orange; medium dark brown spots encircle the umbilical area, numerous on base, less on sides; terminal edges medium brown.

48. *Palmadusta (Purpuradusta) gracilis japonica* (Schilder, 1931)

– Cate, 1966: plt. 43; figs. 56 a, 56 b –

Localities: 19, 37, 43, 57, 75 b

(3) u	L	W	H	Lip	Col
Largest shell:	18.0	10.6	8.6	16	13
Smallest shell:	15.0	9.2	7.3	15	12

This is another uncommon species living in the intertidal zones of Okinawa. It is most frequently collected on the tide flats at Kue, Onna, and Henza-Miyagi.

Shell pyriform, semi-bulbous; terminals strongly produced; aperture wide, straight; right margin heavily calloused, sub-angled; teeth short, fine; primary dorsal color light grey-white, overlaid with numerous thin flecks of light brown, a larger dorsal blotch frequently present as well; large brown spots line both margins, both terminal openings lined with purplish-brown; base, teeth, and interstices ivory.

49. *Palmadusta (Purpuradusta) fimbriata marmorata* (Schröter, 1804)

– Cate, 1966: plt. 43; figs. 58 a, 58 b –

Localities: 9, 19, 33, 37, 57, 65, 81, 85

(18) c	L	W	H	Lip	Col
Largest shell:	13.1	7.2	5.9	17	16
Smallest shell:	11.1	6.1	5.0	18	16

This species is found commonly under rocks and in coral at Kue, Onna, Yagaji, and Bolo Point. The shells closely resemble the Philippine forms and may be a link in the range of the species, which terminates in the Japanese islands to the north.

Shell sub-pyriform, bluntly flattened adapically; terminals obscure to the rear, less so in front; aperture fairly wide; teeth very fine, weaker on base; right margin thickened, angled, sub-shouldered; primary dorsal color light grey, overlaid irregularly with pale brown, with a wide, darker brown transverse broken band; apex and terminals deep lavender; margins, base, teeth, and interstices off-white.

50. *Bistolida (Blasicrura) quadrimaculata quadrimaculata* (Gray, 1824)

– Cate, 1966: plt. 43; figs. 60 a, 60 b –

Localities: 39, 57, 67

(2) r	L	W	H	Lip	Col
Largest shell:	21.2	10.0	8.5	17	18
Smallest shell:	20.8	10.1	8.5	18	17

This species must be considered rare until additional field work can give us a true picture of its distribution in these islands. One specimen was collected at Okinawa in 1955, but no records were kept of the specific locality at the time. However, two more shells were collected by the same worker at Machinato in 1956.

Shell long, narrow, sub-pyriform; terminals heavily calloused, blunt; aperture wide, straight; teeth long and fine on base, heavy and short on outer lip; primary color off-white, dorsal area darker because of 4 wide, pale gray transverse bands, all overlaid with minute flecks of light yellow-brown; two dark brown spots at either end; base, terminals, margins, teeth, and interstices off-white.

51. *Bistolida (Blasicrura) pallidula pallidula* (Gaskoin, 1849)

– Cate, 1966: plt. 44; figs. 63 a, 63 b –

Localities: 41, 57, 81, 85

(2) u	L	W	H	Lip	Col
Largest shell:	21.5	11.5	9.0	22	17
Smallest shell:	19.0	9.3	7.5	20	18

This species lives on the reef flats, usually hidden in rough, algae-covered crevices in about four feet of water; it is not often found. The solidly formed shells seem to have a thicker, more concentrated dorsal color than specimens from elsewhere.

Shell cylindrically oblong, heavy, solid; terminals heavily calloused, weakly produced; aperture nearly straight, narrow; teeth relatively fine, well defined; margins thickly calloused, right side more so, sub-angled; basic color off-white, dorsum overlaid with a thick covering of brownish-yellow flecks (the large shell, whose measurements are listed here, has a definite mantle line) that obscures the 4 broken transverse brown bands characteristic of this species; terminals, base, teeth, and interstices off-white to pale ivory.

52. *Bistolida (Blasicrura) luchuana* Kuroda, 1960

– Cate, 1963: plt. 15; figs. 2, 2 a –

Localities: 14, 39, 45, 55, 57, 63 a, 65, 75 a, 85

(23) c	L	W	H	Lip	Col
Largest shell:	21.7	13.0	10.4	20	20
Smallest shell:	16.1	9.4	7.7	18	14

This is perhaps the only species endemic to the Ryukyu Islands; as far as I have been able to determine, its range does not extend as far as the Philippines or Japan. I have examined over 75 specimens of this species and compared them with *Bistolida dayritiana* (Cate, 1963), and am convinced this latter species is not presently found in Ryukyu waters, and therefore cannot be considered as part of this molluscan fauna. At Onna *B. luchuana* is found abundantly on the submerged tide flats, most often in water just below low tide line under rocks, living in a soft, thick-stemmed, green sponge of an unidentified species. *Bistolida luchuana,* particularly at Onna, is associated with such other cypraeid species as *Ravitrona h. helvola, R. l. labrolineata, Erosaria erosa phagedaina, Staphylaea s. staphylaea* and *S. l. limacina.* An interesting observation is that many of the specimens of *B. luchuana* have jet-black animals, while others seem to be lighter, grey. This species has also been found at Okuma, and is never seen exposed above water due to the receding tide, as are species such as *Monetaria moneta rhomboides, Ornamentaria a. annulus,* and *Ravitrona c. caputserpentis*; the usual depth for this mollusk is from 3 to 7 feet. The species has also been collected on the south east coast of Miyako Island (Way); Schilder (1962) reports a "'semifossil' shell (22.5 mm.) coming from the Sukiran dredgings off Okinawa (Col. McCarty, 1955)."

Shell pyriform, lightweight; terminals strongly produced; aperture fairly wide, mostly straight, curving gently left; teeth fine, well defined, longer on rear half of base, shorter in front, labial teeth of medium length; margins well calloused, somewhat upswept and angled on the right side; basic color light-grey, 4 very pale, wide transverse bands of darker color, all overlaid with numerous, fine flecks of pale yellow-brown; a faint mantle line often present; apex depressed, dark brown; terminals, margins, base, teeth, and interstices pale ivory.

53. *Bistolida (Blasicrura) teres teres* (Gmelin, 1791)

Syn.: *Cypraea tabescens* Dillwyn, 1817 (Solander MS)
Descr. Cat. Recent Shells **1**: 463
Cypraea punctulata Hidalgo, 1907
Monogr. gén. Cypraea (M. Acad. Cien. Madrid **25**: 484)

– Cate, 1966: plt. 44; figs. 66 a, 66 b –

Localities: 33, 42, 65, 71, 85

(5) u	L	W	H	Lip	Col
Largest shell:	29.6	17.7	13.8	25	26
Smallest shell:	27.3	16.2	12.8	23	25

The shells whose measurements are recorded here were collected on a shallow-water coral outcropping at Minami. Other specimens from Smuggler's Cove, Zampa-Misaki and from Taiwan would suggest a link with the species in the Philippines and Japan.

Shell ovate to oblong-ovate, solid, heavily formed, base swollen, apex depressed; terminals produced; aperture fairly wide, curving slightly adapically; teeth fine, short on base, crossing columella and long shallow fossula, somewhat larger and longer on outer lip; margins heavily calloused, angled and shouldered on right side, enveloping rear terminal; primary dorsal color pale blue-grey, overlaid with a thick pattern of light brown flecks, smudges, and a large dark brown central blotch; widely dispersed brown spots mark both margins; terminals, margins, base, teeth, and interstices off-white.

54. *Bistolida (Bistolida) kieneri depriesteri* (Schilder, 1933)

– Cate, 1966: plt. 44; figs. 67 a, 67 b; text fig. 1 –

Localities: 43, 53

(1) r	L	W	H	Lip	Col
Shell measurements:	13.5	8.1	6.2	15	12