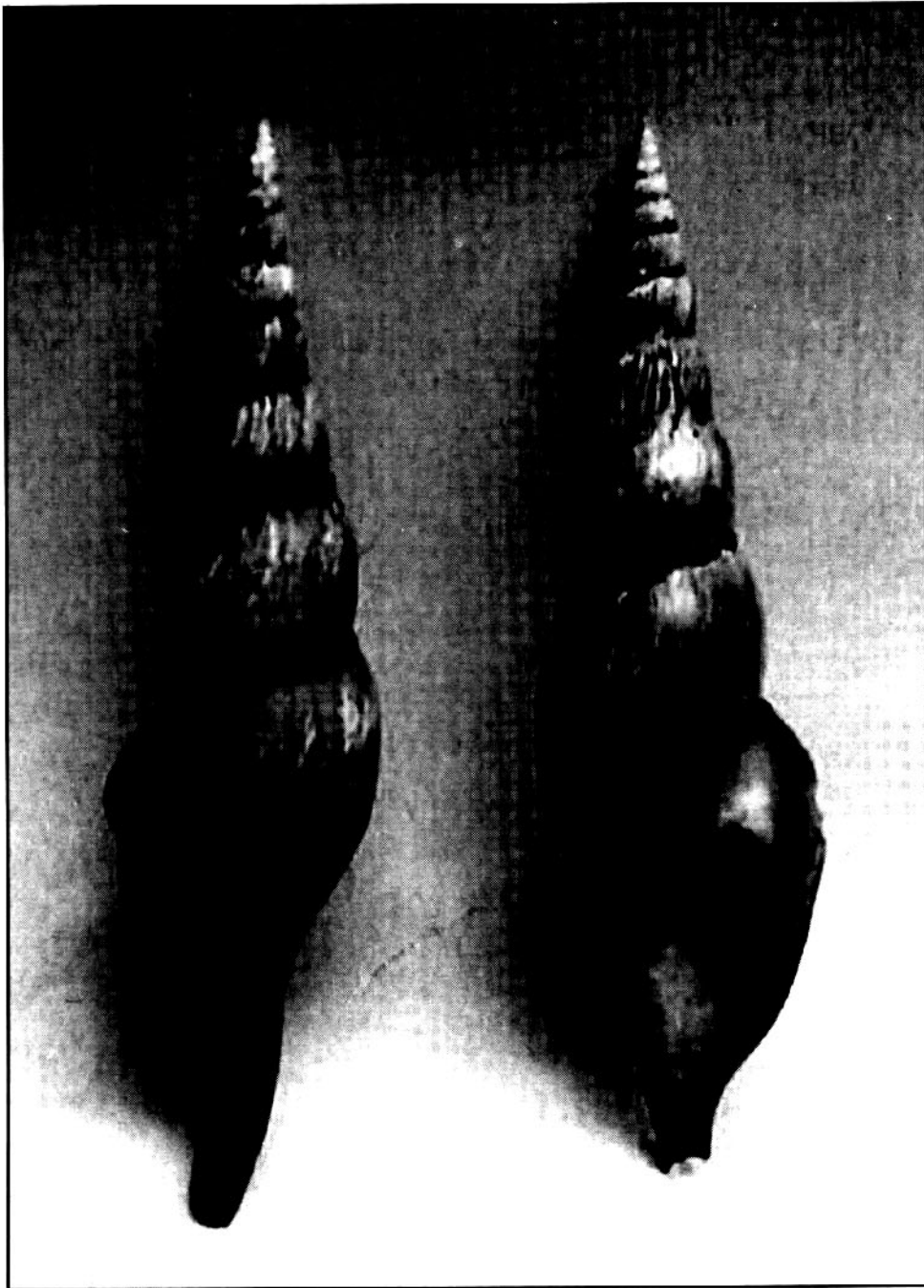


# *of Sea and Shore*



Volume 21, No. 4

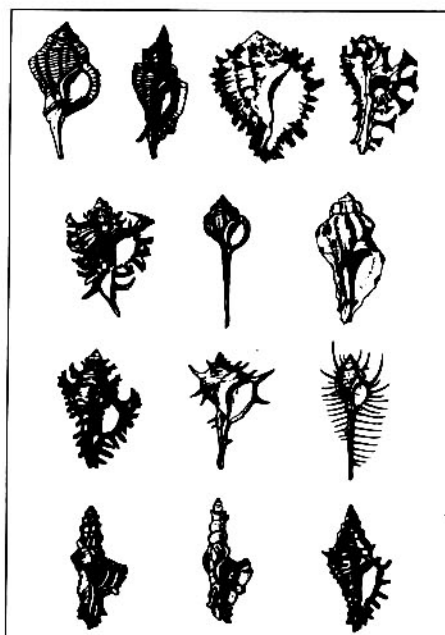
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## From the Editor's Desk ...

Another issue that is getting to you a bit late, the result of an extended trip to Thailand and the Philippines, the year end holidays and the fact that the magazine is the work, entirely, of one person. Anyway, here it is, hope you enjoy it.

I'm also working on the new edition of the *Catalog of Dealers' Prices for Shells* ... (see page 237) and other projects that you'll be reading about in future issues. I'd like to hear about your projects too - and will give them some publicity.

Until the Spring issue - *Tom*

**IN MEMORIAM**

**Manuel Montilla  
Harold E. Vokes**

**Of Sea and Shore Magazine** [US ISSN 0030 0055] is published four times each year by Of Sea & Shore Publications; Port Gamble, Washington 98364 USA. Subscriptions are \$15. per volume (4 issues) in the U.S., \$20 elsewhere. Special rates for First Class & Air Mail delivery available. Send address changes to P.O. Box 219; Port Gamble, WA 98364-0219. Telephone/Fax (360) 297-2426  
email: ofseashr@sinclair.net  
URL: <http://www.ofseaandshore.com>  
This is issue #4 of Vol. 21. Date of issue January 21, 1999.

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EDITOR: TOM RICE

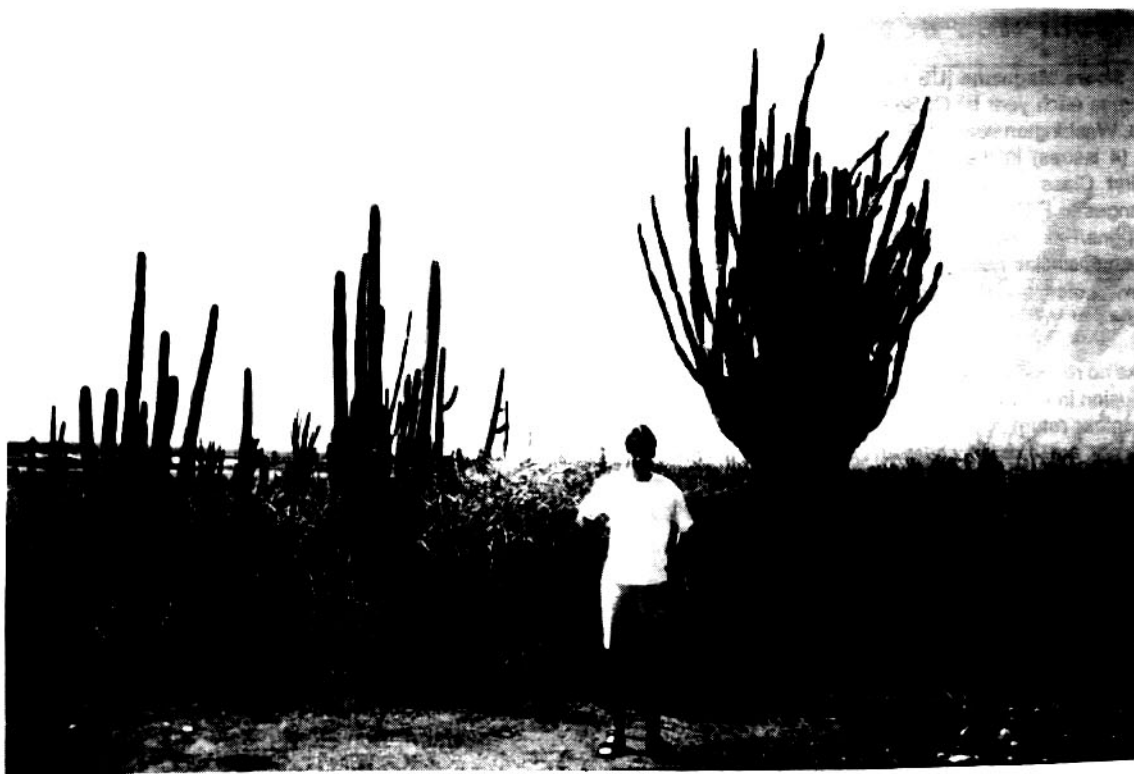
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1. A snorkeler observing a school of squid beneath her in the clear blue Caribbean water. Photo by James B. Wood.



2. Jason posing with the inland cactus on the island of Bonaire. Photo by the author.





3. Jennifer watching birds above a cove in Washington-Slagbaai Park. Photo by the author.

**BONAIRE**  
**AN ISLAND PARADISE**  
**OR**  
**A DESERT ISLAND?**

**Roland Anderson**

I have recently returned from a working vacation on the island of Bonaire in the southern Caribbean Sea. I was helping a research project carried out there on the Caribbean reef squid *Sepioteuthis sepioidea*, which is common there in shallow water.

Bonaire is a small island off the coast of Venezuela but it is part of the Netherlands. It was strange to hear that a flight from the Netherlands is considered a domestic flight, and doesn't have to clear Customs. Dutch, Spanish and English are all commonly spoken, along with a local dialect called *papimentu*. While the Antillean guilder is the official currency, most merchants cater to Americans and deign to take U.S. dollars - but they give change in guilders!

If you think of a tropical island in the Caribbean Sea, you might envision palm trees or rain forest vegetation bordering pellucid blue seas, but such is not the case at Bonaire, except for the water. The clear, clear, blue, blue



4. The author feeding a hungry iguana lizard. Photo by James B. Wood.

water so valued by scuba divers was there, but the land was very different from what I expected. First, it was hot and very dry. The temperature ran about 85-90° F and the water was 82° F. Bonaire only gets about 15-20 inches of rain a year, mostly in the winter, and it seemed less than that when looking at the terrain. Most of the uplands are desert and the dominant vegetation is a saguaro-like cactus. We also saw prickly pear cactuses, a low round barrel-shaped cactus and a short vine-like cactus that resembled a ground cover. This was not a place for walking off the paths or roads with any exposed flesh. We speculated that walking on the ground cover cactus would be akin to fire walking! What vegetation that was not cactus can only be termed as scrub brush and sparsely-leaved trees. The brush supported herds of semi-wild goats, who probably contributed to the sparseness of the vegetation and usually gave us an early morning wake-up "maa-s" about four in the morning.

We stayed in a rental house in the village of Republik, high in the hills several miles from the water via twisting roads. While quite a distance from our squid-watching site, the house was exposed to constant trade winds that kept the 85-90° F daytime temperatures more tolerable. The house had a cement fence to keep the semi-wild goats and donkeys out. A large partially-roofed patio overlooking a rock garden with cactuses allowed us to bird-watch while enjoying an afternoon beer after our daily squid observations were over. Several birds especially enjoyed by our team were green parrots, yellow orioles and bananaquits and bright orange troupials. Closer to the water we saw snowy egrets, great blue herons, laughing gulls and brown pelicans. In a natural salt pond on the north end of the island and in the salt-dehydration ponds at the south end, we saw the large impressive pink flamingos. The salt ponds make sea salt for export.

We spent four to six hours a day snorkeling to observe squid behavior. The purpose of the research was to determine if squid communicate using their skin patterns, either with others of their schools of 10-20 individuals, or with other animals such as squid predators. Squid can make various colors and patterns on their skins with the use of color cells in their skin called chromatophores. The squid have direct control of these cells can change their color or pattern according to their mood or in response to their mates, others in schools, or other animals. We were particularly interested in the courtship behavior of the squid. When a female is receptive, she turns pale, overlain with a dark saddle pattern. A male develops a striking striped pattern on his back when he's feeling amorous. Two aggressive males take on a zebra pattern of zigzagging stripes. Both sexes could assume a deimatic display toward a mild threat, such as a curious parrot fish. The deimatic display is a pale body with two large false eyespots toward the back of the fins. In response to a more serious threat, such as a marauding yellowtail

snapper, the whole school of squid turned pale, darted to the surface, and quickly jetted out of sight. Although most of the colors and body patterns have been documented before, little attention has been paid to the ecological or ethological context of the patterns, and we filmed many of them for future analysis. This is expected to be a four-year study, and this year we were learning the basics.

One day we took a break from squid watching and visited Washington-Slagbaai National Park at the north end of the island, for bird watching, snorkeling (for fun!) and other touristy activities. We drove through seven miles of cactus-covered terrain over a rough dirt road and finally came to a small oasis, an algae-covered pond at the base of a rocky cliff. Although it is known for the birds frequenting the tepid pool, I was more impressed by the blue-tailed lizards and large green iguanas hanging around. The iguanas had obviously been previously fed by tourists. When I wiggled my fingers at them seductively, they came close and tried to bite me. We finally gave them pieces of orange to eat in payment for posing with us.

While watching squid in the shallow 5-10 foot deep water was our primary concern, it was hard to avoid noticing other molluscs as we drove to and from our dive site, scrambled over the rocks to get to the water, or got bored when the squid weren't doing anything interesting. Crawling in or among the cactuses were two types of land snails. It was unnerving to see snails on cactus plants - somehow you don't expect to see molluscs in such dry conditions. Likewise, we saw littorinids on rocks on the shore that seemed perfectly happy well above the splash zone. *Nerita* clustered under rocks of the splash zone. A bit lower yet, two types of chitons nestled in depressions of the rocks, *Acanthopleura granulata* and *Ceratozona squalida*. Under rocks in shallow water we found several file clams, *Ctenoides* (= *Lima*) *floridana*, a bivalve with gaudy frilly tentacles. While snorkeling one of us found a cowry, *Cypraea acicularis*.

All of Bonaire is a marine park whose animals are protected and you are not even allowed to take dead shells or coral. This protection means that different rare animals can sometimes be seen. I was intrigued by the pen shells living in the deeper coral sand. Some were living inside the blades of lettuce corals, obviously a protective habitat. This was the first time I had seen live pen shells, which are bivalves somewhat different from the norm. In many of the areas where we saw squid we also saw the gaudy nudibranch *Tridachia crispata* crawling among the coral rubble. This lettuce sea slug is probably the most-photographed nudibranch in the Caribbean, but its brilliant colors make it deservedly so.

Other notable molluscs we saw were *Octopus vulgaris*, *O. briareus*, and the rarely-seen *O. filiosus* (= *humelincki*). We saw the first two while snorkeling at night or

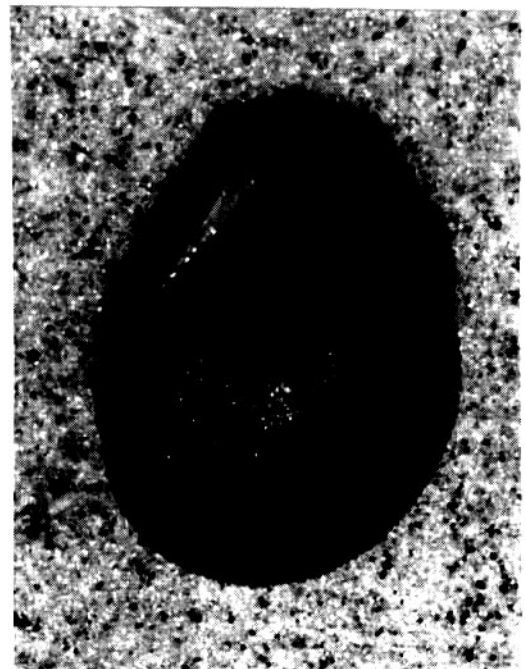


in their dens during the day, but the latter was seen hunting among the broken coral during the day. *Octopus filiosus* is notable for having two bright false eyespots in the webbing at the base of the second pair of arms. These eyespots (or "ocelli") are thought to startle or frighten possible predators.

In addition to the squid study and other nature observations, we did a preliminary survey of commensal shrimp living amid sea anemones and a study of how various species of brittle stars fall through the water when dropped. Several cleaner shrimp live in the tentacles of the sea anemones or next to them, and these shrimp in the Caribbean may be analogous to the well-studied damselfish of the tropical Pacific, which do the same thing. The brittle stars do different actions when falling through the water, either maintaining their normal posture, folding their arms over their bodies, or curling their arms in a knot over their bodies. We're hypothesizing the different falling postures may allow the brittle stars to fall more quickly through the water to avoid possible predation and allow them to land right side up. Further studies and publications are planned from the results of all these projects.

Although Bonaire brings new meaning to the term "desert island," its molluscan fauna was immensely interesting. I look forward to returning next year to learn more about the squid, other molluscs and additional wildlife.

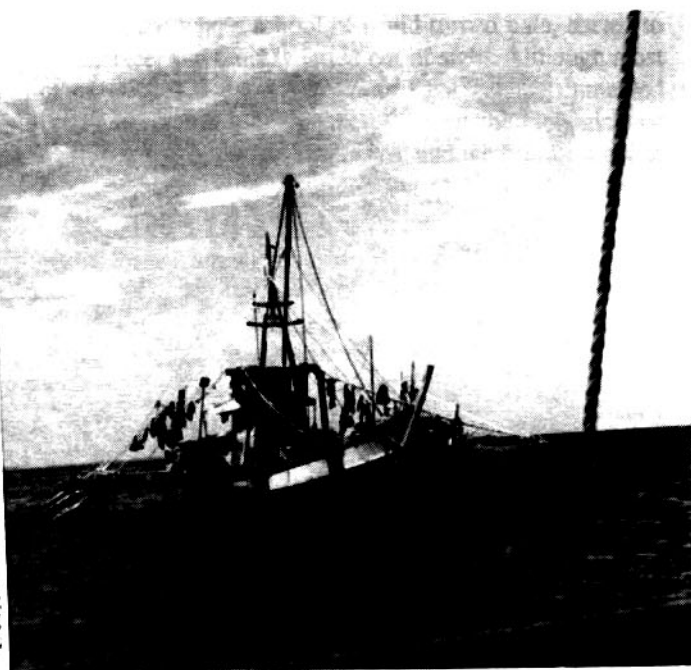
5. *Cerion uva* crawling on the cactus. Photo by James B. Wood.



6. We found the bivalve *Otenoides floridana* commonly under rocks in shallow water. Photo by Jason Chinn.

## TOM'S TRAVELS

The five+ week trip made during November and December of 1998 to the Philippines and Thailand was a success and I hope you'll be looking forward to reading about it in our next issue. To tempt you here are a few photos taken on our adventure.

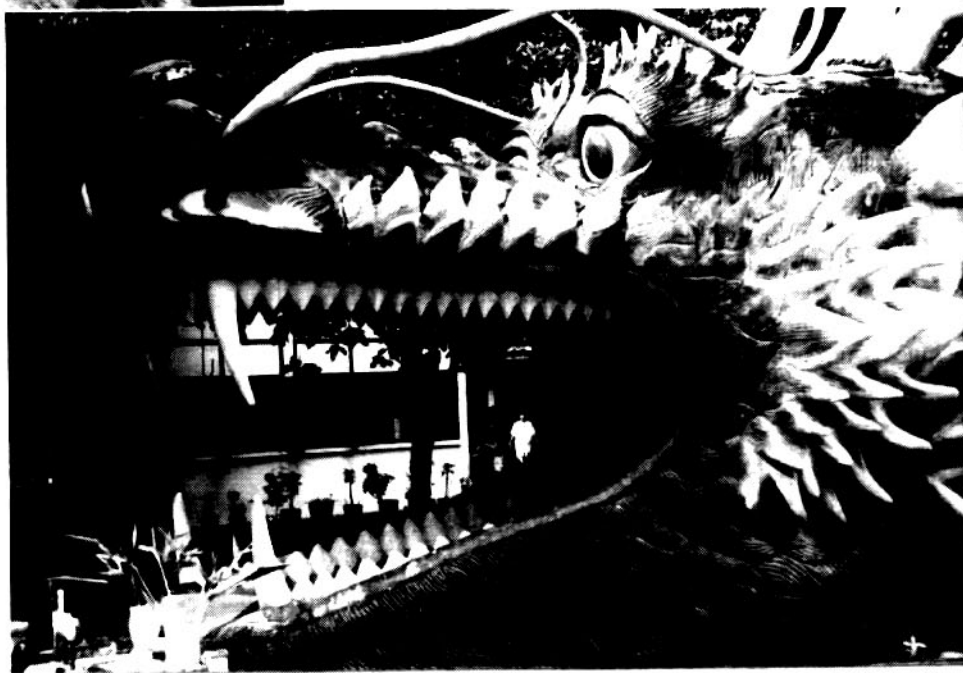


Is this our transportation on interisland trips?

And why are the Editor and Somwang and Somnuk Patamakanthin standing in the dragon's mouth?

What's a dragon doing in a shell story?

**More Photos  
from our trip  
on pages 200,  
230 and 237**





## Essays from a Mollusc Watcher Part V

John Orr

### MUTATIONS AND MUTANTS

Neo-Darwinian evolutionists assert that it is impossible for organisms to inherit acquired traits. They also insist that all evolution hinges upon random chance. But perhaps we should keep an open mind about such assertions. Take adaptations, for example. The ways in which molluscs spread far and wide by adapting so readily to different ecological habitats suggests that natural selection acts as a directional force, choosing mutant traits which harmonize with prevailing environments.

Part of this process relates to environments impinging upon mutation rates by affecting the growth and development of organisms, whether at cellular or ecological levels; high U/V light and other forms of radiation, for instance, are known to alter mutation rates. The effects of nutrition may do the same. At all events, environments can be regarded as two-dimensional: those such as weather and climate exerting forces on organisms from without, inwards; and others, such as microscopic reactions within cellular ecosystems imposing forces from within, outwards, as if seeking equilibrium. Neither does natural selection always have the last word given that organisms can modify environments as well as adapt to them.

Just as two levels of environment exist, so do two levels of metabolism: animal metabolism, which helps organisms adjust to ever-changing climatic conditions, and cellular metabolism, which ensures that cells within their own pinhead ecosystems divide, multiply and differentiate into specialized organs. To this must surely be added genetic metabolism (genes, in effect, are units of mutations) which can affect both cells and body organs either progressively or regressively. But if a mutation (regardless of whether it may arise randomly or in response to a need) happens to coincide with a change in the environment, then what might have been a progressive trait could become regressive, or vice-versa, in relation to the altered conditions.

#### Life and Death

While mutations afford the opportunity to provide evolution's vital ingredient of variability, natural selection strives to harness and harmonize that variability with environmental conditions. But, by virtue of nature's on-going experimental methods, flaws and 'failures' often arise. However, in the sense that co-evolution, at whatever level, strives to maintain a balance, death is just as much a critical part of the regulating process as life, and the inability of organisms to adapt - leading to species,

genera, families and sometimes whole phyla perishing - doesn't necessarily represent 'failure' in the overall context of a broad, self-balancing system (any more than the demise of stars and suns into black holes represents a failure of self-adjusting systems on a massive cosmic scale; new stars are always being 'born' to counter-balance the 'death' of old ones. So are species of adaptable organisms like molluscs.

#### The Barrier in Between

Consider, for example a population of gastropods grazing in hospitable surroundings along an inter-tidal reef somewhere in the tropics. Unusually severe monsoon rains cause floods which alter the course of a nearby river, so that silt and sand flow into the sea to gradually build up an impenetrable barrier between marine organisms occupying reef shallows. As currents alter direction, ecological features on each side of the barrier change. Molluscs of the same species become isolated into different ecological pockets.

Those on the south side of the barrier are now exposed to powerful rip currents, irregular tides and a sandy, rock-strewn seabed; whereas those north of the barrier dwell in calm, hospitable surroundings which fulfill all requirements for supporting the growth of marine organisms, corals and algae pastures. Our imaginary shells, here, continue to thrive. But not those unfortunate enough to be trapped south of the barrier. Being unused to the push and pull of strong currents, many perish as they try in vain to maintain a firm foothold. But then, at some time, a genetic mutation arises in one of them. This is expressed in the form of a larger, more muscular foot, which helps to prevent the snails being washed away, leading, by way of natural selection, to favor a rise in the survival rate.

Alternately, of course, living specimens could develop muscular feet haphazardly by expending energy on maintaining a holdfast (like Lamarck's blacksmith who strengthened his arms by shaping horseshoes). But according to neo-Darwinism, their survival would always be a hit and miss affair, since acquired strong feet can never be passed on to their offspring unless genetically inherited from a chance mutation. So, did the mutation arise randomly or in response to a survival need? Before attempting to answer this, let's take another example of how the environment might have influenced the shape of an organism so that it might better withstand adverse conditions.

#### Defying the Storm

In coastal regions, exposed more or less continuously to strong winds and rough seas, free-swimming veligers of snails emerge from their egg capsules more robustly

designed than those which hatch in calm sheltered zones. Certain groups of marine snails which thrive along unusually stormy coasts, as in south Australia, for example, produce veliger offspring with velums or "wings" that are relatively larger and more densely ciliated than calm water species. These fortified features enable them to withstand better the turbulent environment until they sink to the seabed to begin searching for food. (Certain other gastropods, including cones, bypass the veliger stage altogether and hatch as living young complete with tiny adhesive feet). Now did genetic switches trigger random mutations that caused the velums to grow larger with more densely ciliated rims because of harsh environments or in spite of them? In other words, were these simply fortuitous, accidental mutations which just happened to aid survival under an oppressive environment, or was the impact of the environment somehow implicated in stimulating these mutational end-effects in response to a need? If not, then (like the giraffe's neck) it seems incredible, given the probability stakes, that chance alone should have accidentally hit upon several mutations almost in a row whose end-effects favored survival under identical environments:

- (a) Veliger velums change in size and numbers;
- (b) Veliger velums change shapes (long and thin, short and round);
- (c) Veliger velums become more densely ciliated.

Perhaps the strengthened velums arose from dormant genetic codes of ancestral mutant genes suppressed along redundant chromosome strands of DNA within cell nuclei of different genera until reactivated by regulator mechanisms, again in response to a need - in this case strong velums to combat turbulent conditions. Certainly, if regulator genes can release suppressed mutational codes in response to environmental needs, then they must have acquired the capacity to do so from the environment. Otherwise, the codes would remain masked, or else trip haphazardly by coincidence, providing veliger snails with reinforced velums which don't need them, as well as those which do.

Obviously, a reinforced foot or velum triggered by random mutations would be of no advantage to gastropods dwelling in the dominantly placid environment of a sheltered lagoon. So how does nature overcome this anomaly?

#### Transient Mutations

As mentioned in a previous essay, there is compelling evidence that adapted marine organisms given a new lease of life by natural selection in a turbulent, inhospitable marine environment would revert to their former states of 'normality' if the environment changed back again to previous placid lagoon-like shallows. This is part of a see-saw phenomenon that relates to the adaptive impact on

organisms of environmental changes linked to natural selection. Professor Michael Crawford and David Marsh describe it as 'plastic heredity' in their book, The Driving Force. This is a form of flexibility involving changes in genetic behavior and is recognized as working either through the suppression of genetic potential that might otherwise be expressed, or through the expression of genetic potential that might otherwise be suppressed.

So under stimulation from the reversed environment and natural selection the mutant gene potential for 'normality' (suppressed while rough conditions prevailed) would now be expressed again; whereas the genes coded for strong feet and reinforced veliger velums would once more be suppressed ... not permanently, but only until such time as the surroundings may change back to rough and ready turbulence. The inheritance of such pliable or flexible traits only lasts for as long as the environment remains stable, which could either be a relatively brief moment in time or run into millions of years. If the latter, then the transient trait to all intents and purposes would become a fixed or permanent genetic mutation. I would be interested to know how many such flexibly expressed mutations already exist.

## HAIRY LIFELINES

Since hair-like cilia exist in almost every living organism, from a single-celled *Euglena*, via molluscs, to humans (they are numerous in our gut, ears and other organs), they form one of nature's early evolutionary successes - a success that in many ways has been pioneered by molluscs. Cilia in molluscs generate water currents for breathing, trapping food and secreting waste-matter. Their structures, especially among bivalves, attain a peak of sophistication in hydro-mechanics that humans cannot even begin to emulate. Their filter feeding cilia systems are probably the most refined and efficient ever evolved in any aquatic animal group. Population densities of marine bivalves in tidal water is evidence enough of both their feeding and breeding proficiency; so vast are some mussel beds that they even show up on satellite photographs.

It is only one step forward - or is it backwards? - from cilia to flagella, which is a long whiplash vibrant variant, and also one of nature's classic means of motion and navigation for both primitive and sophisticated organisms, whether pulling the cell behind it or, in the case of sperm, pushing the cell before it. (It was Arthur Koestler who said that the purposiveness of all vital processes, the strategy of genes and the power of the exploratory drive in animal and man ... all seem to indicate that the pull of the future is as real as the push [pressure] of the past). Human spermatozoa would probably be unable to



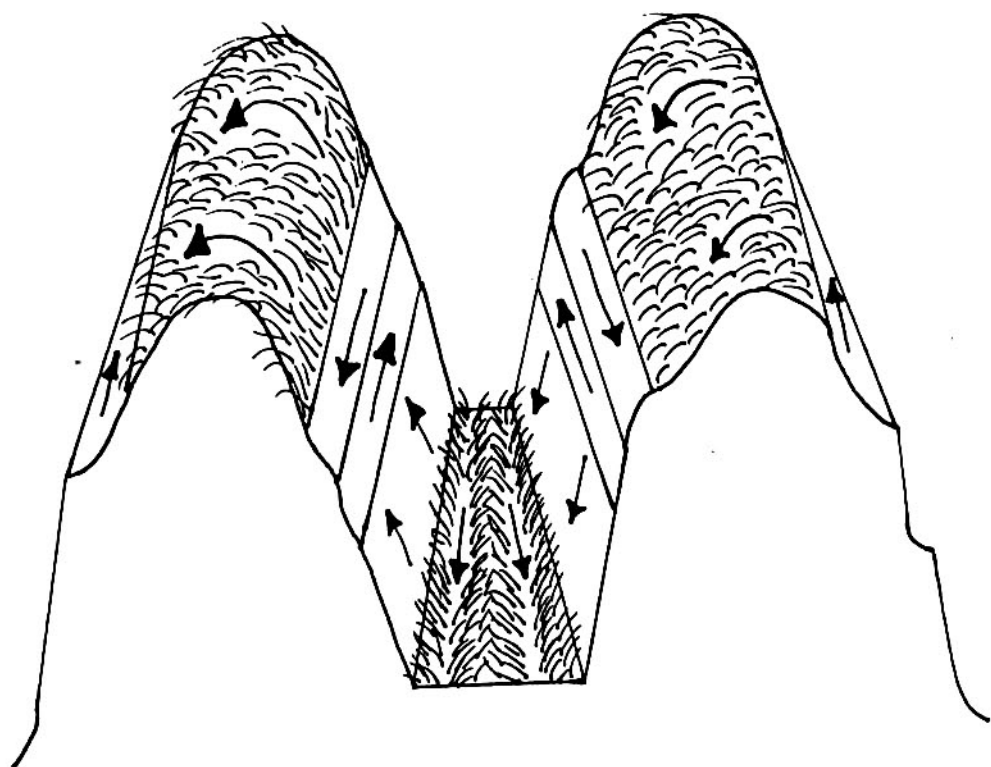


Fig. 10. This diagram illustrates a unique feature among molluscs in their use of finely-tuned cilia to separate nutrients from waste products and to sort food particles into grades or sizes - in some cases into as many as four or five different categories. Cilia beat larger particles across ridges of sorting surfaces and smaller ones along the grooves.

penetrate and fertilize a female egg without the forward energy exerted by its whiplike flagellate 'tail'. We are told that an army of common bacterium, *E. coli*, thrive in the human gut to help break down and expel waste products by means of a flagellum which actually rotates like a wheel - millions of years before innovative Man ever put his shoulder to one - and when necessary is even reversible if some particle of debris evades the suction of secretion. Propeller-like flagella of *E. coli*, or variants of them, no doubt pummel debris into easily expelled waste products from the gut of numerous organisms besides human ones. They may be less sophisticated in the stomach of molluscs, although they serve the same function. Yet curiously, all flagella and cilia have a specific morphological pattern: highly magnified cross-sections (x 60,000 or more) reveal nine pairs of linked fibrils neatly deployed in a circle around an unlinked paired core, the complete set enclosed in a wavy membrane sheath.

What is more, cilia and flagella never seem to have evolved. There is no sign anywhere of modified or intermediate stages in the development of their standard 9 plus 2 pattern of inner filaments. They are today what they must have been when life first appeared on earth in the form of flagellated cyanobacteria, called spirochetes,

which dominated the earth about 2500 million years ago. How, therefore, in Darwinian terms of evolution can we account for the initial appearance of such stabilized and proven structures of good design? Stranger still is the way natural selection under the impact of environmental nuances has, on the one hand, modified cilia or flagella into beneficial life-sustaining photosynthetic, filtration and gut processes; yet on the other, into components of life-destroying structures within the cnidoblasts of stinging nematocysts attached to the trailing arms of jellyfish or to the filaments of aeolid nudibranchs. Nevertheless, the measure of cilia and flagella versatility is probably best exemplified by the way they aid vision in association with rods and cones behind the retina of eyes, be they relatively simple molluscan organs of sight, or highly complex human ones.

Microscopic cilia and flagella clearly pursue, by whatever means available, the Darwinian aim of ensuring the reproduction, survival and perpetuation of the particular organism to which they are attached. Since both devices aid survival in one way or another, can we say that the force behind the energy which activates them is subject entirely to uncontrolled Darwinian chance? If so, then why are cilia, whether in the gut of mammals or the gill of bivalve molluscs, critically selective in absorbing

nutritious particles and expelling debris? And why should flagella tend to steer organisms towards, instead of away from, nutritional or sexually reproductive targets, even assuming that any motivation behind the force may be nothing more radical than the natural twin drive to assuage hunger and savor sex?

Certainly, without one or the other, evolution - whether of molluscs or us - would probably have stopped short even before the emergence of single-celled amoebas. Without either, it might never have got off the ground at all.

## DENTAL DIGITS

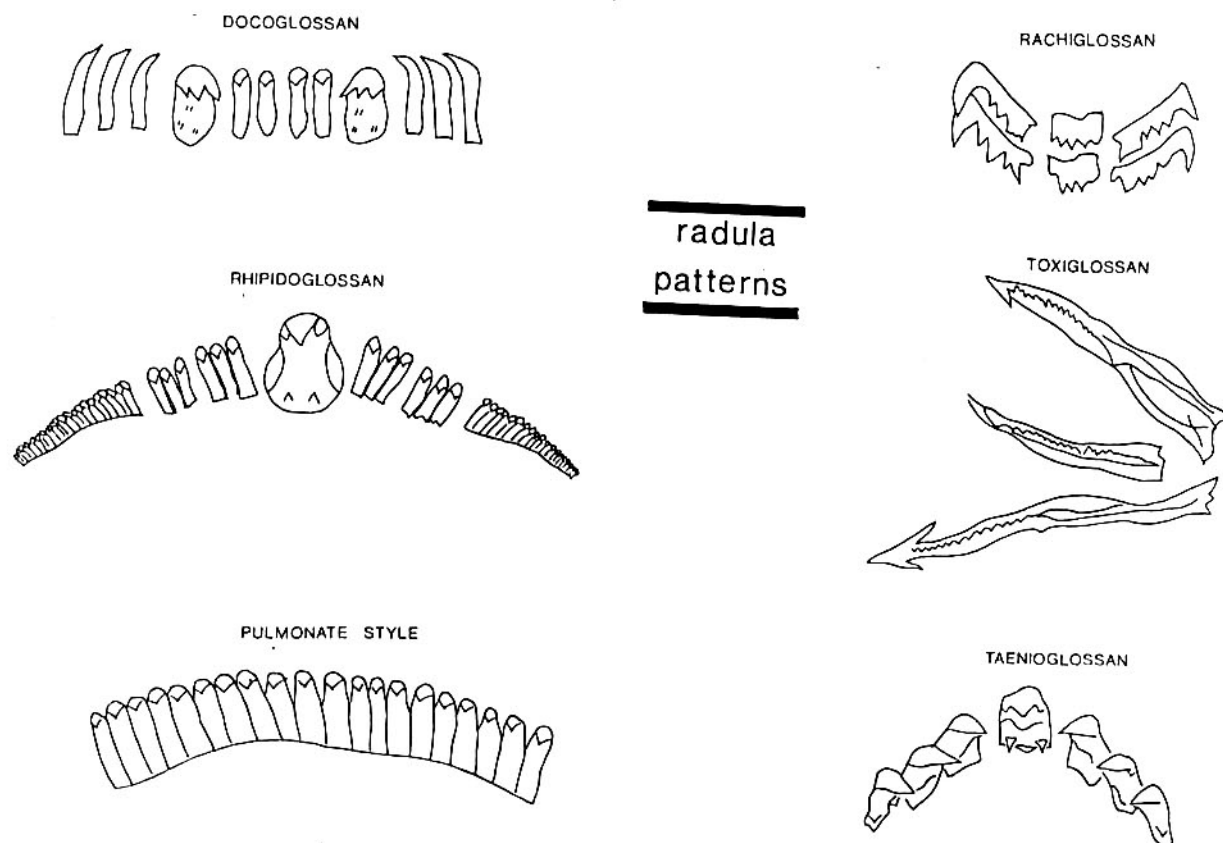


Fig. 11. Diagram of radula patterns which are unique to molluscs. They can be very complex and varied between different genera and species. Illustrated here are six different forms and arrangements of radula teeth geometry used by gastropods. Each one is tailored to suit the snail's specific feeding habits.

Imagine chewing a T-bone steak with a mouthful of 600 teeth instead of our modest human arrangement of molars, canines and incisors. It would be a nightmare for all of us - and one for the dentist, too! This is not the case with snails, however, which use hundreds of barbed scythe-shaped teeth for feeding. These are mounted on a chitinous muscular membrane or 'tongue' which forms a file-like device called a radula ribbon, unique to the molluscan phylum. The shape and deployment of teeth between families, genera and species differ widely and often aid identification. Some are astonishingly complex,

with geometrical structures adapted to a detritus diet; others are strictly herbivorous feeders and possess radulas which are spread over the surface of their 'tongues'; while at least three families attack their prey with venomous harpoons or darts.

Gastropod radulas are by far the most diverse and may carry from one tooth per five or ten transverse rows up to as many as 200 spread across 600 or more rows. More than 200,000 teeth are mounted in precise formations on a single radula of some herbivorous land snails. Adjacent



Fig. 12. The taenioglossan radulas of cowries are always confined to seven teeth in each row: a central cusp flanked by a lateral tooth beside which are marginal teeth. Those seen here are dissected from a rare Bubble Cowrie (*C. cruckshanki*) X160.

to a central tooth or median - sometimes absent - laterals and marginals are deployed, each set specifically shaped for serving different functions like scraping, spooning and chewing.

#### Wear and Tear

Six types of radula teeth are found in gastropod molluscs. They range from the most primitive, crowded rhipidoglossan pattern to the highly specialized toxiglossan tooth which is a venomous harpoon exclusive to cone shells (probably around 500 species), and poisoned darts unique to other families (turrid and auger shells). In between are other patterns, probably the most common among gastropod prosobranchs being the taenioglossan radula which is always confined to seven teeth in each row: a median with defined cusps, and a lateral tooth on each side which in turn are flanked by two marginals. For example, all 180 or so species of detritus-feeding cowries grow seven teeth per row - no more no less, while the number of rows may vary, the teeth count per row never alters. The question is, do the genetic switches regulating taenioglossan and other tooth patterns throughout different families of shells trip at precise tooth-counts by accident or design?

Radulas function by means of a complex set of muscles and cartilage tissues upon which the radula file is mounted, with the teeth facing rearwards. Muscle activate the tongue in a series of rhythmic strokes rather like the

piston of a reciprocating engine - up, down, forwards and backwards - the critical position depending upon the angles between the proboscis and the facing surface bearing nutritional material. A crucial notch protrudes from the base of radula teeth to provide support for rows in front and behind as they scrape material off food-bearing surfaces. Otherwise they would collapse in disarray.

It's remarkable how natural technology reinforces the unique teeth of molluscs with substantial amounts of silicon mixed with horny chitinous material - the same mineral which today is modified by human technocrats as chips to drive computers and much other paraphernalia of modern electronics. Moreover, the purpose of using silicon, whether monitored by nature or humankind is identical: to utilize the sturdy properties of a mineral which has a hardness factor approaching that of a diamond. As for families of limpets and chitons (coat-of-mail shells), nature takes another step to further reinforce their radula teeth with black iron oxide in the form of magnetite, presumably because of the extra hard granite-like rock surfaces off which they scrape algae in their splash-zone shore habitats. Even so, despite these reinforcing materials, front teeth wear out almost daily and their blunted stumps drop off into the gut. Yet, incredibly, up to five new ones form, also daily, in the radula sac and move forward on the radula rather like replacement parts on an assembly line (how about that for fast regeneration!). The bio-mechanics of such rapid precision in tooth

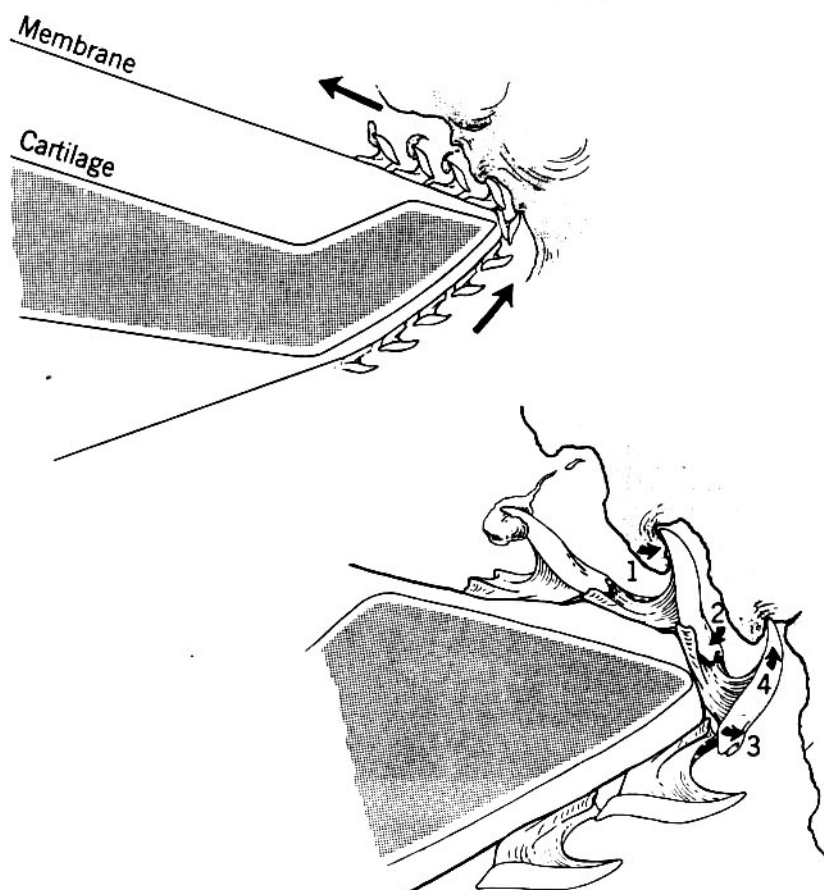


Fig. 13. Diagrams showing how a ridged plate located on the base of most radula teeth overlap to form an interlocking support system as the snail scrapes surfaces for food. (After Carole Christmanin in *The Shellmakers* by Alan Solem, 1974).

formation are not fully understood. However, there would seem to be a valid link somewhere between the only remotely comparable present-day trait in the lifetime of humans involving the replacement of baby milk teeth. These are pushed out by the once-and-for-all embedded adult molars which can only then ever be replaced by false ones as they rot and erode painfully away over the years of our momentary lifespan ... surely a less satisfactory survival force, still operating today after hundreds of millions of years, to forge the snail's tiny radula tooth. Human teeth may be more adaptable in the sense that they emerge as an all-embracing set of omnivorous munchers, but molluscan radulas are almost as flexible and certainly more varied insofar as they are adapted to different styles of feeding and types of diet.

### Harpoon

As for the harpoon radulas of cone shells, their designs are masterpieces of ingenuity - far more so than the crude equivalent, first carved out of reindeer horn by neanderthal hunters some 50,000 years ago during the last ice age. Then *Homo sapiens* was at the peak of his inventive prowess and left behind for posterity exquisite paintings of 30,000 year-old hunting scenes still visible on the walls of

caves in southern France. Although these may well have heralded our transition from biological to cultural evolution, nature certainly seems to have stolen a long march on our skills as craftsmen of weaponry millions of years before, with a far more sophisticated harpoon. These harpoons are hollow and stored in the pouch or 'quiver' linked to the snail's proboscis. The cone snail's harpoon is derived from conventional radulas, and two other families of marine gastropods carry similar weapons, though much more primitive (Turrid shells and Auger shells).

The barbs of cone shells are functionally adapted to best suit the kind of prey on which the snails feed: fish (piscivores style), worms (vermivores style) and molluscs (molluscivores style). So each harpoon has its own characteristics. More remarkable is the hollow tube within the shaft of these harpoons. It is filled with a neuro-toxin, so lethal in some species that quite a few people have died after being stung by a mature snail. Several species of cones are known to be particularly venomous and widespread. Two are *Conus geographus* and *Conus textile*. (Their shells are ornamented with insidiously attractive color motifs, and both inhabit shallow, sandy areas in the tropics, usually under rocks or coral slabs.)



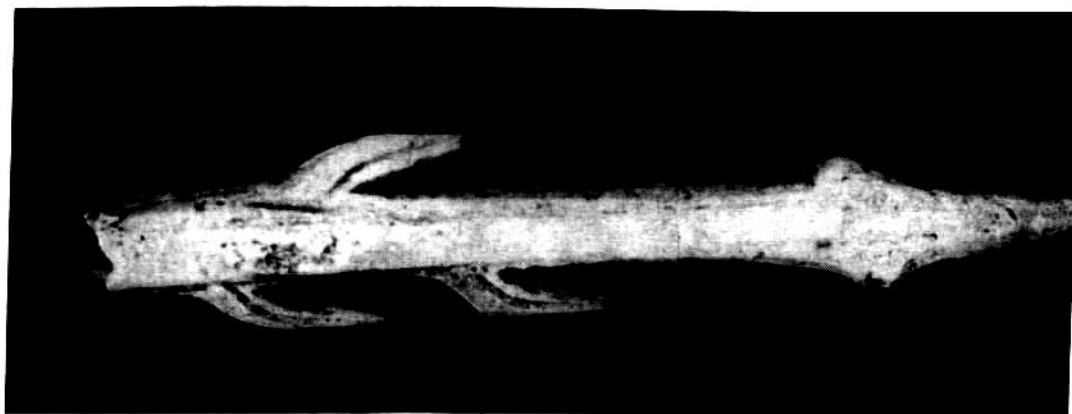


Fig. 14. The first harpoon ever used by Man was like this one, carved from reindeer horn by Magdalenian hunters of southern Europe some 15,000 years ago. (Courtesy Ashmolean Museum).

Why were the harpoons fashioned by early human hunters relatively crude and primitive compared to these refined, streamlined weapons? (It wasn't until those great whale hunts of the 1860's that we produced a harpoon remotely compatible with that of nature's unique device.) Our human scale of observation precludes us from attributing to cone shells, equipped with only a rudimentary form of brain, the intellectual foresight to devise, design, assemble and operate its own defensive mechanism. Perhaps it could be partly explained by a form of inherited instinct with its innate propensity to impel animals without any conscious purpose into patterns of meaningful behavior.

#### A Brainwave

Certainly, our intelligence differs from instinct insofar as it is equated with conscious awareness. But in the last analysis, the intelligence which evolved and operated the cone shell's sophisticated harpoon radula system seems no less inferior to that of our talented ancestors who were able to paint elegant hunting scenes on cave walls, (though apparently unable to design a streamlined harpoon). But such molluscan intellectualism must have emanated from sources unrelated to any brain as we know it. This may suggest, as Holmar Ditforth does in his book Origins of Life, that the genius of creative, expressive nature is able to function as a mind without a brain. Perhaps we should think about that ... with our brains.

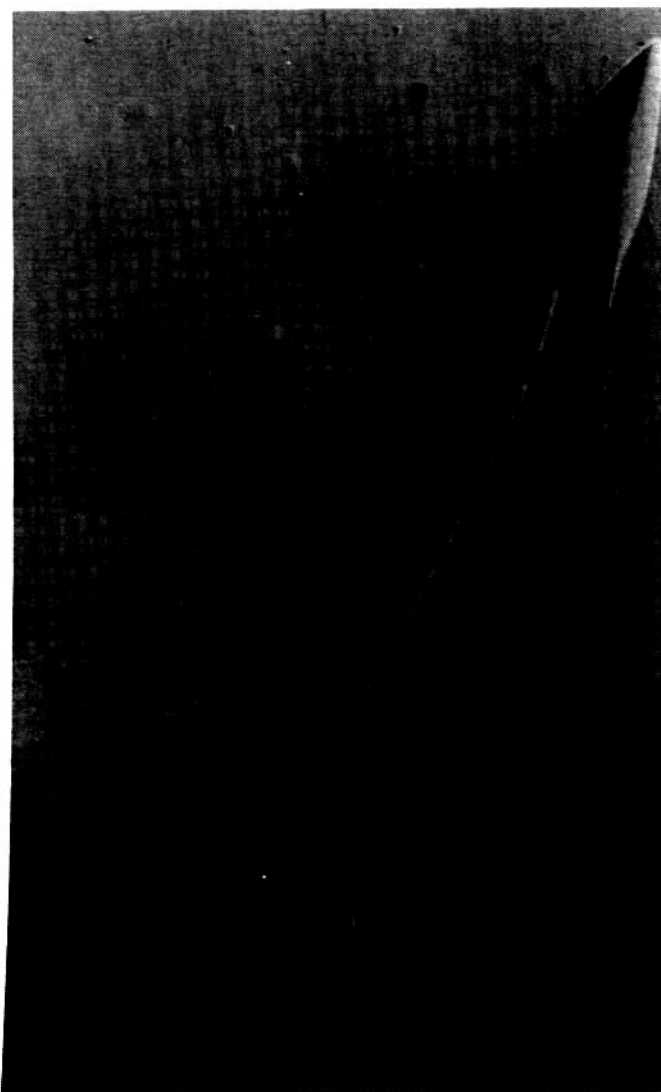


Fig. 15. 'Harpoon' radulas of cone shells are modelled upon the feeding habits of different species. Above (15a) fisheaters, piscivorous style (*Conus achatinus*) X100

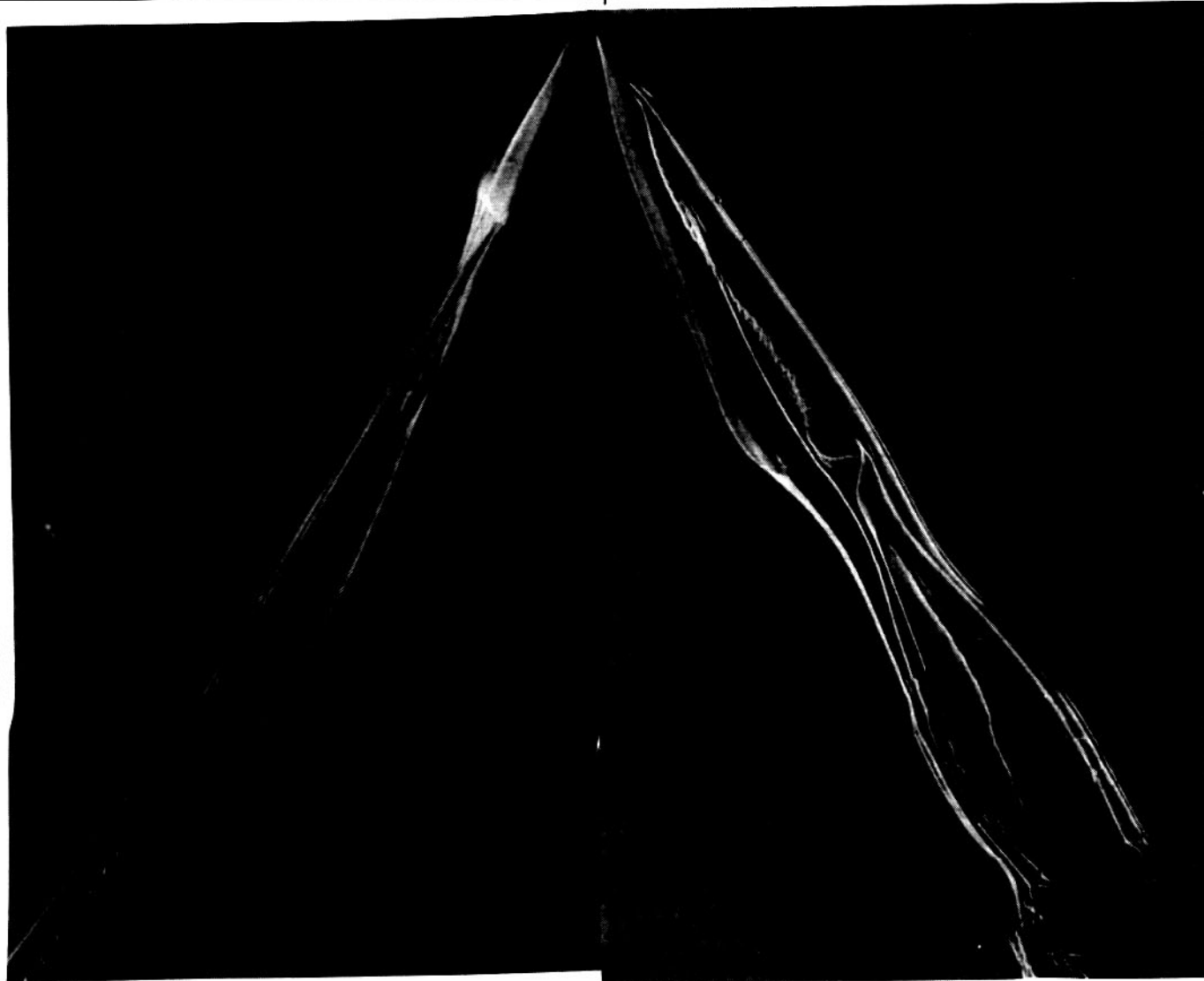


Fig. 15b. worm-eaters, vermivorous style (*Conus marmoreus*) X250

Fig. 15c. mollusc-eaters, molluscivorous style (*Conus coronatus*) X320

## WHY MANTLES MATTER

The sculpture and color patterns of shells mirror the development and behavior of certain cells which, among gastropods, are gathered inside a thin tenuous membrane known as the mantle. It is a unique organ with astonishing properties and provide a link between outer visible shell morphology and inward 'invisible' crystal patterns. It is really a fleshy extension of the snail's foot, known as the mantle lobe, which deposits calcium carbonate in the form of calcite or aragonite, as well as pigments, along the exterior lip of the growing shell. Among glossy shells like cowries and olives the snail's mantle either cover the whole of the shell's exterior or divides into two lobes which when expanded, meet at the apex of the dorsum. The movement of the mantle is what gives a gloss to the surface.

Inner cells may be segregated in zones or spread along the edges; many may act together, some independently with rhythms of their own, and others sporadically. For example, certain groups of pigment cells function in regular cycles to produce blotching effects. If they lag behind cells producing calcium carbonate, then zones of paler color tend to ornament the shell; when they outpace them, darker patched form; of adjacent blocks of calcium and pigment cells keep pace with each other they evoke well defined bands. Sometimes mantle pigment cells are grouped in arrow-like formations and yield 'V'-shaped or tented motifs, as in many species of cone shells. Occasionally, some curious illusions emerge which resemble mountain ranges in the idiom of classical Chinese landscape paintings.



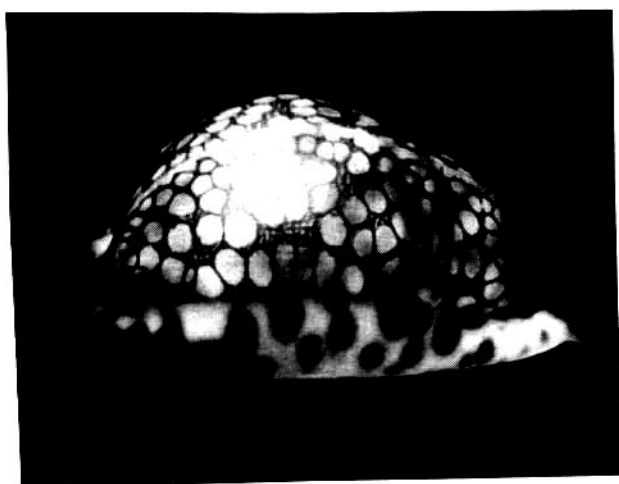


Fig. 16. Patterns that are printed and stained on shells sometimes give a truncated appearance. Since the base margins are often thickened and calloused, the effect confuses and probably serves as camouflage, as shown by this *Cypraea histrio* cowry from East Africa. The sharply defined dorsal color motifs are printed.

### Modes and Codes

When, within mantle cells, different teams of structural or pigment-coded genes maintain the same direction of activity and are switched on and off by genetic 'switches' at regular intervals during growth, the style and pattern of shells are simply repeated as each successive whorl increases in size until maturity is reached. Murex, augur, terebra and wentletrap (Epitonidae) shells are among striking examples of this rhythmic pattern. A major shift in direction and rhythm of structural 'shell-programmed' genes occurs when spirally coiled juvenile shells, often with a wide aperture, lengthen and thicken. Another switch in the structural steering mechanism probably takes place when rows of ribs or teeth start to form along inner or outer lips of shell apertures. While this is taking place another set of coded genes programmed towards forming the operculum is activated. Meanwhile, a siphonal notch, fusing into a long or short anterior canal, almost certainly represents another substantial phase change, especially prominent in the Tibia and Turrid families of shells.

### Split Images

When cowries and some related families approach maturity, both pigment and structural-coded genes seem to be steered along paths which transform the final appearance of their shells in a way that tends to thicken and truncate them into two segments, so that the patterns of their dorsums clash with motifs on their margins. What is more, these margins are invariably stained with pigment, not printed like most of those ornamenting their dorsums.

Staining occurs when pigment mixes with calcium secretions before both are deposited, virtually simultaneously, as layers of enamel and pigment. Direct printing arises when the pigment cells act independently, depositing gene-coded patterns directly onto outer surface layers of the shell. Stains are in depth, printed motifs are not. This is why printed patterns are usually sharply and clearly defined on outer surfaces. Ornamented stains, on the other hand, have a rather smudged appearance because stains repeatedly superimposed by cells between successive layers of enamel are usually a little off-center. This results in a fainter, unfocused shadow effect. In most shells some of the patterns are printed and others stained.

Other specialized cells within mantle tissues deposit an organic matrix compound of protein substances known as conchiolin, which helps bind crystals together rather like cement between bricks. Indeed, the bonding properties of the 'brick-and-mortar' layers of organic substances combine with the micro-crystals to form exceptionally fracture-resistant shells. Abalones are a case in point. Another substance, periostracum, is discharged from a small groove in the mantle of many snails and deposited on the exterior of the shell where it hardens into a fibrous brown protein. This has the dual function of camouflaging the shell in its surroundings and protecting it from corrosion. The horny operculum or trapdoor of many snails is also made of conchiolin.

Another useful function inherent in the mantle is to carry out prompt repairs to any damage the shell might sustain. Whether such emergency measures involve the same blastomere cells associated with tissue regeneration is unclear. Although repairs are robust they often tend to be rather rough and ready as if restoration cells have over-compensated for the original damage which, of course, may be spontaneously intentional as an extra precaution against future cracks or breakages.

### Taking the Strain

As for the remarkable crystalline building blocks of shells, these can only be revealed by examining cross-sections under high magnification. The geometric framework of crystal formations is similar among most shells of the carbonate. These are in the form of cubic/rhomboid crystals of calcite and ortho-rhombic forms of aragonite near the inner peripheries, laminations towards the center and pillars of ribbed structures near the outer edges. Many conform to a pattern called by crystallographers crossed-lamellar structures (see essay "Seeking Clues from Clays" *Of Sea and Shore* 21:1:39).

Most structural designs, as well as color patterns, appear to be shared by different families, genera and species. Such motifs are not really surprising given that many snails and their shell characters are allied to different

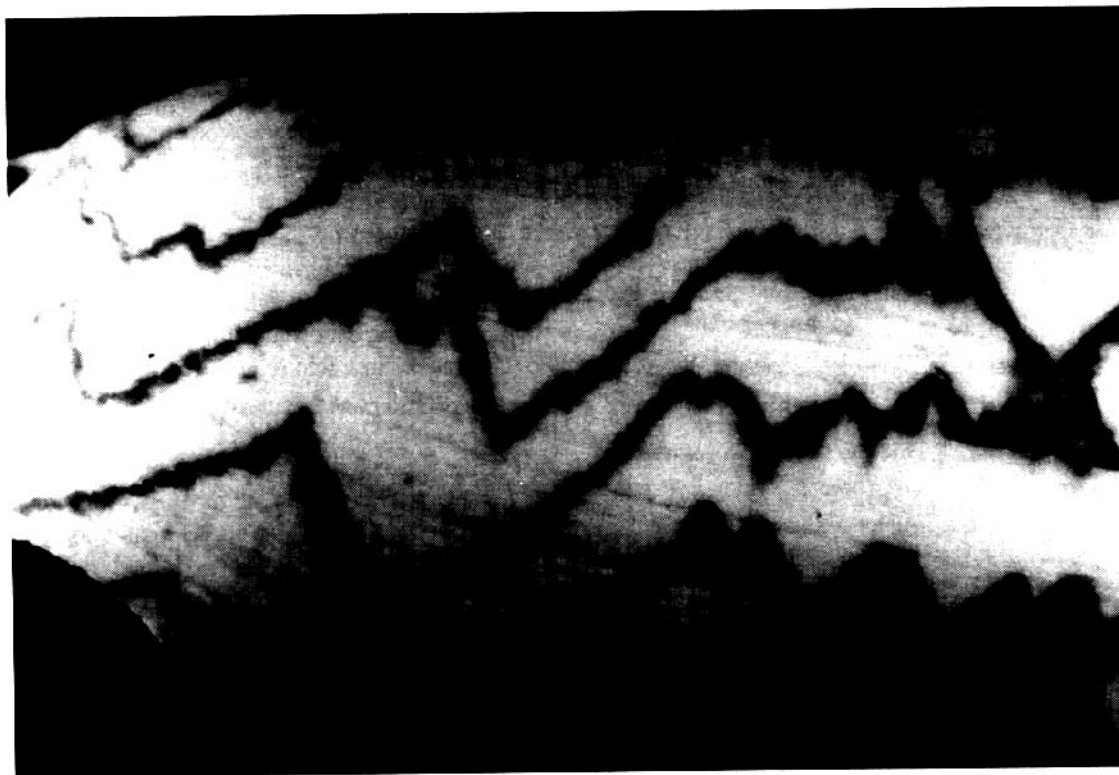


Fig. 17. These color patterns on the surface of *Conus nobilis* give a 3-D impression of mountain ranges in the Chinese idiom.

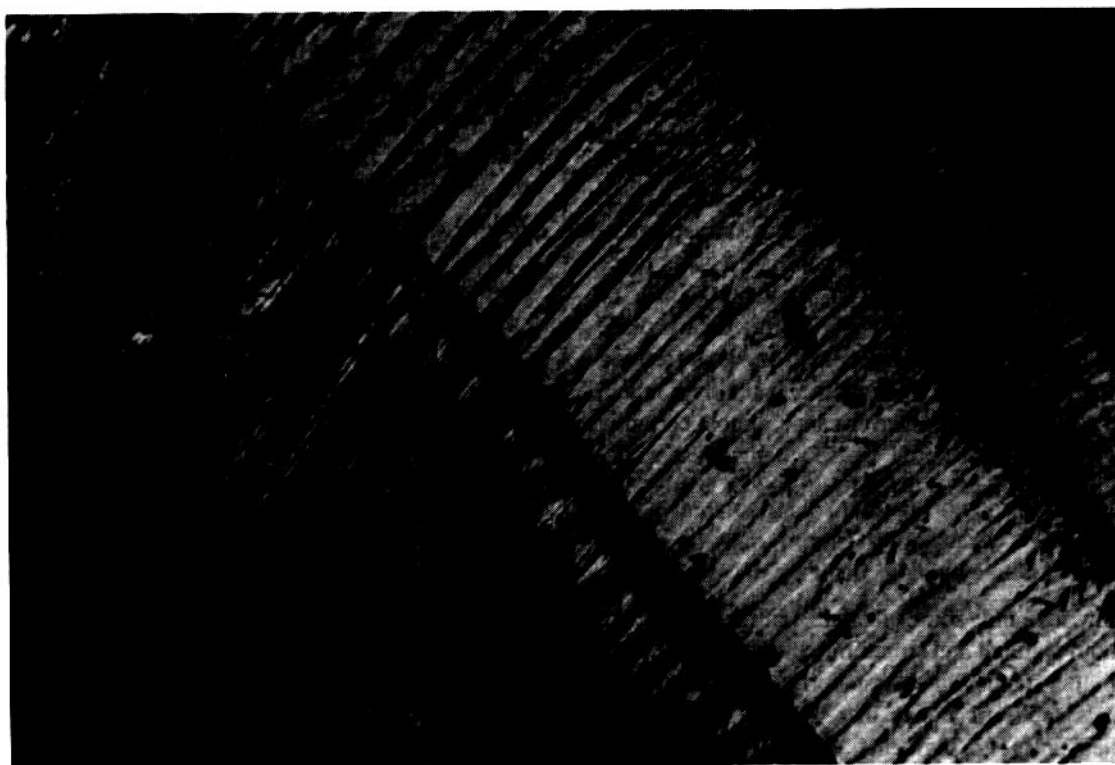


Fig. 18. Seen here is a cut-away section of a cowrie shell magnified 40 times under polarized light to show typical crystal formations: top outer periphery, simple non-prismatic columns; center, crossed lamellar structures of prismatic layers and, bottom, inner periphery, homogeneous layers of small granular crystals.

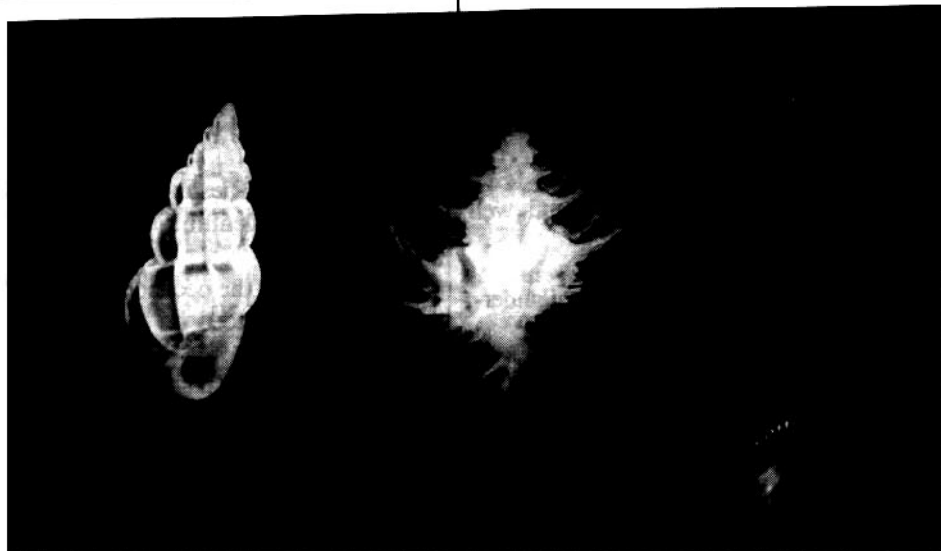


Fig. 19. Structural programmed teams of genes are responsible for repeating shapes and color patterns of shells. If 'switched' on and off at regular intervals successive whorls are simply repeated as shells grow. Here are some striking examples of shell families that show this uniform sculpturing. (Left to right: Epitoniidae, Muricidae and Terebridae).

medleys of common genetic themes, some expressed as major inherited traits, others as semi-adapted ones related to environment. With genetic time switches probably able to orchestrate all the existing colors and patterns of shells, these similarities are possibly visible examples of inherited traits in one species spilling over, at different places and at different times, into others. Likewise, genes may also be able to help orchestrate shapes of shells, but they cannot have any role in the evolutionary cause of their physiological forms.

We must therefore look elsewhere for an answer to this unsolved dilemma of the origins from which innate shapes and forms arose, whether organic body plans of molluscs or the dominantly inorganic shapes of their crystallized shells. The genetic code in DNA molecules seem irrelevant since it is confined to programming only the sequence of amino-acid proteins. SO how can uniform crystal patterns and their geometrical building blocks produced by cross-lamellar structures be transformed into countless morphological expressions ultimately embodied in the architecture of a shell's ornate appearance? Perhaps the inheritance of morphic fields associated with physical or chemical reactions linked to progressions of habit and memory are a part of a valid explanation. In any event nature seems to have pre-empted human intellectualism long before the advent of modern technical printing methods since these merely mirror in a more refined way those basic offset techniques which many snails have already been imparting to the exterior of their shells for millions of years.

As for snails being designers of their own shells, they were practicing architects long before the Christopher Wrens and Lloyd Wrights of this world knew one end of a set square from another. Lloyd Wright, incidentally, was as great admirer of shells, describing them as 'houses' of inspired design and form.

Continued from page 231

**Feb. 6-11, 2000. 4th International Abalone Symposium.** Cape Town, South Africa. Peter Cook or Ken Findlay, Centre for Marine Studies, University of Cape Town, Private Bag, Rondebosch 7701, Cape Town, South Africa; phone: +27-21-650 3631; fax: +27-21-6503283; email: [ema@physci.uct.ac.za](mailto:ema@physci.uct.ac.za)

**Nov. 20-25, 2000 5th International Aquarium Congress Monaco**  
Dr. Nadia Ounals; Musée océanographique, MC 98000 Monaco. Phone: 377 93 153 600; Fax: 377 93505297. e-mail: [la2000monaco@meditnet.com](mailto:la2000monaco@meditnet.com)

**Dec. 4-8, 2000. Molluscs 2000 Sydney, Australia**  
"Understanding Molluscan Biodiversity in our Region Into the 21st Century". Convenors: Dr. Winston Ponder, Dept. Malacology, Australian Museum, 6 College St., Sydney 2000, Tel: (02) 9320 6120; Fax: (02) 9320 6050; e-mail: [winstonp@amsg.austmus.gov.au](mailto:winstonp@amsg.austmus.gov.au)  
and Dr. Gee Chapman, Institute of Marine Ecology, University of Sydney, Sydney, NSW 2006; Tel: (02) 9351 4778; Fax: (02) 9351 6713; e-mail: [gee@bio.usyd.edu.au](mailto:gee@bio.usyd.edu.au)

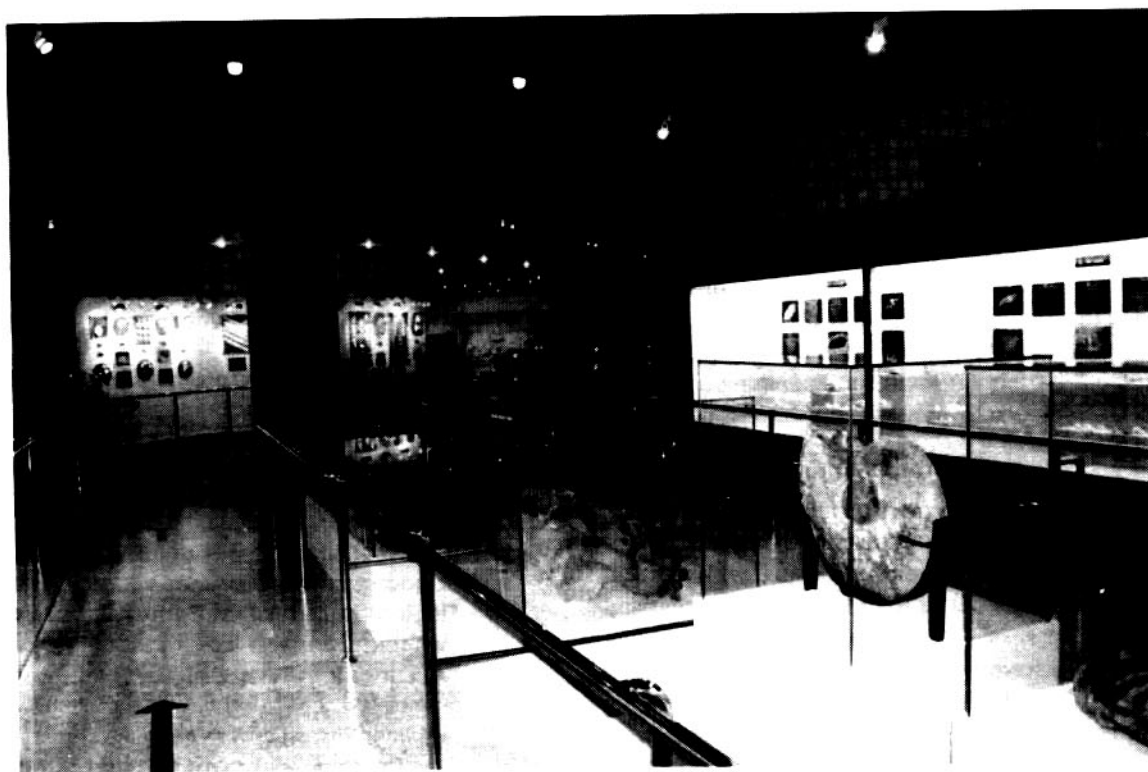
Information from various sources. Including: Donald Dan, Conchologists of America Award Chairman; 6704 Overlook Dr.; Fort Myers, FL 33919.

**FIND SOME HIDDEN SHELLS****by Betty Hamann**

(Example: the broken table leg was clamed and well glued.)

1. The hen ruled the roost while the cock led a philandering life.
2. My itinerary includes L.A., Beijing, Leningrad and London.
3. My goodness, her majesty's slip perchance is showing?
4. Martha and Rachel met their boyfriends at the mall.
5. Hey bub, blended whiskey is your problem!
6. Her wedding dress was trimmed with ribbon, net, applique aand embroidery.
7. The boys terrified the girls during recess.
8. Kermit erased the blackboard for his teacher.
9. In Moscow Riesling was seldom found, though vodka was plentiful.
10. He studied the decision pro and con, changed his mind and vetoed it.
11. There was no panic. One by one they filed out.
12. The winner, I tell you, was jubilant.
13. The deaf Bantu lipread the missionary's sermon.
14. Frankly, Carl, I'm petrified.
15. P. J. Dames co-authored the book with W. H. Elkinson.
16. The lab technicians used petri, tongs, tweezers and scalpel.

(answers on page 220)



Another gallery in the fantastic Phuket (Thailand) Shell Museum - read about our visit there in our next issue.



**SHELL-RELATED WEB LIST****Tom Eichhorst**

Here are some shell related sites I have bookmarked. The list is by no means exhaustive and is only up to date as of this second — oops, you missed it! It is already out of date. Web pages are not permanent and they are not checked for accuracy. You may find a site you really like only to have it disappear as the owner gets bored, tired, dead or whatever. You also have to carefully watch for web page accuracy. There is no governing body (thank goodness) that checks these pages for accuracy. You will find most of these sites with great images and super data. You will also find some with misidentified shells or poor data. Thankfully most sites are here because the site owner has a passion for his or her subject and wants to share. This means the typical error is unintentional. For instance, one site showed a "Triton Trumpet, used as a trumpet in the South Pacific." The shell shown is a *Charonia variegata* from the Atlantic and it is identified as a *Cymatium nobilis*. The majority of shell related pages range from actually pretty good to some that are great. I have found only a couple that had nothing really to offer of value (in my eyes) - these sites are not here. Sadly, there are also some excellent sites missing because I could not get the link to work correctly.

Now for the disclaimer. If I missed your site or a site you like, I apologize. Let me know and I will gladly update my list. I make no claims as to the accuracy of this list. When I drew it up, all the links worked. However, at least one in ten of my bookmarked sites did not work when I was checking them to complete this list. The site had been withdrawn or I had a bad bookmark. Also, I do not make any claim as to the reputation of anyone associated with a particular web page.

So here you have it, mistakes, oversights, misspellings and all. Oh, one more thing, the asterisk symbol (\*) indicates a site with a lot of images.

Send your suggestions, deletions, additions, etc. to the list to Tom Eichhorst, [thomas@Rt66.com](mailto:thomas@Rt66.com) or to 4528 Quartz Dr. NE, Rio Rancho, NM 87124. Or to Tom Rice at [ofseashr@sinclair.net](mailto:ofseashr@sinclair.net) or to the Of Sea and Shore webmaster at [ofseaandshore.com](mailto:ofseaandshore.com)

**BOOK DEALERS**

**Amazon.Com** (mail order books)  
<http://www.amazon.com/exec/obidos/subst/dex2.html/002-4628858-9230468>

**Barnes and Noble Books**  
<http://www.barnesandnoble.com/>

**Capricornia Publications** (Australia, new and used natural history books)  
<http://www.capricornia.com/>

**Mal de Mer Enterprises** (inprint shell books)  
[maldemer@compuserv.com](mailto:maldemer@compuserv.com)

**Naturama** (Italy) (shell & natural history books)  
<http://www.dada.net/naturama/>

**SHELL DEALERS**

Editor's Note: see advertisements in this issue. Listing of dealers is on <http://www.ofseaandshore.com>

**FRESHWATER**

**Apple Snails** (everything you ever wanted to know; images; links)  
<http://huizen.dds.nl/~snc/index.htm>

**Aquatic Mollusks of North Dakota** (field guide on the web, images, maps, discussion)  
<http://www.npwrc.usgs.gov/resource/distr/invert/mollusks/mollusks/htm>

**Endangered Freshwater Molluscs** (images and data)  
<http://eelink.net/EndSpp/ESimages/ESmollusks.html>

**Illinois Natural History Survey** (87% freshwater, 13% terrestrial)  
<http://www.inhs.uiuc.edu/cbd/collections/mollusk.html>

**Michigan Shells** (freshwater bivalves, gastropods and land snails, nice images)  
<http://gopher.science.wayne.edu/animals/mollusc/>

**Unio Gallery** (SW Missouri State Univ. - info and images on life of freshwater mussels)  
<http://www.smsu.edu/mcb095f/gallery/>

**GENERAL**

**American Fisheries Society** (professional org., articles, links, laws, employment)  
<http://www.fisheries.org/>

**Biosis** - Internet Resource Guide for Zoology (UK) (searchable list of publications)  
<http://www.york.biosis.org/zrdocs/desktop/journals.htm>

**Center for Biodiversity** (information on different species and research projects)

[http://www.inhs.edu:80/cbd/main/cbd\\_home.html](http://www.inhs.edu:80/cbd/main/cbd_home.html)

**Checklist of European Marine Mollusca**

<http://www.mnhn.fr/base/malac.html>

**C.I.T.E.S.** (worldwide endangered list/regulations/agreements)

<http://www.wcmc.org.uk/cites/english/index.html>

**C.O.A. Conch-L Archive**

<http://museum.nhm.uga.edu/CONCH-L/CONCH-Larchive.html>

**Coastal Aquaculture** (commercial giant clam growing projects)

<http://www.cgiar.org/CLARM/resprg/casep.htm>

**Conch-L Rules**

<http://museum.nhm.uga.edu/CONCH-L/CONCH-Lrules.html>

**EBAY Auction** (on line auction for anything, use key words like seashell to search)

<http://www.ebay.com/>

**Euro Brach Net** (information, references, links on brachiopods)

<http://www.com.univ-mrs.fr/EuroBrachNet/>

**Fossil Shell Images** (under construction, images of Texas and Alabama fossil shells)

<http://www.physics.uiowa.edu/~cnewsom/fossils/Oysters/>

**Florida Caribbean Science Center (USGS)** (lots of data on research programs)

<http://www.nfrcg.gov/>

**Hawaiian Library** (general information on some Hawaiian marine life)

<http://www.mic.hawaii.edu/aquarium/lib.htm>

**Intertidal Estuarine Subsystem (USA)** (ecology of intertidal area)

<http://www.csc.noaa.gov/otter/htmls/ecosys/ecology/intbeach.htm>

**Invertebrate Identification Keys** (I.D. keys for many common marine invertebrates)

<http://www.mbl.edu/html/KEYS/INVERTS/contents.html>

**Molluscan Pictures** (Chan Sow-Yan) (images of sea and land shells, area maps of Singapore)

<http://home1.pacific.net.sg/~chansy/>

**Molluscs Image Links** (Steve Hilliard, USA) (links to sites with shell images)

<http://habanero.cb.uga.edu/GSC/images.html>

**Molluscs Net** (Bret Raines) (images, links, chat rooms, etc)

<http://www.molluscs.net/>

**Natural History Auction** (museum type fossils, minerals, etc. for auction)

<http://NaturalHistoryAuction.com/>

**New Zealand Mollusca** (Andrew M. Spurgeon, NZ) (checklist for species, links, images)

<http://homepages.ihug.co.nz/~andrewms/flist.htm>

**North Carolina Sea Shells** (info on N.C. and some shell images)

<http://ils.unc.edu/~bucks/shells.html>

**Oak Ridge Nat. Lab. Environmental Sciences Div.** (USA)(lots of projects on ecology)

<http://www.esd.ornl.gov/>

**Of Sea and Shore** (Tom Rice, USA) (publications, shells, images, links)

<http://www.ofseaandshore.com>

**Raising Snails** (Rebecca Thompson & Sheldon Cheney, USA)(grow and eat your own collection)

[http://www.nal.usda.gov/afsic/AFSIC\\_pubs/srb96-05.htm](http://www.nal.usda.gov/afsic/AFSIC_pubs/srb96-05.htm)

**Sea Shells of Southwest Florida** (mostly tourist info, but slanted toward shell collectors)

<http://www.news-press.com/seashells/index.htm>

**Shells from 100' Dredging** (Ross Gunderson) (images of seldom seen shells)

<http://www.uwp.edu/academic/biology/dredge/100list.htm>

**Systematic Research Collections** (Recent & Fossil Mollusca)

<http://www.inhs.uiuc.edu/cbd/collections/mollusk.html>

**The Tree of Life** (Univ. Arizona) (project to list all life)

<http://phylogeny.arizona.edu/tree/phylogeny.html>

**Type Catalog for Molluscs** (Smithsonian) (under construction, will list all name types in collection)

<http://www.nmnh.si.edu/gopher-menus/TypeCatalogueofRecentMollusks.html>



**Underwater World** (Mall of America, Minnesota) (public aquarium stuff)

<http://www.underwater.com/general.html>

**United States Fish & Wildlife Service** (general stuff)

<http://www.fws.gov/>

**U.S.G.S. Nonindigenous Aquatic Mollusks** (search by area of U.S. for list of alien molluscs)

<http://nas.nfmg.gov/cgi-bin/nas/molluskshuc2>

**Zoological Record, Taxon and Reference List**

<http://www.york.biosis.org/zrdocs/zrprod/zoorec.htm>

### INDIVIDUAL WEB SITES

**Angelo's Corner** (shell exchange and extensive book list)

<http://www.fortunecity.com/greenfield/shell/195/eng-home.htm>

**Australian Microshells** (Patty Jansen) (images and discussion of micro, and some larger shells)

<http://www.ozemail.com.au/~fileject/>

**Deborah Wills Homepage** (Alabama shell information)

<http://fly.hiwaay.net/~dwills/>

**Eddie Hardy's Guide to Marine Gastropods** (thousands of images, references, searchable)

[http://www.gastropods.com/shell\\_pages/index.html](http://www.gastropods.com/shell_pages/index.html)

**Eric Faust - Seashells (USA)** (a few nice Cypraea images)

<http://www.inetworld.net/ericf/seashells.htm>

**Flavio's Shell Page** (images of shells)

<http://www.geocities.com/CapeCanaveral/6276/>

**Guido T. Poppe's Web Page** (species listm thousands of images, links)

<http://www.club.innet.be/~year0078/>

**Machiko Yamada's Marine Jewel Box** (numerous images of all manner of shells)

<http://shell.kwansei.ac.jp/shell/>

**Stan's Sea Shell Samples** (some interesting collection images)

<http://www.zianet.com/patstan/samples.htm>

**Steve's Home Page** (Steve Lonhart) (stuff on Monterey Bay, Calif., some interesting images)

<http://www-biology.ucsc.edu/people/potts/lonhart/>

### LAND SHELLS

**The Liguus Home Page** (Emilio Jorge Power) (Liguus facts, data, distribution, images)

<http://pw1.netcom.com/~ejpower/lighomepage.html>

### MUSEUM AND SCHOOLS

**Academy of Natural Sciences** (Philadelphia) (species lists - Dr. Gary Rosenberg)

<http://www.acnatsci.org/>  
(database of Recent West Atlantic gastropods)

[gopher://erato.acnatsci.org:70/11/wasp](http://erato.acnatsci.org:70/11/wasp)

**Australian Museum** (images, data)

<http://www.austmus.gov.au/science/division/invert/mal/index.htm>

**Bailey-Matthews Shell Museum** (Sanibel, Florida)

[http://www.uwp.edu/academic/biology/bmsm/bm\\_shell.htm](http://www.uwp.edu/academic/biology/bmsm/bm_shell.htm)

**California Academy of Sciences** (San Francisco)

<http://www.calacademy.org/>

**CSU Fullerton - Marine Bio 317** (lots of images of different types of marine life)

[http://biology.fullerton.edu/courses/biol\\_317/web/organisms.html#Molluscs](http://biology.fullerton.edu/courses/biol_317/web/organisms.html#Molluscs)

**Florida Museum of Natural History** (specimen search engine)

[http://www.fimnh.ufl.edu/scripts/dbs/malacol\\_pub.sap](http://www.fimnh.ufl.edu/scripts/dbs/malacol_pub.sap)

**Los Angeles Natural History Museum**

<http://www.lam.mus.ca.us/nhm/>

**Santa Barbara Museum of Natural History** (Calif)

<http://www.sbnature.org/>

**Smithsonian** (Dept. Invert. Zoology) (lots of info and over 150 squid related links)

<http://www.nmnh.si.edu/departments/invert.html>

**Univ. Calif. at Santa Cruz - Bio161L** (class on marine biol, lots of images from Monterey Bay)

<http://www.biology.ucsc.edu/classes/bio161l>

**Univ. Hawaii - School of Ocean & Earth Sci & Tech** (ton of info on Hawaii)

<http://www.soest.hawaii.edu/>

Univ. Washington - Catalog recent & Fossil Conus 1937-1995

<http://www.biology.washington.edu/bsa/AKohn/title.html>

### SHELL CLUBS

The Astronaut Trail Shell Club

<http://pw1.netscom.com/~ejpower.atsc.html>

Central Florida Shell Club

<http://www.magicnet.net/~lkoestel/cfsc.html>

Englewood Florida Shell Club (images, links)

<http://www.flnet.com/~crosby/shell/index/html>

The Georgia Shell Club (images, links)

<http://museum.nhm.uga.edu/GCS/>

Indianapolis Shell Club

<http://www.oaktree.net/makuabob/INDYCHEL.HTM>

Jacksonville Shell Club (great images, complete list of Ranellidae)

<http://home.sprnet.com/sprynet/wfrank/jacksonv/htm>

Marco Island Shell Club

<http://www.naples.net/clubs/shell.htm>

Naples (Florida) Shell Club

<http://www.naples.net/clubs/nplshell.htm>

North Alabama Shell Club (images and links)

<http://fly.hiwaay.net/~dwills/nasc.html>

The North Texas Conchological Society

<http://home.earthlink.net/~jcaldeira/ntcs.html>

Pacific Shell Club (Los Angeles)

<http://www.ocnow.com/community/groups/shellclub/>

The St. Pete Shell Club, Inc. (Florida)

<http://www.geocities.com/RainForest/Vines/3910/>

### ORGANIZATIONS / PUBLICATIONS

The American Malacological Society, Inc. (publication, links, resource list, listserver)

<http://erato.acnatsci.org/ams/>

The Captured Cowry (Cypraea stuff, articles, images, index)

<http://www.oaktree.net/makuabob/>

Conchologists of America, Inc. (articles, images, news, species lists, links, etc.)

<http://coa.acnatsci.org/conchnet/>

Conch-L (good group of folks interested in shells)

<http://museum.nhm.uga.edu/CONCH-L/CONCH-L.html>

Hawaiian Shell News (magazine on the net, articles, images, auction)

<http://www.hits.net/~hsn/>

The Italian Malacological Society (publication, links, lists)

<http://www.aicon.com/sim/index.htm>

The Malacological Society of Australasia (publication, database, shell shows)

<http://www.austmus.gov.au/science/division/invert/mal/malsoc/malsoc1.htm>

The Netherlands Malacological Society

<http://web.inter.NL.net/users/Meijer.T/emv.htm>

The Veliger (USA) (home page of publication)

<http://ucmp1.berkeley.edu/barryr/veliger.html>

Vita Marine & Spirula (Netherlands) (publications, links, information, shell shows)

<http://home.wxs.nl/~spirula/>

### SHELL COLLECTING TRIPS

Editor's note: see ads in this issue

### SHELLS SPECIFIC - CEPHALOPODS

The Cephalopod Page (James B. Wood) (images, descriptions, data, links)

<http://is.dal.ca/~ceph/wood.html>

In Search of Giant Squid (USA) (Smithsonian exhibit, links)

<http://seawifs.gsfc.nasa.gov/squid.html>

Cephalopods in Action (images and video clips)

<http://www.nmnh.si.edu/cephs/>

### SHELLS SPECIFIC - CHITONS

Chitons.com (Glenn & Laura Burghardt) (worldwide chiton list, images, descriptions)

<http://home.inreach.com/burghardt/>

**Cyber Chiton Art** (Charlotte Beunders, Netherlands)  
(paintings based on chiton images)  
[http://home.wxs.nl/~spirula/cbs\\_art.htm](http://home.wxs.nl/~spirula/cbs_art.htm)

### SHELLS SPECIFIC - CONUS

**Cone Shells & Conotoxins** (Bruce Livett) (an incredible amount of info on cones)  
<http://grimwade.biochem.unimelb.edu.au/~bgl/content.htm> (old site)  
<http://grimwade.biochem.unimelb.edu.au/cone/> (new site)

**The Cone Snail Web** (Lin Chao-Hsein) (cone data, toxin discussion, images)  
<http://life.nthu.edu.tw/~lablpc/lin/index.html>

**Poisons Information Database** (some cone data, limited)  
<http://vhp.nus.sg/PID/PIDanimal.html>

**Toto Oliver & Lourdes Cruz** (Univ Utah) (more on cone toxins)  
<http://128.110.194.110/People/regfaculty/~olivera/olivera.html>

### SHELL SPECIFIC - MICROSHELLS

**Microgastropods of Sanibel** (Ross Gundersen) (images and descriptions)  
<http://www.uwp.edu/academic/biology/micros/micro.htm>

**SHELL(LESS) SPECIFIC - NUDIBRANCHS** (give some of these a try, the images are out of this world)

**SEA SLUGS** (Steve Long) (nudibranchs, Opisthobranchs and other sea slug data, 2,000+ images, newsletter, links)  
<http://www.oz.net/~miranda/>

**Mediterranean Slug Site** (alphabetical listing of images, links)  
<http://www.mnhn.fr/base/malac.html>

**Nudibranch Bibliography** (Gary McDonald) (search engine for all known articles or publications)  
<http://scilib.ucsd.edu/sio/indexes/mcdonald.html>

**Nudibranchs of the British Isles** (Bernard Picton) (electronic field guide, images, data, links)  
<http://www.pictonb.freeserv.co.uk/nudibranchs/index.html>

**The Shell Slug Forum** (Bill Rudman) (Q & A, some data, links, book reviews)  
<http://www.mnhn.fr/base/malaco.html>

**Slug Site** (Michael Miller) (lots of images, worldwide, links)  
<http://slugsite.tierranet.com/>

### SHELL SPECIFIC - RISSOIDAE

**Mediterranean Rissoidae Illustrated** (excellent pen & ink drawings of these tiny shells)  
<http://www.turin.net/shell/>

### SHELL SPECIFIC - SCAPHOPODS

**The Scaphopod Page** (Patrick Reynolds, Hamilton College, USA) (Dentalium & other tuck-type shells, images, links)  
<http://www.hamilton.edu/Academics/bio/preynolds/scaphopoda/>

### SHELLS SPECIFIC - TRIVIA

**Trivia of Southern Africa** (Matthew Grote) (Trivia images and some data)  
<http://members.aol.com/Mattgrote/matt.html>

### MISCELLANEOUS

**Microsoft Terra Server** (no shells, but a fun sight, with satellite photos of much of the earth, except my house)  
<http://www.terraServer.microsoft.com/>

I hope this list is of some use. It is a bit overwhelming at first. But just take your time, hit a link or two that sound interesting and have fun!

## LET'S LOOK FOR AUTHORS

by Betty Hamann

## A. Find the hidden authors.

(Example: Foresight is usually preferable to hind-sight.)

1. There was a gloomy pall as the cortege rolled along.
2. Down by the river rill and weeping willows I first met you.
3. Tony Randall starred in The Odd Couple.
4. My TV has a gremlin next to the picture tube.
5. The capital of NY state is Albany, not Schenectady.
6. I think I ran my very best race yesterday and this morning.
7. That Lothario will woo doxies, lassies and dolls.
8. The village of Old Saybrook, CT, is picturesque and rustic.
9. She was grinning from ear to ear with a bee in her bonnet.
10. The girls went to Hobart School and the boys to Penn Academy.
11. The policeman in Basra fines queen the equivalent of \$500.00.
12. Penn State vowed to break OSU, getting more TDs and fewer penalties.
13. He finally had a M.S. degree in malacology.
14. I'll bring food and silver if you'll grab bottles and ice.

## B. Find the twisted authors.

(Example: it was clearly a simple case of fraud.)

1. With Crowell it was always a matter of winning battles.
2. I just met Jacques but Rene I know from kindergarten.
3. The leering satyr, reprehensible critter that he was, took off after the maidens.
4. I wonder why my brew ossified in the vat.
5. Open sesame, open. Ah, suddenly a golden palace appeared.

6. Joseph steered her around the puddle.
7. Enamel, a derivative of who knows what, is usually glossy.
8. Hieronymus, Cavendish and Joslyn, G.I. brothers of Guinevere, all perished at Barino Bay.
9. Climbs up very high - cut epiphytes and parasites off the limb.
10. Wherever you see S.A.E. please write the name Society of Automotive Engineers.
11. Again, Ali will rise, KO Valdez, and become champ.
12. Although the shell was very red, no paint had been applied.
13. It's easy to miss a white epitonium hiding in the sand.
14. When you dial WNOS remember it is a country western station. (answers page 232)

## EXQUISITE LATIAXIS

Exquisite *Latiaxis santacruzensis* of the Galapagos islands  
Rose sculptured in white

Exotic Sea Shell of the Pacific Ocean found 1970  
in deep waters

At first sight ... you captured my heart  
I wanted to have you, hold you, draw you, and to be at  
one with you

Now ... in my curio cabinet ... in beauty and awe you  
reign supreme

My Sea Shell Snail ... with magnificent glory and  
ultimate delight

For all to admire ... morning, noon, and night.

Josephine's Exquisite *Latiaxis santacruzensis*.

Gift from Husband Jack Young ... Sept. 1975

JOSEPHINE YOUNG

## AD RATES

Display advertising in Of Sea & Shore is available  
at the following rates:

Full page \$175 per issue - \$500 per year  
½ page \$ 95 per issue - \$325 per year  
¼ page \$ 55 per issue - \$200 per year  
1/8 page \$ 35 per issue - \$120 per year

Rate is for camera-ready copy - add 20% single  
insert price for set-up fee (one time only charge).  
Closing dates are first of March, June, September  
and December. Send to Editor at address on "In  
This Issue" page

# RECENTLY DESCRIBED SHELLED MARINE MOLLUSKS



*Conus immelmani* Korn, 1998

Another new species of cones joins those we covered in the last issue. As with all the new species we mention, we urge those readers interested to consult with the publications in which the species are originally described for a complete description and illustrations. We present the new species here to make our readers aware of developments in our hobby.

*Conus immelmani* Korn, 1998  
Natal Province, Republic of South Africa  
*La Conchiglia*, 288:11-22

In discussing the new species, the author makes the following observations. "*C. immelmani* resembles *C. amadis* and *C. lozeti* in shell pattern and shape. *C. amadis* is of similar size and weight and may have a very similar shell pattern. However, it can be clearly separated by its angulate to carinate shoulder, carinate late postnuclear sutural ramps, white to light brown narrower larval shell, and its more prominent spiral sculpture on sutural ramps as well as last whorl. Marginal brown dots are absent from the early postnuclear sutural ramps in *C. amadis*. *C. lozeti* should no longer be considered as an aberrant form of *C. amadis* because it differs from the latter species in its dentiform columellar plait, its broader larval shell and the weak spiral sculpture of its sutural ramps.

"*C. lozeti* seems closer to *C. immelmani* than *C. amadis*. However, it is distinctly smaller than *C. immelmani* (60 vs 90 mm), relatively heavier, slightly broader and more conical, has a distinctly stepped spire with straighter outline and an angulate shoulder; its dentiform columellar plait is absent in *C. immelmani*. *C. lozeti* has a pure white apex, a pink aperture." (New species larval whorls are white to faint pink, aperture white, violet-blue in subadults.)

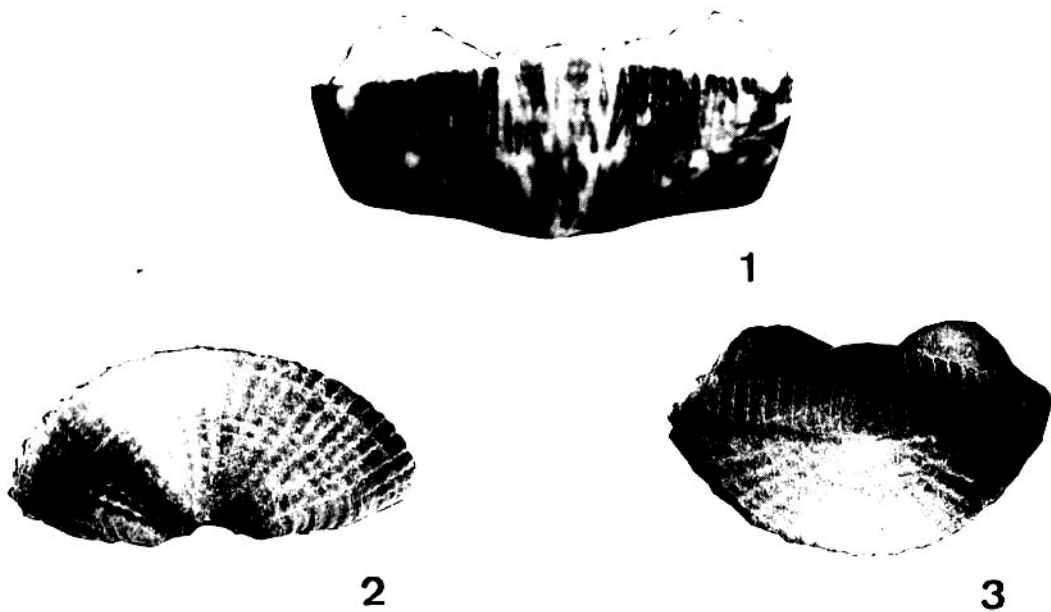
The article includes 12 color photographs of specimens of the new species, as well as comparisons to *C. natalis* and *C. lozeti*. There are also 8 1/2-page color photo close-ups of the animals of *C. immelmani* and *C. natalis*.

Korn, Werner. 1998. A new species of *Conus* from Natal and Transkei. *La Conchiglia* 288: 11-22.

An energetic and enthusiastic group of collectors have, as their favorite mollusks, the Polyplacophora (or chitons). Several new species have been added to that Class as well.

*Ischnochiton doli* Van Belle and Dell'Angelo, 1998  
deep water in the Tyrrhenian Sea, off Civitavecchia, Italy  
*Apex* 13 (1-2): 77-79. April 1998





Above: *Ischnochiton dolii* Van Belle and Dell'Angelo, 1998

This new species is described from an assortment of valves (69 head valves, 228 intermediate and 36 tail valves) found in a Roman jar brought up from the sea's bottom. It is yet to be determined if the species is Recent or possibly subfossil.

The authors surmise that a complete animal would measure approximately 20 mm in length, rather elevated, carinated with the side slope straight, the valves not beaked. Color of the tegmentum dark brown, variously blotched and/or streaked with white.

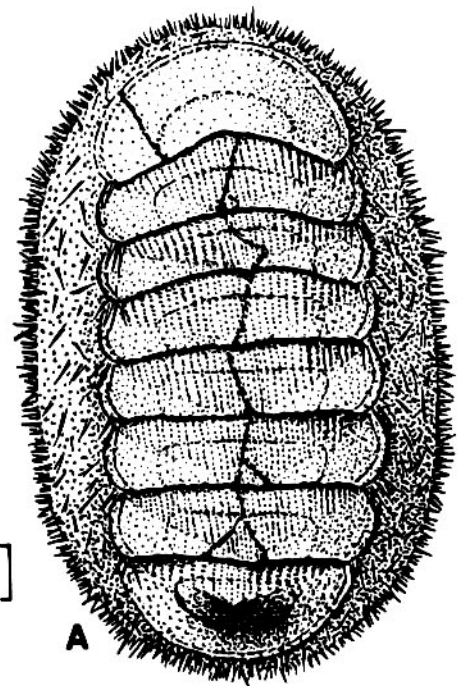
The authors compare the new species with various Recent and fossil chitons of the region. The species is currently known only from the type material, but perhaps further research will bring more specimens to light.

Van Belle, R.A. and B. Dell'Angelo. 1998. Description of a new species *Ischnochiton dolii* sp. nov. (Polyplacophora: Ischnochitonidae) from Civitavecchia, Italy. *Apex* 13 (1-2): 77-79

#### *Leptochiton vietnamensis* Sirenko, 1998

Deep-water, South China Sea off near southern Vietnam  
*Ruthenica*, 8 (1) 1-6

The new species, taken at a depth of 700 m lives on and eats wood. The species is small, 12 mm and white in color. The author remarks that the new species differs from all known species of the genus *Leptochiton* by the peculiar aesthetes in groups with strongly projecting caps on the upper side. The latter character connects the new species with species of the genera *Ferreiraella* and *Nierstraszella*. However, complexes of their generic

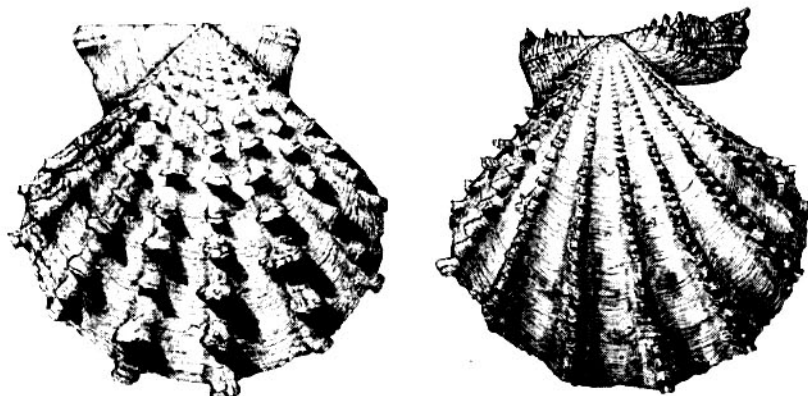


*Leptochiton vietnamensis* Sirenko, 1998

characters indicate a convergent similarity. The author also notes that there are presently thirteen species in *Ferreiraella*, *Nierstraszella* and *Leptochiton* known to feed on sunken wood.

Sirenko, B.I. 1998. One more deep-water chiton living and feeding on sunken wood: *Leptochiton vietnamensis* sp. nov. from the South China Sea (Mollusca, Polyplacophora). *Ruthenica* 8(1): 1-6.





*Mirapecten yaroni* Dijkstra and Knudsen, 1998

*Callochiton jeareyae* Dell'Angelo and Mifsud, 1998  
False Bay to Algoa Bay, South Africa, shallow water  
*Bollettino Malacologico* 33(1-4): 1-10. Feb. 1998

A moderately sized species (up to 16 mm) the color is reddish, with or without white or creamy white blotches. The valves are moderately elevated, subcarinated, not beaked. Tegmentum minutely granulose, closely beset with black dots (the pigment cups of the shell-eyes) in head valve, lateral areas of intermediate valves and post-mucronal area of tail valve. The girdle is described as rather wide, reddish, mostly with white bands positioned next to the sutures of the valves I/II and VII/VIII, very densely covered with fine, elliptical, rough spicules.

The authors compare their new species with the other two *Callochiton* from South Africa (*C. dentatus* [Spengler, 1797] and *C. herberti* Kaas & Van Belle, 1990), pointing out significant differences - two other species from adjacent areas (*C. clausadeae* Kaas & van Belle, 1985 and *C. vanbninii* Ferreira, 1983) are mentioned as being significantly different, especially in the slit formula and tegmental sculpture.

Dell'Angelo, Bruno and Constantine Mifsud. 1998. *Callochiton jeareyae*, a new species from South Africa (Mollusca, Polyplacophora). *Bollettino Malacologico* 33(1-4): 25-28

Now on to more new species from various groups.

*Mirapecten yaroni* Dijkstra and Knudsen, 1998  
Israel, Gulf of Aqaba, Elat.  
*Molluscan Research* 19(2): 43-104

This new species has been found in the area of Elat from littoral to sublittoral depths, living on the underside of coral boulders or amongst coral rubble on sandy bottoms. In comparing their new species with *M. rastellum* (Lamarck, 1819), the authors note that their species grows larger (up to 70mm, *M. rastellum* to 45mm). The regularly arranged radial lirae of both species are identical, those sculpture on the lirae is different. Strongly developed lamellae are produced in mature specimens of the new species, but are nearly absent or weakly spinose in *M. rastellum*. Radial riblets are present on the auricles of *M. yaroni*, but absent on *M. rastellum*. The color of the new species is darker with red and brown spots, whereas *M. rastellum* is paler with more cream coloration. *M. yaroni* lives in shallow waters, while *M. rastellum* lives in deeper waters. *M. moluccensis* Dijkstra, 1988, differs from *M. yaroni* in its nodulose lirae, more numerous radial riblets on the auricles, and in color (whitish, with black and reddish linear spots on the left valve). *M. mirificus* (Reeve, 1853) is strongly inequivalve and inequilateral, with a nearly flat left valve and irregularly developed radial lirae.

One interesting footnote: the species is dedicated to the late Dr. Isaac Yaron (1934-1985) who had, for many years, studied the Red Sea molluscan fauna and had tragically lost his life while diving in the Gulf of Aqaba.

Dijkstra, Henk H. and Jorgen Knudsen. 1998. Some Pectinoidea (Mollusca: Bivalvia: Propeamussidae, Pectinidae) of the Red Sea. *Molluscan Research* 19(2):67-70. November



*Strombus (Laevistrombus) guidoi* Man in 't Veld & de Turck, 1998

1 & 2 lip variation  
3 showing canal

4 apex detail  
5 semi-fossil example of  
*S. turturella*  
6 dorsal view of fig. 2

*Strombus (Laevistrombus) guidoi* Man in 't Veld & De Turck, 1997

Port Via, Vanuatu

Gloria Maris 36(1-6): 91-107

The authors state that *S. guidoi* differs from *S. canarium* and from *S. turturella* by its white color, the distinct shape of the posterior canal and the related shape of the strongly posteriorly protruding outer lip. The presence of the freely protruding lip at the extreme posterior portion of the columella is also a character not present in the other two species. A total of 35 specimens studied from the type locality shared these constant characters. Adult shells of the new species range in size from 45 to 54 mm. Color is white, in some specimens with a pattern of obscure yellow lines. All adult specimens with a golden-yellow, metal-like gloss on the columella as well as the outer lip. Inside of columella and aperture white.

Man in 't Veld, L.A. and K. De Turck. 1997. Contributions to the knowledge of Strombacea. 6. A revision of the subgenus *Laevistrombus* Kira, 1955, including the description of a new species from the New Hebrides. Gloria Maris 36(1-6): 103-106.

*Favartia (Murexiella) paulskoglundii* Hertz and Myers, 1998

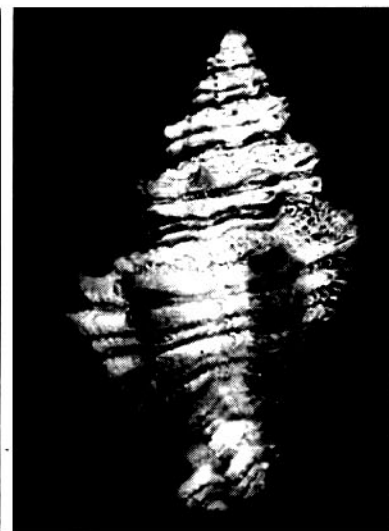
Islas Tres Marietas, Nayarit, México intermittently south to Isla Salango, Ecuador, 5.5 to 36.0 m depth.

The Nautilus 112(3): 95-98. October

This small (up to 17 mm) species is compared with *F. (M.) exigua* (Broderip, 1833) and differs in having an indistinct suture and sloping shoulder with thickened varices whereas *F. (M.) exigua* has an impressed suture and somewhat excavated shoulder with sharply elevated

To right: holotype  
of *Favartia (Murexiella)*  
*paulskoglundi* Hertz &  
Myers, 1998

Below: *Scabricola*  
*dampierensis* Salisbury  
& Heinicke, 1998

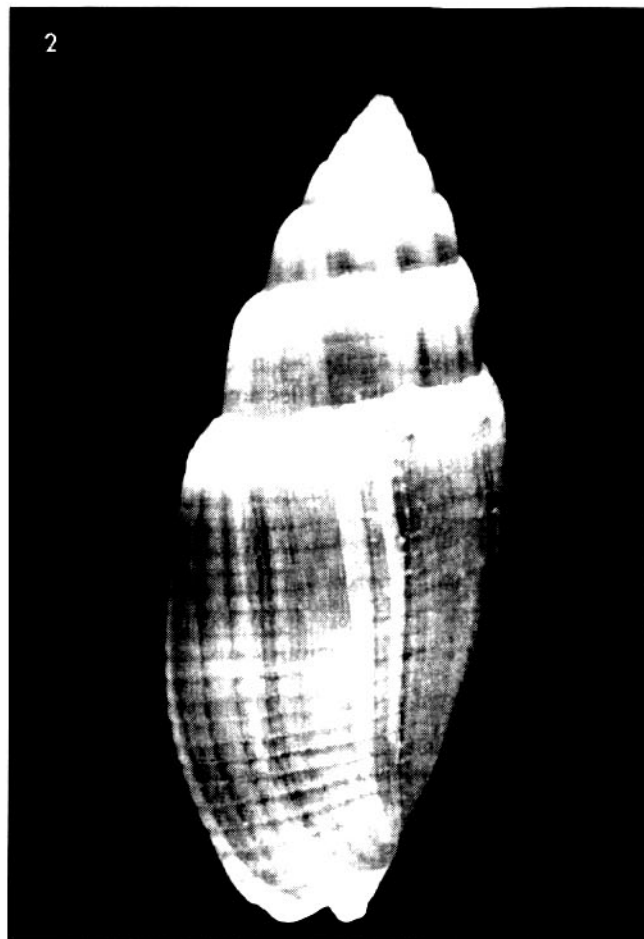
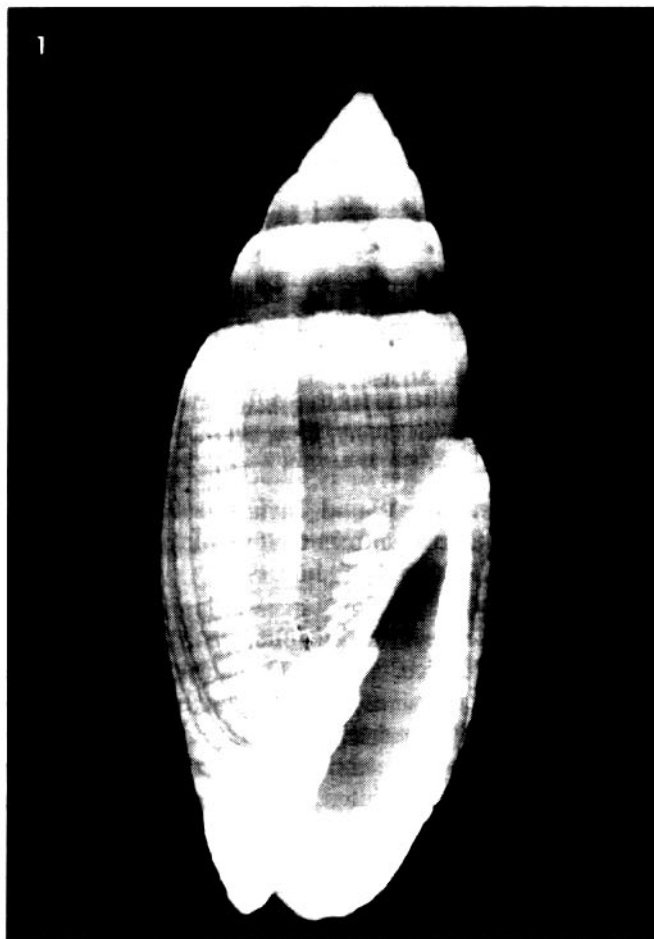


varices. The new species has five strong major cords with one minor cord in each interspace, whereas *F. (M.) exigua* has five strong cords with no minor cords in the deeply-cut interspaces, the edges of the cords somewhat overlapping the interspaces.

In comparison with *F. (M.) lappa* (Broderip, 1833) the new species differs in the number of spiral cords on the body whorl, five major cords with strong minor cords

between on the new species and five major cords with two strong minor cords on the shoulder and no minor cords on the body whorl on *F. (M.) lappa*. In *F. (M.) paulskoglundi* there are six to seven varices which do not obscure the indistinct suture, whereas in *F. (M.) lappa* the five varices project above and obscure the suture,

Hertz, Carole M. and Barbara W. Myers. 1998. A New *Favartia (Murexiella)* from the Panamic Province (Gastropoda: Muricidae) and Designation of a Lectotype for *F. (M.) exigua* (Broderip, 1833). *The Nautilus* 112(3): 95-98



***Scabricola dampierensis* Salisbury and Heinicke, 1998**  
 Dampier Archipelago, Western Australia  
La Conchiglia 287: 17-20. April-June 1998

The new species has been found from the Exmouth Gulf, Western Australia to the Northern Territories, Australia at depths of 5 to 15 meters in sand. In comparing it to *Mitra lacunosa* Reeve, 1844, with which it has been confused, the authors state that *M. lacunosa* is an elongate shell with all the characteristics of a *Mitra* sensu stricto. It differs from *Scabricola dampierensis* new species in being a more slender shell, with rounded shoulders, having wide-spaced, deeply punctate spiral grooves, thin outer lip, interior of aperture brown, a cream colored shells with wide brown flame-like streaks and a distinctive wide central brown band on the body whorl. *Scabricola dampierensis* differs in having pronounced tapering shoulders with dark reddish-brown spots displayed in the center of the shoulder. It is a typical *Scabricola* species in that the aperture length is equal to or greater than the spire. It had also been confused with *Mitra fulgurita* Reeve, 1844, but that differs from *S. dampierensis* in the color being cream with light straw-colored longitudinal streaks, lacking red dots, with rather shallow punctate spiral grooves.

Salisbury, Richard and Hans-Heinrich Heinicke. 1998. Description of a New Mitrid (Gastropoda: Mitridae) from the Dampier Archipelago, Western Australia. La Conchiglia 287: 17-20

***Pterygia purtymuni* Salisbury, 1998**  
 Hawaiian Islands (type locality: Maalaea Bay, Maui)  
La Conchiglia 289: 45-48. October-December

The author states that his new species is similar to *Pterygia glans* (Reeve, 1844), but is smaller, not as elongate, lighter in color and ornamented with much finer nodules. *P. glans* is sculptured with square, raised, stair-step shaped nodules. At the intersections of the spiral ridges and axial folds, the nodules are often tipped with a pair of white spots - this color pattern is not seen in the new species. *Pterygia crenulata* (Gmelin, 1791) also occurs in Hawaii, but differs from the new species by being much larger (new species to approximately 20 mm), more elongated sculpture with coarser nodules, of a different color pattern (light tan with dark blotches and bands); Hawaiian specimens are noted for having dark brown lines between the spiral cords and being quite elongate.

Salisbury, Richard. 1998. Description of a new Hawaiian *Pterygia*. *Pterygia purtymuni* n. sp. (Gastropoda: Mitridae). La Conchiglia 289:45-48



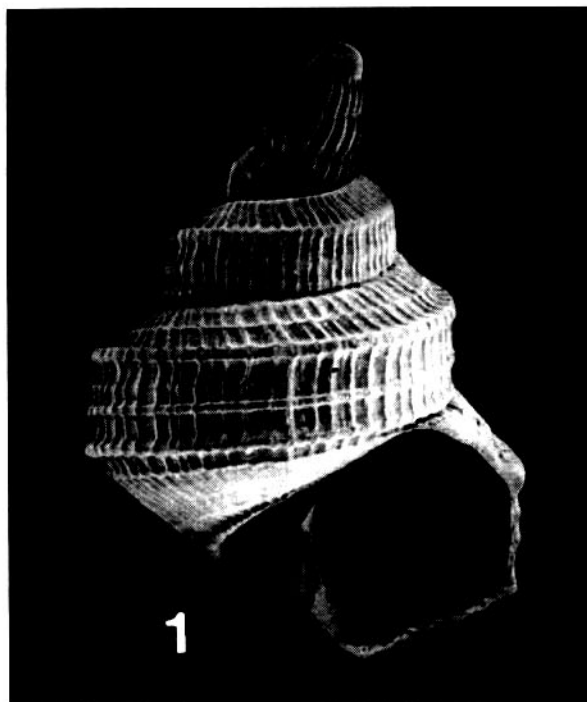
Above  
*Pterygia purtymuni*  
 Salisbury, 1998; left  
 paratype, right holotype

***Iphitus robertsi* Sabelli and Taviani, 1997**  
 deep water (184 m) northern Gulf of Mexico  
The Nautilus 110(3):94-96. July 1997

The new species represents the first record of the genus in the Gulf of Mexico. It may be parasitic on deep-sea scleractinian corals, as are its congener from New Zealand. The shell is small, relatively fragile, umbilicate with carinate, angular whorls which rapidly increase in diameter. Color is whitish, with few, irregular, pale brownish blotches.

Sabelli, Bruno and Marco Taviani. 1997. *Iphitus robertsi* (Epitonidae: Nystiellinae), A New Species of Deep-Sea Gastropod from the Gulf of Mexico. The Nautilus 110(3): 94-96





Above:  
*Iphtus robertsi*  
Sabelli & Taviani, 1997

***Epitonium fabrizioi* Pastorino and Penchaszadeh, 1998**  
Chubut Province, Argentina (Patagonia)  
*The Nautilus* 112(2): 63-68. September 1998

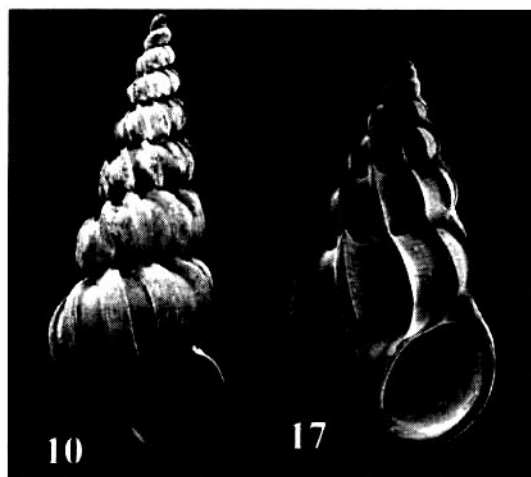
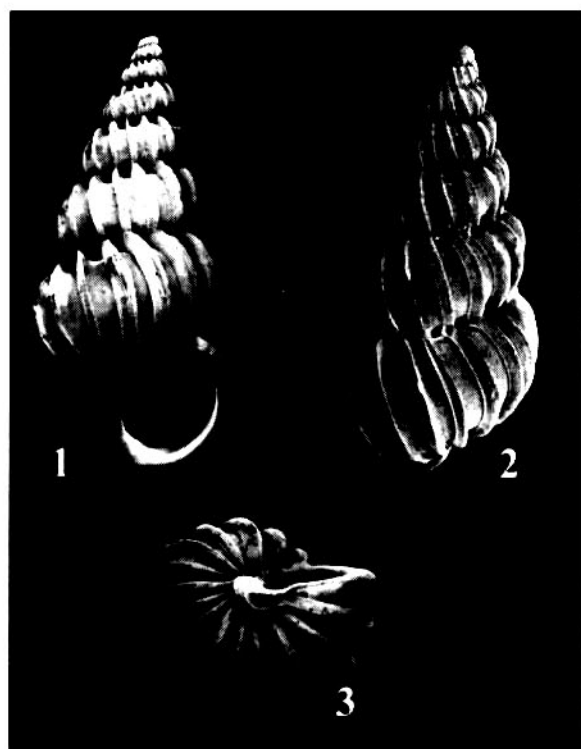
This new species is described from shallow water of Puerto Pirámides, Chubut Province, Argentina where it is found with the similar *E. georgettinum* (Kiener, 1839). It can be distinguished from that species by its smaller size, more straight profile and by its sharper, more numerous ribs.

Pastorino, Guido and Pablo Penchaszadeh. 1998. *Epitonium fabrizioi* (Gastropoda: Epitoniidae), a New Species from Patagonia, Argentina. *The Nautilus* 112(2): 63-68

***Cancellaria (Euclia) laurettae* Petit and Harasewych, 1998**

Golfo de Chiriqui (eastern Pacific), Panama  
*The Nautilus* 112(4): 113-116. December 1998

Dredged at a depth of 270-360 meters, the new species is said to easily be distinguished from other Recent members of the subgenus by its lack of a distinct shoulder with spines or nodes and finer spiral sculpture. It is assigned to the subgenus based on the morphology of its columellar plications, spiral sculpture, and overall shell shape. Size of specimens in the type series ranges from 38.6 to 46.2 mm. Base color is white to light beige, with



Above:  
1-3 *Epitonium fabrizioi* Pastorino &  
Penchaszadeh, 1998. 10 *E. geor-*  
*gettinum*. 17 *E. albidum* (d'Orb., 1842)

3 broad, spiral bands of ginger to dark brown (darkest along suture, 1 at mid-whorl, 1 anterior to stromboid notch). Aperture with light tan overglaze, with darker band along outer lip of specimens with strong denticles. The new species occurs in two forms - an ovate form that is much lighter in weight and slightly larger than the squarer form.

Petit, Richard E. and M. G. Harasewych. 1998. *Cancellaria (Euclia) laurettae*, a New Species of Cancellariidae (Mollusca; Neogastropoda) from Western Panama. *The Nautilus* 112(4): 113-116.

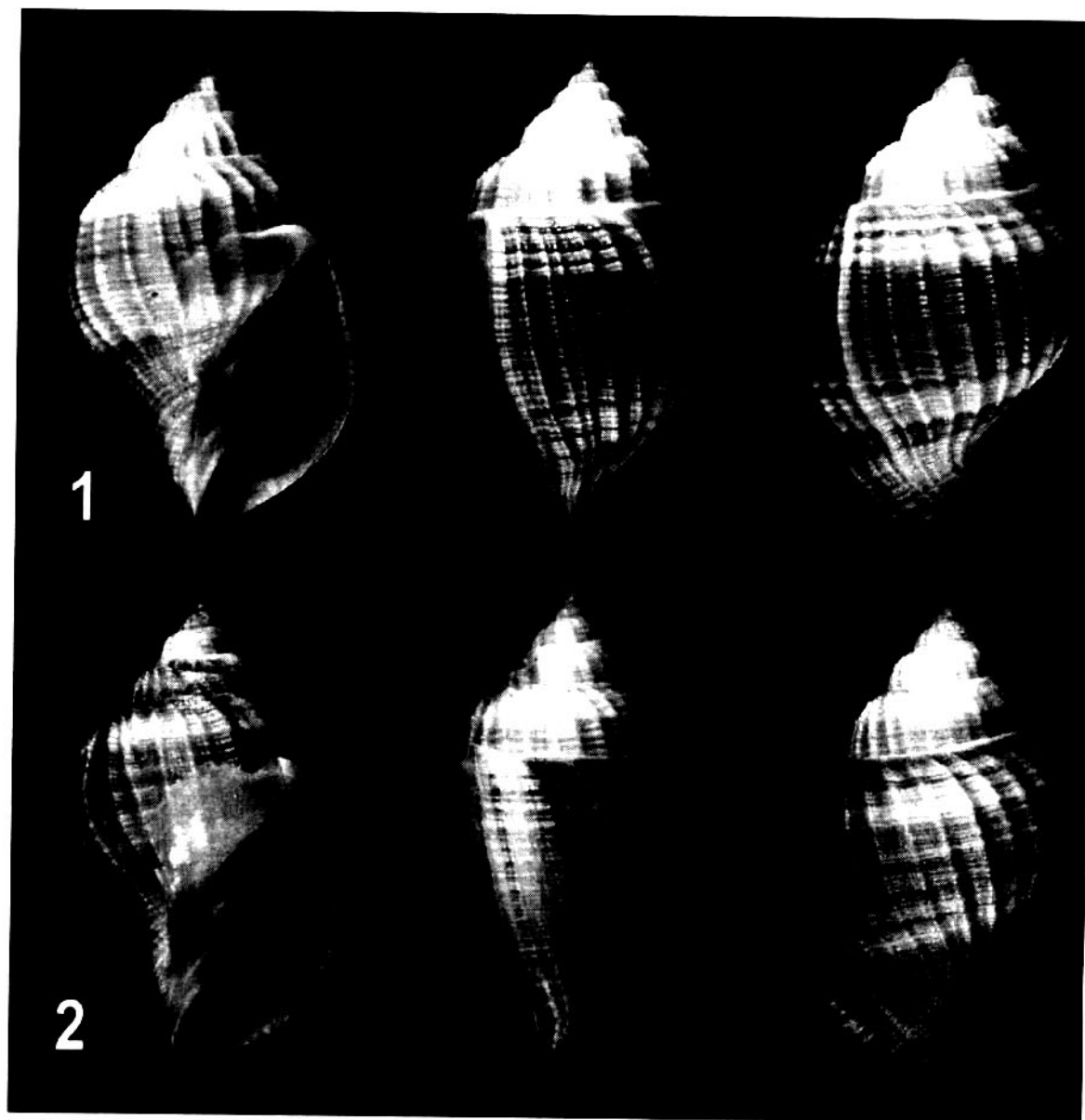


Fig. 1 Holotype of *Cancellaria (Euclia) laurettae* Petit and Harasewych, 1998 - the ovate form. Fig. 2 same new species, Paratype 1 - the squarer form

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#### NEW BOOK

##### *Return to the Sea*

Anne M. Johnson

Innisfree Press, Philadelphia. \$11.95

This 140-page paperback has the author exploring the spiritual message of Ann Morrow Lindbergh's 1955 book, Gifts From The Sea. (The forward to the current book is written by Reeve Lindbergh.) Through personal story and reflective journaling questions, the author invites women everywhere to "return to the sea".

## Recent Publications

**Iberus** (Revista de la Sociedad Española de Malacología)  
Vol. 16 (1) June 1998

The freshwater molluscs of Valencian Community (Spain) rivers. Pujante Mora, Tapia Ortega and Martínez Lopez. 29 species discussed, text in Spanish, distributional maps, 19 pages.

The genera *Megalomphalus* and *Macromphalina* (Mollusca, Caenogastropoda, Vanikoridae) in the Caribbean area, with the description of thirteen new species by Roland and Rubio. 120 figs. (black and white photographs), 51 pages. The new species are all minute and are listed below (authors of all are Rolan and Rubio, 1998):

*Megalomphalus margaritae* from Florida and the Bahamas (type locality is Key West, Florida).

*Macromphalina garcesi* from the south of Cuba and Puerto Rico (type locality Cienfuegos Bay, Cuba).

*Macromphalina robertsoni* is known only from the type locality of Cienfuegos, South Cuba.

*Macromphalina paradoxa* is also known so far only from its type locality of Cienfuegos, Cuba.

*Macromphalina worsfoldi* is known only from Dead Mans Reef, Grand Bahama Island, Bahamas.

*Macromphalina canarreos* is known only from Los Canarreos Archipelago and Cienfuegos, Cuba.

*Macromphalina jibacoa* is known only from the type material of Jibacoa, northern Cuba between La Habana and Varadero.

*Macromphalina apexplanum* is another known only, thus far, from the type material from St. Johns, Antigua.

*Macromphalina diazmerlanoi* which has a type locality of Bahía Nenguan, Santa Marta, Caribbean coast of Colombia and has not been found elsewhere.

*Macromphalina harryleei* is known only from the island of Tobago - the type locality.

*Macromphalina susoi* is also known so far only from the type locality of Destin, Florida.

*Macromphalina thompsoni* too is known only from its type locality of East Colon Island, Bocas Toro, Panama.

Global biodiversity and life-history evolution in the prosobranch gastropods. M. Oliverio, pp. 73-79.

Two new species of *Dikoleps* (Gastropoda, Skeneidae) from the Mediterranean coast of Spain. Rubio, Dantast and Luque. pp. 81-93, 45 text figs. The two new species are *Dikoleps marianae*, a sublittoral species from NW Africa (Cabo Leven, Western Sahara) to Western Mediterranean; *Dikoleps rolandi* is known only from the Catalan coast of Spain and is also a sublittoral species. Both species are minute, measuring only approximately 1mm in diameter.

The family Turridae s.l. (Mollusca, Gastropoda) in Angola (West Africa), 1. Subfamily Daphnellinae by Rolan, OteropSchmitt and Fernandes. pp. 95-118, 45 text

figs. covering twelve species. (See elsewhere in this issue for the six new species introduced in this article.)

A new species of *Tomura* (Gastropoda, Heterobranchia, Comirostridae) from the Caribbean by Rubio and Rolan. pp. 119-123, 1 text fig., text in Spanish. *Tomura xenoskeneoides* is described from Nichupté Lagoon, Cancún, Quintana Roo, México.

S.E.M. study of the plerocercoid larval *Phyllobothrium* sp. (Tetraphyllidae, Phyllobothriidae) and *Nybelinia lingualis* (Trypanorhyncha, Tentaculariidae), cestode parasite in *Octopus vulgaris* (Mollusca, Cephalopoda) off Vigo estuary by Gestal, Abollo, Arias and Pascual. pp. 125-132, 8 text figs. text in Spanish.

Contribution to the knowledge of the family Caecidae. 4. The temporary septum formation of some caecid species (Caenogastropoda: Rissoidea) by Pizzini, Oliverio and Nofroni. pp. 133-140, 19 text figs.

Journal of Conchology, Special Publication No. 2, June 1998. Molluscan Conservation: A Strategy for the 21st Century, edited by Ian J. Killeen, Mary B. Seddon and Anna M. Holmes, 320 pages, papers presented at a conference on the subject held in Cardiff, Wales in November of 1996.

Smithsonian Contributions to Zoology, Number 586. Systematics and Biogeography of Cephalopods. 1998. 2 volumes - 599 pages, various authors, numerous photographs and line drawings.

Smithsonian Contributions to Zoology, Number 598. A Revision of Axinellidae (Porifera: Demospongiae) of the Central West Atlantic Region. Alvarez, Van Soest and Rützler. 47pp, 23 text figs. 1998.

Smithsonian Contributions to Zoology, Number 600. A Review of Morphological Characters of Hydrobioid Snails. 1998. by Robert Hershler and Winston F. Ponder. 55 pp, 20 text figs. (line drawings).

The Bulletin of the Russian Far East Malacological Society. Vol. 1 (1996 - issued April 1997) 91pp, Vol. 2 (1998) 110pp. Articles in English and/or Russian. Vol. 1 has the following English-language articles: Japanese contribution to the Cenozoic marine *Bivalvia* paleontology of Sakhalin and Kurile Islands by Kafanov and Amano and Gastropods and small bivalves of fresh and brackish waterbodies in the southern Kurile Islands. Annotated list of species. by L.A. Prozorova. The other articles, in Russian, are accompanied by short English abstracts. In

Vol. 2, the English articles are: An Unending Saga of Unanswered Questions by Eugene Coan and Paul Scott and Annotated list of beringian freshwater molluscs by L.A. Prozorova; and, as before, the remaining articles in Russian include English abstracts. Contact the Society's Secretary: Konstantin A. Lutaenko, Institute of Marine Biology, Far East Branch, Russian Academy of Sciences, Vladivostok, 690041, Russia.

Xenophora, Number 83, July-Sept. 1998. Bulletin de l'Association Française de Conchyliologie. 32pp, all articles in French, numerous full-color illustrations.

Bollettino Malacologico XXXIII 1997. Società Italiana di Malacologia. 60pp, articles in Italian or English, with abstracts in same. Article on Barleeidae and Anabathridae and another about the variability of *Gibbula fanulum* and another on a population of *Pinna nobilis* and still another on the littoral soft-bottom mollusks of NE Sardinia and a final one on fossil mollusks from NW Italy are those in Italian, with English abstracts. There are three articles in English, in two of which new species are introduced and these we'll cover elsewhere. The third English article is on two species of bivalves (*Notolimea clandestina* Salas, 1994 and *Goodallia macandrewi* [Smith, 1881]) from Malta.

Molluscan Research, Vol. 19(2), Nov. 1998. The Malacological Society of Australasia. Articles include: Acute toxicity of a plant molluscicide, *Brassica actinophylla* on *Indoplanorbis exustus* and non-target organisms (14pp); Ultrastructural changes in the digestive system of *Indoplanorbis exustus* (Gastropoda: Planorbidae) exposed to the molluscicides, niclosamide and *Brassica actinophylla* (16pp); Population genetic structure of the muricid gastropod *Lepsiella vinosa* in Gulf St. Vincent, South Australia by Triantafyllou, Donnellan and Butler (12pp); Some Pectinoidea (Mollusca: Bivalvia: Propeamussiidae, Pectinidae) of the Red Sea by Dijkstra and Knudsen (62pp); Freshwater snails of the genus *Gyraulus* (Planorbidae) in Australia: the taxa of Tasmania by D.S. Brown (51pp).

Argonauta, X (7-12) (1997). Associazione Malacologica Internazionale. Single article in this 32-page issue. Contribution to the knowledge of the family Caecidae. 3. Revision of the Caecidae of the Canary Islands (Caenogastropoda: Rissoidea) by I. Nofroni, M. Pizzini and M. Oliverio. Black and white and color photos.

Argonauta, XI:1 (Oct. 1997). Associazione Malacologica Internazionale. All articles in English. These are: The small marginelliform gastropods from Ghana

(Neogastropoda, Cysticidae) by Rolán and Fernandes (pp. 3-12); Host relationship of *Chrusallida canariensis* (Heterostoma, Pyramidellidae) epizoic on *Bursa scrobilator* (Caenogastropoda, Bursidae) at Canary Islands (pp. 13-18) by M. Oliverio and R. Vega-Luz; A new species of *Bothropoma* (Gastropoda, Turbinidae) from Cuba (19-24) by E. Rolán, F. Rubio and R. Fernández-Garcés. Illustrations in color and black and white.

Gloria Maris Vol. 37 (1-6) July 1998. Belgian Society for Conchology. The entire 48-page issue is taken up by the single article: Neritoidea of the Solomon Islands, Alphabetical Review; Part 1 marine species; Part 2 non-marine species, by A. Delsaert. Seven color plates and 4 black and white plates. Text in English and Dutch.

Basteria Vol. 61, No. 4-6, 73-144. Jan. 26, 1998. Nederlandse Malacologische Vereniging. Included are the following articles:

Notes on Buliminidae. 5. On the systematic position of Arabian Buliminidae (Gastropoda, Pulmonata), with the description of a new genus. R.A. Bank and E. Neubert 12pp, 8 shell figures.

*Vallonia costata* (Müll.) (Gastropoda, Pulmonata) in South Africa, with additional notes on other alien species. A.C. van Bruggen. 3pp, 1 text fig.

*Rissoa membranacea* (J. Adams, 1800) (Gastropoda, Prosobranchia) from the Dutch Wadden Sea. G.C. Cadée. 10pp, 1 text fig.

Notes on *Cyclodostomia* Sacco, 1892 (Gastropoda: Pyramidellidae). J.X. Corgan and J.J. van Aartsen. 2pp.

Notes on the occurrence of *Hydrobia acuta* (Draparnaud, 1805) (Gastropoda, Prosobranchia, Hydrobiidae) in western Europe, with special reference to a record from S. Brittany, France. D.F. Hoeksema. 13pp, 18 text figs.

The Metaxiinae dredged by the CANCAP expeditions, with the new species *Metaxia carinapex* and *Metaxia hapax* from the Cape Verde Islands (Gastropoda, Heteropoda: Triphoridae). J. van der Linden. 8pp, 10 figs.

*Oxychilus mortilleti* (Pfeiffer, 1859): a redescription (Pulmonata, Zonitidae). G. Manganelli and F. Giusti. 22pp, 22 text figures.

Ruthenica Vol. 8, No. 1 (June 1998). Russian Malacological Journal. One of two 1998 issues, the following articles appear:

One more deep-water chiton living and feeding on sunken



wood: *Leptochiton vietnamensis* sp. nov. from the South China Sea (Mollusca, Polyplacophora). B.I. Sirenko. pp 1-6, 3 text figs.

On the protoconchs of Ukrainian Eocene Scissurellidae (Gastropoda). O.V. Amitrov and E.A. Zhegallo. pp 7-11, 2 full-page text figs.

A new genus of Fissurelloidei (Gastropoda) from the Upper Carboniferous of Moscow Basin: the oldest known example of the suborder. A.V. Mazaev. pp 13-15, 11 figs.

*Aplysia parvula* Guilding in Mörch, 1863 and *A. juliana* Quoy et Gaimard, 1832 from coastal waters of Moneron Island: the first record of the family Aplysiidae (Opisthobranchia, Anaspidea) in Russian fauna [text Russian]. A.V. Martynov and E.M. Chaban. pp 17-28, 4 full-page text figures (line drawings).

*Runcinida marisae* sp. nov. (Opisthobranchia, Runcinidae), a new runcinid mollusc from the Sea of Japan [Russian text]. A.V. Chernyshev. pp 29-32, 16 line drawings.

Fresh- and beackish-water pectinibranch gastropods of Kurile Islands. L.A. Prozorova. pp 33-38, 19 line drawings

New species of the genus *Acroloxus* Beck (Pulmonata, Acroloxidae) from the Kolhyma River Basin [Russian text]. L.A. Prozorova and Ya. I. Starobogatov. pp 39-42, 2 text figs.

Land snails of the genus *Landouria* Godwin-Austen, 1918 and some other Bradybaenidae of Nepal (Gastropoda, Pulmonata). A.A. Schileyko and A.G. Kuznetsov. pp 43-54, 9 shell drawings.

Subgenus *Gyraulus* (Pulmonata, Planorbidae) from the south of the Russian far east [text in Russian]. L.A. Prozorova and Ya. I. Starobogatov. pp 55-58, 12 drawings.

A new species of the genus *Planorbis* (Gastropoda Pulmonata Planorbidae). E.V. Soldatenko and Ya. I. Starobogatov. pp 59-63, 2 text figs. New species is *Planorbis kubanicus* from Bavaria, Germany.

New data on the bivalve mollusc fauna of the North Pacific Ocean. 5. The status of some scallops of the subfamily Chlamyidae von Teppner, 1922 and notes on the genus *Mizuhopecten* Masuda, 1963 (Pectinidae). [text in Russian]. pp 65-73, 3 text figs showing 12 specimens.

New data on the bivalve mollusc fauna of the North Pacific Ocean. 6. *Callista trigonoovata* Scarlato in Volova et Scarlato, 1980 is a new synonym of *Callista* (*Ezocallista*) *brevisiphonata* (Carpenter, 1864) (Veneridae). [text in Russian] pp 75-76. 1 text fig.

Differentiation of reproductive strategies within a taxon, as

exemplified by octopods. V. V. Laptikhovsky. pp. 77-80.

Statoliths in accelerometers of squids and cuttlefish. A.I. Srkhipkin and V.A. Bizikov. pp 81-84.

Ruthenica. Vol. 8, No. 2 (November 1998) includes:

Prosobranch gastropods of the continental slope of Kurile Islands. [text in Russian] A.N. Golikov and B.I. Sirenko. pp. 91-135, 15 text figs (most full-page, numerous black and white photographs).

Land mollusks of the Kopet Dag Range: fauna, ecology, zoogeography. I.V. Muratov. pp 137-145, 30 shell drawings.

*Melanochlamys diomedea* (Bergh, 1893) (Opisthobranchia: Aglajidae), a new genus and species in the fauna of Russia [text in Russian]. E.M. Chaban and A.V. Martynov. pp 147-152, 5 drawings.

A new genus and species of onychoteuthid squid (Cephalopoda, Oegopsida) from the Southern Ocean. K.N. Nesis, M.A.C. Roeleveld and I.V. Nikitina. pp 153-168, 6 text figs. New species is *Notonykia africanae* from off South Africa.

Vita Marina, International Magazine on Sea and Shells. Vol. 4a5, Nos. 1-2, May 1998. Included in this issue:

Opisthobranch Molluscs from the Azores. Peter Wirtz. pp 1-16 with 41 color photographs on 5 full-page plates.

The Rumphius Biohistorical Expedition, A story of present and past marine biology. H. L. Strack. pp. 17-40, 3 full-page color plates with 25 photographs, also 18 text figs.

Recent *Spondylus* species from the Middle East and adjacent regions, with the description of two new species. K.L. Lamprell. pp 41-60, with 4 full page (and one partial page) color plates showing 40 specimens.

Vita Marina, Vol. 45, Nos. 3-4 (December 1998). Articles this time are:

Revision of *Euprotomus* Gill, 1870. 1. The systematic position of *Strombus listeri* Gray, 1852. G.C. Kronenberg. pp. 1-6, including 1 full-page color plate.

A new species of *Spirotropis* (Gastropoda: Turridae) from the Gulf of Aden. M. Morassi. pp. 7-10, 1 text fig. New species is *Spirotropis suryima*.

A new species of *Cotonopsis* Olsson, 1942, from an unexpected locality (Gastropoda Prosobranchia: Columbellidae)

G.C. Kronenberg and H. Dekker. pp 11-16, 1 full-page color plate, 7 text figs. New species is *Cotonopsis vanwallegheimi* from the Andaman Sea (taken by Burmese fishermen working out of Ranong, Thailand).

On the identity of *cardium robillardi* Sowerby, 1894. R.P.A. Voskul. pp 17-20, 2 color figs.

A revision of the recent European Patellidae (Mollusca: Gastropoda). Part 1. The Patellidae of the Azores, Madeira, the Selvagens and the Canary Islands. F.F.L.M. Titselaar. pp 21-59, 27 text figs. and 4 full-page color plates.

For information write: Vita Marina; P.O. Box 64628; NL-2506 CA Den Haag, The Netherlands.

**Apex** Vol. 13 (1-2), April 1998. Société Belge de Malacologie. Includes:

A puzzle of highly multiform species: *Oliva fulgurator* (Röding, 1798) and related American taxa. B. Tursch, D. Greifeneder and D. Huart. pp. 1-61, 11 full-page black and white plates.

Un nouveau genre de Pholadidae (Mollusca, Bivalvia) du Paléogène inférieur du nord de l'Atlantique. J.-M. Pacaud [text in French] pp 63-76, 34 black and white text figs. Includes new species, *Cyrtopleuropsis lescailloni*.

Description of a new species *Ischnochiton dolii* sp. nov. (Polyplacophora: Ischnochitonidae) from Civitavecchia, Italy. R.A. van Belle and B. dell'Angelo. pp. 77-79, 5 figs.

**Apex**. Vol. 13 (3), July 1998. Articles include:

The influence of physicochemical parameters on the distribution of dominant bivalve species in the ensenada do Bafo (Ria de Ferrol) in Northwest of Spain. C. Olabarria, V. Urgorri and J.S. Troncoso. pp 81-93.

Description of eight new species of Muricidae (Gastropoda). R. Houart. pp. 95-109, 47 text figs., including 38 shells. The new species are *Attiliosa edingeri* and *Favartia eastorum* from Western Australia, *favartia deynzeri* from the Red Sea, *Apixystus rippingalei* from Queensland, *Trophonopsis bassetti* from New South Wales and Queensland, *Orania rosadoi* from Mozambique, *Ergalatax dattiloi* from the Philippine Islands, Indonesia, and Japan, and *Thais herberti* from South Africa.

Taxonomic revision of the Indo-Pacific *Vasticardium assimile* species group (Mollusc, Cardiidae). J. Vidal. pp 111-125, 32 figs. Includes new species *Vasticardium thomassini* from Natal, S.W. Madagascar and Zanzibar.

Description of *Trophon iarae* n.sp., a new muricid from southern West Atlantic (Gastropoda: Muricidae) with illustration of related species. R. Houart. pp. 127-130, 12 text figs. New species occurs in Brasil, Uruguay and the Falkland Islands.

*Oliva ouini*, a new species from Hansa Bay, Papua New Guinea, with notes on the anatomy of *O. oliva* (L., 1758). Y. Kantor and B. Tursch. pp 131-153, 9 black and white plates.

**The Nautilus**, Vol. 111, No. 2 (Feb. 1998), this issue contains the following articles:

Two new deep-water Pseudolividae (Neogastropoda) from the south-west Pacific by P. Bouchet and G. Vermeij. pp. 47-52, 14 figs. New species are *Fusulculus crenatus* from the New Hebrides Arc (and from the Coral Sea to NE of Fiji) and *Fusulculus albus* from north of New Caledonia (also off north New Zealand).

Generic Revision of the Neogastropod Family Pseudolividae. G. Vermeij. pp 53-8417 text figs.

**The Nautilus**, Vol. 112, No. 1 (July 1998) includes:

Clarification of the taxonomic status and reproductive anatomy of *Philomycus batchi* Branson, 1968 (Gastropoda: Pulmonata: Philomycidae). H. Lee Fairbanks. pp 1-511 text figs.

Additions and corrections to the taxonomy of the genus *Peasiella* Nevill, 1885 (Gastropoda: Littorinidae). D. G. Reid and Y.-M. Mack. pp 6-33, 145 text figs.

Donald Richard Moore (February 16, 1921 - October 19, 1997): biographical sketch, zoological taxa, and bibliography. pp 34-40, 2 photographs.

**The Nautilus**, Vol. 112, No. 2 (Sept. 1998). The following are included:

Thecosome pteropod (Gastropoda) assemblages of the Mexican Caribbean Sea (1991). E. Suárez-Morales and R. Gasca. pp 43-51.

A new deep-sea limpet of the genus *Pectinodonta* Dall, 1882 from New Zealand, and new distribution records for *P. aupouria* and *P. morioria* Marshall, 1985 (Gastropoda: Acmaeidae). B.A. Marshall. pp 52-57, 8 text figs. The new species is *Pectinodonta marinovichii* from off White Island to off Hokitika, New Zealand.

Rediscovery of *Discus brunsoni* Berry, 1955 and *Oreohelix alpina* (Elrod, 1901) in the Mission Mountains,

Montana, with comments on *Oreohelix elrodi* (Pilsbry, 1900). P. Hendricks. pp. 58-62.

*Epitonium fabrizioi* (Gastropoda: Epitoniidae), a new species from Patagonia, Argentina. G. Pastorino and P. Penchaszadeh. pp. 63-68, 21 text figs.

Two new species of *Periploma* (Bivalvia: Anomalodesmata: Periplomatidae) from the southern Caribbean. N.A. Ardila and J.M. Diaz. pp. 69-72, 11 text figs. The new species are *Periploma (Periploma) coseli* from eastern Colombia and *Periploma (Periploma) sanctamartaensis* also from eastern Colombia.

The Nautilus, Vol. 112, No. 3 (Oct. 1998). In this issue are:

Learning from the collector: a survey of azooxanthellate corals affixed by *Xenophora* (Gastropoda: Xenophoridae), with an analysis and discussion of attachment patterns. N. Feinstein and S.D. Cairns. pp. 73-83.

Shell microstructure of mytilids (Bivalvia) from deep-sea hydrothermal vent and cold-water sulfide/methane seep environments. M.J. Kennish, A.S. Tan and R.A. Lutz. pp. 84-89, 21 test figs.

Molluscan taxa and bibliography of Henry van der Schalie. M.E. Gordon. pp. 90-94.

A new *Favartia (Murexiella)* from the Panamic Province (Gastropoda: Muricidae) and designation of a lectotype for *F. (M.) exigua* (Broderip, 1833). C.M. Hertz and B.W. Myers. pp. 95-98, 8 text figs. *Favartia (Murexiella) paulskoglundii* with a range from Islas Tres Marietas, Nayarit, México, intermittently south to Isla Salango, Ecuador.

The Nautilus, Vol. 112, No. 4 (Dec. 1998), contains the following articles:

*Pulvinites exempla* (Hedley, 1914) from the New Zealand region (Bivalvia: Pulvinitidae). B.A. Marshall. pp. 99-102, 9 text figs.

*Acrorhis oetricola* Odhner, 1937 (Gastropoda: Pulmonata: Planorbidae) at Iguazú, Misiones, Argentina, and the rediscovery of the type series of *Acrorhis odhneri* Hylton-Scott, 1960. C.F. Ituarte. pp. 109-112, 6 text figs.

A new species of land snail of the genus *Georissa* (Gastropoda: Hydrocenidae) from the Philippine Islands. K. Auffenberg. pp. 109-112, 6 text figs. The minute *Georissa cavini* is described from near Balasan, Panay Island.

*Cancellaria (Euclia) laurettae*, a New Species of Cancell-

ariae (Mollusca: Neogastropoda) from Western Panama. R.E. Petit and M.G. Hatasewych. pp. 113-116, 4 text figs.

*Leucozonina ponderosa*, a New Fascioliid Gastropod from Brazil. G.J. Vermeij and M.A. Snyder. pp. 117-119, 6 text figs.

La Conchiglia, The Shell (No. 287). April-June 1998. This issue includes:

Statistical study of Cowries from the Sinai area of the Red Sea. E. Heiman. pp. 11-14, 5 color figs.

Two new Mediterranean records of hypermeric Polyplacophora. B. dell'Angelo and S. Ventimiglia. pp. 15 and 16, 1 color and 2 black and white figures.

Description of a new mitrid from the Dampier Archipelago (Western Australia). R. Salisbury and H.H. Heinicke. pp. 17-21, 7 color figures. *Scabricola dampierensis* is the new species.

Some more landsnails from Thailand. J. Hemmen and S. Patakamanthin. pp. 22-24, 7 color photographs.

New species of *Conus* from the tropical western Atlantic region. E.J. Petuch. pp. 25-36, 21 color photographs (for new species see our last issue Vol. 21, No. 3 - Recently Described Shelled Marine Mollusks, page 147).

The Molluscan species living in Maltese *Posidonia* meadows. C. Mifsud. pp. 37-48, 50 color and 1 black and white photographs.

Notes on the genus *Hexaplex*. M. Brunetti, G. Buzzurro, G. Cirone and E. Greppi. pp. 49-52, 6 color photographs.

Description of *Granulina melitensis* n.sp. from the Mediterranean Sea. C. Smriglio, P. Mariottini and S. Rufini. pp. 53-56, 5 color and 2 black and white photographs.

Let's photograph shells! An Introduction! A. Mazzini and ImagePro. pp. 57-58, 1 color text fig.

La Conchiglia (No. 288) July-Sept., 1998. Articles include:

A new species of *Conus* from Natal and Transkei. W. Korn. pp. 11-22, 20 color figs.

Discovery of a new Volutidae population. P. Bail and A. Limpus. pp. 23-26, 6 color illustrations. New subspecies *Athleta (Ternivolva) studeri swainensis* from the area of Swain Reefs, Queensland, Australia is described.

New Cowries from the Myakka Lagoon System and the Everglades Pseudoatoll (Pliocene Okeechobean Sea). E.

Petuch. pp 27-37, 20 black and white photographs.

1st International Workshop of malacology hosted at Menfi (Agrigento, Italy). M. Corso. pp 38-39.

The Zoological Department of the Tiroler Landesmuseum Ferdinandeum in Innsbruck, Austria. H. Nisters. pp 40-41.

The "*Fusinus caparti* complex" from West Africa (Gastropoda: Fasciolarinae). R. Hadorn. pp 43-50, 16 shells in color, plus black and white photos (3).

On the status of *Tibia melanocheilus* (Adams, 1854) and some notes on the appearance of its shell. L. Man in 't Veld and G.J. Visser. pp 51-56, color illustrations.

When handicraft becomes art, C.J. "Goz" Gosselin and his shell creations. M.A.F. Angioy. pp. 57-58, 5 color figs.

La Conchiglia (No. 289) October - December, 1998. The following are included:

New species of the Family Eulimidae from the Canary islands - Part 3. Description of *Fusculima boscheineni* n.sp. W. Engl. pp 11- 14, 6 color and 3 black and white illustrations.

Seashells from Helgoland. F. Lorenz. pp 15-20, 10 color and several black and white photos and drawings.

On the specific distinction between *Natica adansoni* Blainville, 1825 and *Natica prietoi* Hidalgo, 1873 (Disco-poda: Naticidae). F. Gubbioli and I. Nofroni. pp 21-22, 4 color photographs.

*Erosaria turdus* Lamarck, 1810 in the Sinai area of the Gulf of Aqaba. E. Heiman. pp 23-33, 32 color and 2 black and white photographs.

News about South African *Conus* (Mollusca: Neogastropoda: Conidae). W. Korn. pp 36-42, 14 color photographs.

A New Species of *Inquisitor* (Gastropoda: Turridae) from the Gulf of Aden. M. Morassi. pp 43-44. 2 color photos.

Description of a new Hawaiian *Pterygia*, *P. purtymuni* n.sp. (Gastropoda: Mitridae). R. Salisbury. pp 45-48, 8 color and 2 black and white photographs.

Uncommon Mollusks from the Tuscan Archipelago (1st Part). F. Giusti and B. Dell'Angelo. pp 49-52, 7 black and white photographs.

A New species of *Austroharpa* from South Australian waters (Gastropoda: Harpidae). M. Hart and A. Limpus. pp 53-55, 11 color photographs.

European Marine Mollusca: Notes on less well-known species. XIV. *Saxicavella angulata* (S.V. Wood, 1857). J.J. van Aartsen and C. Bogi. pp 56-58, 1 black and white plate.

Hey!

How about writing an article  
about your last shelling trip,  
your favorite shell  
or  
maybe how you got started collecting?

Answers to "Find Some Hidden Shells" pg. 200

1. The hen ruled the roost while the cock led a philandering life.
2. My itinerary includes L.A., Beijing, Leningrad and London.
3. My goodness, her majesty's slip perchance is showing?
4. Martha and Rachel met their boyfriends at the mall.
5. Hey bub, blended whiskey is your problem!
6. Her wedding dress was trimmed with ribon net applique and embroidery.
7. The bboys terrified the girls during recess.
8. Kermit erased the blackboard for his teacher.
9. In Moscow Riesling was seldom found, though vodka was plentiful.
10. He studied the decision pro and con, changed his mind and vetoed it.
11. There was no panic. One by one they filed out.
12. The winner, I tell you, was jubilant.
13. The deaf Bantu lipread the missionary's sermon.
14. Frankly, Carl, I'm petrified.
15. P. J. Dames co-authored the book with W. H. Elkinson.
16. The lab technicians used petri, tongs, tweezers and scalpel.



## VARIABILITY AND TAXONOMY IN CYPRAEIDAE

Willem Krommenhoek, Ph.D.

### Introduction

Over the years I did some quantitative beach research with cowries (*Cypraea* species) on undisturbed beaches at different places along the Indo-West Pacific coasts. One of the results of this research was the quantitative description of variability in a variety of conchological characters in several species of cowries, like size, shape, width of dorsal bands, development of ocellated spots and pigmentation.

I noticed many times that characteristics of specific distinction were not constant at all, but showed gradual expression, from about absent until fully developed. This makes such characteristics unsuitable for taxonomic purposes.

At the same time, it is well known by everybody who is interested in cowries, that the taxonomy of this group is subject to different interpretations. At one hand, there are the "lumpers", considering all species of cowries to be only one genus and accepting a certain range of variability without taxonomic designation. On the other hand are the "splitters", breaking the cowry-group into many genera, each with a large number of species and subspecies and varieties, each with a name of their own. The result is chaos and confusion.

Based on the modern biological concepts explaining the origin and purpose of variation, and on my results with measuring the amount of variation, I will try to explain why it does not make sense to designate small morphological difference to taxonomic levels. Only commercial classification is interested in an overload of names, because it makes collectors believe that those names stand for real and constant "subspecies" or "varieties".

### Origin of Variation

A population of living beings is composed of many individuals and, with rare exceptions, no two of these are exactly alike. We are well aware of this in human beings, but we tend to overlook similar individual variation in lesser groups such as cowries. For all species, however, it is a fact that members of a population share some important features, but differ from one another in numerous ways, some rather obvious, some very subtle. This variation arises from different sources.

First there is the recombination of genes during sexual reproduction, a process described by the Mendelian Rules. Next, there is crossing-over, the process in which parts of

chromosomes are exchanged during the process of nuclear division in which the number of chromosomes is reduced by half during the production of eggs and sperms.

These two processes do not lead to new alternative gene forms at a given chromosome locus (alleles), but only to recombination of existing ones.

Only mutation, the process in which a stable heritable change in the genetic material occurs, is a potential source of entirely new alleles. Taken together, these processes generate new alleles and new combinations of alleles, and provide the genetic variability on which natural selection can act to produce changes in populations.

On the other hand, variation may also be the result of environmental factors only. This so-called phenotypic variability is produced by exposure to different environmental conditions during development, like temperature, availability of nutrients, etc. These variations have no genetic base and therefore cannot be inherited.

### Variation and the Species Concept

In the preceding paragraph, the term population is used. In modern biology it is defined as a group of individuals that interbreed and so share a common gene pool. Members of small populations resemble each other more closely than they resemble members of other local populations. This observation is the result of the fact that individuals of one population are more related genetically and are exposed to more similar environmental influences. Hence, we may consider such local populations as temporary units that intergrade with other similar units. All local populations together make up the species.

Variation between the local populations of a species is often correlated with geographic distribution. The farther apart two populations are, the smaller the chance of direct gene flow between them, and hence the likelihood that the differences between them will be more marked. Each local population tends to evolve adaptations to the specific environmental conditions in its own portion of the species range. Environmental conditions often vary geographically in a more or less regular manner, and as a result of this most species show north-south or east-west gradients. However, sometimes geographically correlated variation is not gradual. There may be a rather abrupt shift in some character in a particular part of the species range. Such an abrupt shift in a genetically determined character sometimes is designated as a "subspecies", a term also applied to more isolated populations, such as those on different islands. But among biologists this term is not generally accepted. Many feel that the distinction is too often made arbitrarily on the basis of only one morphological characteristic.

Back to the species. It will be clear from the definition that the members of a species are distinguishable from each other in a variety of ways, but at the same time all members of a single species share certain biologically important attributes and that, as a group, they are genetically separated from other such groups.

Although the existence of discrete clusters of living organisms that can be called species has long been recognized, the concept of what a species is, has changed many times in history. In modern views, it certainly is not a static entity, typified by some ideal form as was the idea in the 18th century. As has been shown, it rather is a genetically distinct group of natural populations that share a common gene pool and that are reproductively isolated from all other such groups. This species concept says nothing about how different each other two populations must be to qualify as separate species. Of course, most species can be separated on the basis of fairly obvious anatomical, physiological or behavioral characters, but the final criterion for living species is always reproduction. Morphological characteristics can only serve as clues towards the identification of reproductively isolated populations; they do not in themselves determine whether a population constitutes a species.

#### Systematics and Nomenclature

It will be clear from the previous paragraphs that application of this theoretical definition is very difficult. Only one thing is sure: the view of classical taxonomists, that personal judgement in deciding which characters should be considered and how they should be weighed in matters of nomenclature, is far too simple. Experience and subjective judgement are always involved, but the degree of subjectivity evident in classical taxonomy has motivated modern systematists to attempt to develop more objective methods. One of these new approaches to taxonomy is called phenetics or numerical taxonomy. It uses as many morphological characters as possible, weighs all characteristics equally in the expectation that if enough characteristics are compared, the subjective judgements will be unnecessary. Other modern ways to classify include molecular taxonomy, using the degree of hybridization of single-stranded DNA molecules of specimens of two species, or the amino acid sequences of proteins, or the DNA sequence itself.

Whatever technique or method used, modern biologists try to group individuals in species, and species into genera in a way that indicate evolutionary history as well. Doing so, a genus is a group of related species, but nobody knows how closely they are related. The "lumpers" like large genera and species with a certain range of variation without taxonomic designation, whereas the "splitters" prefer small compact genera, containing only species that are very closely related. They also designate certain variations as "subspecies" and "varieties".

The current system of classification and nomenclature dates from the Swedish naturalist Carl Linné (Latinized: Carolus Linnaeus), who lived from 1707 until 1778. His system already used kingdoms, classes, orders, genera and species. Phylum and family categories were added later. As Linné worked a century before Charles Darwin, he had no conception of evolution and thought that each species represented an immutable entity. He was simply grouping organisms according to similarities, primarily morphological.

The modern system of naming dates from Linné. He introduced the binary nomenclature of giving each species a name comprised of two words: first the name of the genus to which the species belongs, and second, a designation or that particular species.

How is this reflected in the taxonomy of cowries? Linnaeus listed 42 species of the single genus *Cypraea* in 1758. About 60 years later more than 100 species were known, and from those days the problems in taxonomy date.

In 1884, Jousseaume recognized no less than 36 genera, a number that was reduced to 6 by Thiele in 1931. However, Schilder and his wife soon afterwards introduced no less than 4 subfamilies, 31 genera, 16 subgenera, only to be surpassed by Steadman and Cotton in 1946, when they listed 13 subfamilies and 61 genera of cowries. Confusion was now complete. In the 1950's, Kay started the study of cowry anatomy in an attempt to correlate anatomy with classification. In the 1970's several authors reduced the number of valid species considerably. Burgess, 1970, proposed one genus for all true cowries and in 1985 recognized 202 species. In 1993, however, Lorenz and Hubert turned the clock back and re-introduced the taxonomy according to the German tradition as proposed by the Schilders, half a century before. In a later section I will go into more details and described the arguments of lumpers like Burgess and splitters like Lorenz and Hubert.

#### Examples of Variation in Cowry Species

After this theoretical introduction about the origin and meaning of variation among living organisms, and the subsequent difficulties for taxonomy, I will bring up in this section some examples of variation in shells of cowry species which I observed over the years by collecting specimens washed-up on beaches along the Indian Ocean. In the last section of this article I will discuss the difficulties for taxonomy which result from these data.

##### A. Variation in Size.

Differences in size between washed-up assemblages of cowries have been observed in a number of cases. I will mention only those cases in which statistical analysis of

species	location	average size	s.d.	number
<i>C. annulus</i> L. 1758	Seychelles	20.7 mm	3.1	103
	E. Java	18.7 mm	2.7	75
	S. Bali	20.8 mm	2.8	35
<i>C. asellus</i> L. 1758	Seychelles	16.6 mm	2.6	91
	W. Java	14.5 mm	1.6	75
	E. Java	16.0 mm	2.3	27
<i>C. caputserpentis</i> L. 1758	W. Java	31.5 mm	3.3	198
	E. Java	30.6 mm	3.3	147
<i>C. clandestina</i> L. 1767	Seychelles	12.0 mm	1.6	56
	S. Sri Lanka	14.3 mm	1.5	69
<i>C. felina</i> Gmelin 1791	S. Sri Lanka	15.3 mm	1.6	72
	W. Java	14.1 mm	0.6	35
<i>C. interrupta</i> Gray 1824	S. Sri Lanka	20.0 mm	1.6	100
	W. Java	18.6 mm	1.8	30
<i>C. isabella</i> L. 1758	W. Java	26.2 mm	3.6	205
	E. Java	24.6 mm	3.6	186
<i>C. lynx</i> L. 1758	W. Java	32.2 mm	4.3	236
	E. Java	28.5 mm	4.3	224
<i>C. moneta</i> L. 1758	Seychelles	21.3 mm	3.1	64
	S. Sri Lanka	19.6 mm	2.5	50
<i>C. nucleus</i> L. 1758	W. Java	19.0 mm	3.5	35
	E. Java	21.6 mm	2.2	52
<i>C. ocellata</i> L. 1758	S. Sri Lanka	20.5 mm	2.5	290
	S. India	22.8 mm	2.5	196
<i>C. staphylea</i> L. 1758	E. Java	16.2 mm	2.3	118
	S. Bali	17.5 mm	2.2	140

the material proved these differences to be significant, meaning that with a certainty of over 95% the observed differences are not the result of change, but must be contributed to a different factor.

From this list, it follows that on the whole the size of the significant larger population is 10% longer than the smaller, fluctuating from 3% in *Cypraea caputserpentis*, to 19% in *C. clandestina*. A big difference in size does not necessarily mean that a great distance between the populations is involved.

#### B. Variation in Shape.

To quantify differences in shape of the shell, I used the ratio width/length x 100 and called it the shape-index. For a few species I worked out differences in shape between populations from different locations.

1. *Cypraea asellus* L., 1758. I compared the shape-index of 78 specimens from West Java to 143 from the Seychelles. It was found that a majority of the shells from W. Java had a shape-index between 58 and 60, while on the Seychelles the majority had an index between 56 and 58. This means that shells from W. Java have a more



rounded shape than those from the Seychelles. Where in the Seychelles the width of the shell measures on the average 57% of its length, this percentage for W. Java is 59%.

2. *Cypraea ocellata* L., 1758. An assemblage of 290 specimens from South Sri Lanka and one of 196 specimens from Southern India, were compared. It was found that a majority of shells from Sri Lanka had a shape-index between 63 and 67, while in the assemblage from India the majority had an index of 63. From this, it follows that shells from Sri Lanka are rounder in shape than those from India. Where in Sri Lanka the average width is 65% of the length of the shell, this is only 63% in India.

3. *Cypraea carneola* L., 1758. 74 specimens from the Seychelles were compared to 42 from West Java. Even among these smaller samples, compared to the previous ones, a marked difference in shape was observed. Where the majority of shells from the Seychelles had a shape-index of 60, this index was 62 for West Java shells, indicating that then population from W. Java has rounder shells than the one from the Seychelles.

In all three cases, the difference in shape, expressed as the percentage of width compared to length, is of the same order. Like in the case of variation in size, it does not make a difference how far the populations of the species concerned, are apart. In case of the populations from W. Java and the Seychelles, the distance is 5,500 km., whereas populations from S. Sri Lanka and S. India are only 350 km. apart.

#### C. Variation in Width of Dorsal Bands

For separate populations of three species, I compared the total width of the transverse dorsal bands plus interspaces in relation to the length of the shell.

1. *Cypraea asellus* L., 1758. An assemblage of 95 beach-found shells from the Seychelles was compared to 94 washed-up specimens from W. Java. On the Seychelles, a majority had a total width of dorsal bands of 55-57% of the length of the shell. This percentage was 52-54 for the W. Java specimens. It seems that the dorsal bands of this species in the Seychelles occupy more of the length of the shell than they do in West Java.

2. *Cypraea carneola* L., 1758. Again a population from the Seychelles was compared to one from W. Java. However, in this species no difference was observed in the total width of the central dorsal bands when compared to the length of the shell. In both populations a majority of specimens ranged between 28 and 32%.

3. *Cypraea interrupta* Gray, 1824. Small populations from W. Java (N = 36) and S. Sri Lanka (N = 27) were compared. In this case the result is very obvious. In the specimens from Java, the total width of the dorsal bands plus interspaces, in relation to the length of the shell, was between 56 and 60%. However, for the specimens from Sri Lanka, this figure was between 64 and 68%. Another sample from the same location in S. Sri Lanka, collected four years later and comprising 227 specimens, fitted exactly in this result.

From the above data it is clear that the degree of variation between separate populations varies considerably for this characteristic. In the case of *C. interrupta*, the expression of the character discussed, varied with 17%.

#### D. Variation in Ocellated Spots

For two species the ocellated spots in two separated populations were compared.

1. *Cypraea ocellata* L., 1758. A shell assemblage of about 200 specimens from S. Sri Lanka and an equally large number from S. India were studied. A characteristic of the species are the white to light tan spots, many of them with a dark brown center, known as ocellated spots.

Per individual there is variability in the size of these ocellated spots; the size of the brown inner spot in relation to the size of the total spot; the size of the not ocellated, white spots. Between individuals of one population variability was found in the ratio ocellated : white spots; and the variability in size of the ocellated spots. Taken all this variability into account, it nevertheless was observed that the majority of specimens from India has less and smaller ocellated spots than found in the population from Sri Lanka.

2. *Cypraea helvola* L., 1758. Although this species has no ocellated spots in the sense of a spot with an inner part of a different color, there are brown and white spots on a gray-greenish dorsum that show a different, but clear kind of variation. About one hundred specimens from E. Java were compared to an equal number from the Seychelles.

Per individual there is variability in the size of the brown spots and the size of the white spots.

Between individuals of one population there is variability in the number of brown spots; and the distribution of the brown spots over the dorsum. This varies from uniform to only present on the lateral sides of the shell.

Between the populations from E. Java and the Seychelles variability was found in the number of brown spots. The majority of specimens from the Seychelles was found to have markedly less brown spots than specimens from Java.



### E. Variation in Pigmentation

In the Seychelles I noticed in 21 species of cowries a considerable number of specimens with less pigment than is considered normal for the species. Sometimes several grades of pigmentation were observed, running from very pale to normal. This phenomenon was not observed in Sri Lanka and only occasional in Indonesia.

### F. Intergrading Variation Between Species

In a number of cases I have shown how variable characters have been used for specific distinction in literature. As I will point out later, this must be regarded as unacceptable. If it comes to the distinction of valid species, only constant characteristics can be taken into account and variable characteristics must be regarded as intraspecific.

I will present four cases of this variability.

1. *Cypraea histrio* Gmelin, 1791 versus *C. grayana* Schilder, 1930. The characteristics for specific distinction between the two species: humped (*C. grayana*) versus not humped (*C. histrio*) and the absence (*C. grayana*) versus presence (*C. histrio*) of a prominent spire blotch appeared to be very variable and mixed. I came to this conclusion after studying 26 specimens of the *histrio-grayana* group from the Seychelles.
2. *Cypraea labrolineata* Gaskoin, 1849, versus *C. gangranosa* Dillwyn, 1817. Here again, the main characteristic for distinction between the species: dorsum with white spots together with the absence of color in the canals (*C. labrolineata*), versus brown spots and the presence of color in the canals (*C. gangranosa*) is not constant and all sorts of mixtures occur. This observation was made after studying about 100 specimens of the *labrolineata-gangranosa* group from Java and Bali.
3. *Cypraea pallida* Gray, 1824 versus *C. vredenburghi* Schilder, 1927. After examining 30 specimens of this group from E. Java, it was quite clear that the characteristics used for specific distinction: presence (*C. vredenburghi*) or absence (*C. pallida*) of a fossula and denticles, and presence (*C. vredenburghi*) or absence (*C. pallida*) of three brown embryonal bands were not at all constant, but intergrading and mixing.
4. *Cypraea hirundo* L., 1758 versus *C. ursellus* Gmelin, 1791. Careful examination of 116 specimens of this group from Java revealed once more the same. Species are distinguished by characteristics like color and the presence (*C. ursellus*) or absence (*C. hirundo*) of posterior ribbing. However, ribbing varied from very clearly present to

barely visible or faint lines only. Neither was color a constant characteristic.

In all four cases, I reached the conclusion that there are no constant conchological characteristics present to justify distinction at the species level.

Summarizing, from this paragraph two facts can be recognized. (1): between local populations of well accepted species significant differences in size and conspicuous differences in shape, dorsal bonding, spots and pigmentation occur, which are not reflected in the generally accepted taxonomy of cowries; and (2): in a number of cases, intergrading characteristics between specimens in the same population have been used for distinction on the species level. Both observations will be discussed in the next section.

### **Discussion**

First, I will present the arguments of a "lumper" and a "splitter". Next, I will try to indicate how the results of quantitative beach research can help to choose between the two standpoints. As a "lumper", I like to introduce Burgess. His *Cowries of the World* (1970, 1985) is well known among collectors. He starts saying that, as we all know, taxonomy and nomenclature of this group of mollusks are chaotic. He is of the opinion that due to the lack of other sources of information, it is necessary to utilize conchological characters in most of the presentation of the species. Burgess acknowledges extensive geographic variation, but in his opinion, this does not justify taxonomic designation. Neither does he accept minor conchological characteristics to distinguish what he calls "so-called" species, as in many cases these variations appear to be inconsistent and impractical to apply, just like I have demonstrated above. For these reasons, he only accepts 202 species of cowries and at the same time, doubt the validity of quite a few. In his own words, "Conchological characteristics used in species determination should be consistent and of such magnitude that they can readily be seen and illustrated." From anatomical studies like those done by Kay (1957, 1959, 1964), he draws the conclusion that taxonomic grouping of the cowries into subfamilies, genera and subgenera as done by Schilder (1939, 1941, 1963), Cotton and Steadman (1946) and Allen (1956) has no anatomical basis and therefore is meaningless and misleading. This lack of anatomical differences between groups of cowries made him decide to revert to the use of the Linnaean genus *Cypraea* for all cowries. As a last consequence of his view, he is not afraid to recognize that "The entire taxonomy of the Linnaean *Cypraea* must be revised, as a result of which the species list materially may be reduced." Many species, now only recognized chiefly by variations in the distribution of spots or color would then be eliminated. These remarks make the lumpers standpoint quite clear.

Let us now turn to the splitters. For this view, I introduce Lorenz and Hubert. They follow, in their work A Guide to Worldwide Cowries (1993) the taxonomy introduced by Schilder and Schilder (1971) in their Catalogue of Living and Fossil Cowries. The Schilders proposed division of the family Cypraeidae into 4 subfamilies, 11 tribes, 22 sections, 46 genera, 72 subgenera and 405 species. The only alteration Lorenz and Hubert make is the removal of the level of subgenus, a level they describe as clumsy.

The justification for the endless lists of names is their opinion that "Those with specialized interest in cowries usually prefer a more differentiated scheme". Also, molluscan species, in their opinion, can never be based on the rigorous definition of it, but rather on intuition and reasoning. They feel that whether the cowries form a genus or a subfamily cannot be decided or disproved. The only condition a system must meet is that it must be compatible with the evolutionary process. It is from this premise that they introduce large genera with a small number of levels. But there is also a personal element involved when they say "We feel that a structural treatment is, after all, to be preferred to the unstructural approach which is used by Burgess".

Back to the species once more. Where Burgess demands clear, constant and distinct characters for distinction on the species level, Lorenz and Hubert are very subjective, their concept of specific or non-specific ranks "Is merely a suggestion based on our own observation".

Based on this subjectivity they use the term subspecies as "A segment of a species that is constant in general features separating it from the typical population."

From their need for structural treatment, they also classify all varieties and forms, but surprisingly enough, do so "As a service to collectors." These designations are without taxonomic significance. So far about the splitters views.

Finally, let us examine the contribution quantitative beach research can have in choosing between both taxonomic views. When the splitters demand "constant general features", even for designating subspecies, it is obvious from the species I have studied, that such features usually do not exist. Even the characteristics they used for species distinction are proven to be not constant, as I have demonstrated for the *histrion-grayana*, *labrolineata-gangranosa*, *pallida-vredenbergi*, and *hirundo-ursellus* groups. Of course, the definition of a species as a group of interbreeding individuals can not be applied to the cowries, but at least there must be a clear and constant difference between groups of individuals in order to designate them as different species. In many cases no

anatomical, physiological or ethological information is available for taxonomic purposes, leaving only conchological characteristics to distinguish between groups. Such characteristics show natural variation as we have seen, and therefore, very often are of no use for distinction.

In my opinion, going this road in taxonomy is going an endless road by definition, with only the subjective interpretation of the author involved. Also, when the splitters indicate their system must be compatible with the evolutionary process, then in my opinion, such a view must be based on facts and not on subjective feelings in order to avoid endless interpretations, drifted away from all biological facts and premises I have discussed in the introduction.

At the same time significant differences in size, which I mentioned for separate populations of twelve species, are not recognized in the splitters taxonomy. This is not surprising, as these differences were not known due to lack of material. Should this new information be incorporated in the system of taxonomy? I don't think so. Such information will contribute to a better understanding of the evolution of cowries, but as long as not enough information is available, or as long as it is not clear whether certain characteristics are really distinct, taxonomy has to be kept as simple as possible. The consequence, indeed, is one Linnaean genus for all cowries. I hope to have demonstrated that no factual information permits the introduction of other levels, and definitely not so when these levels are poorly described, like "subgenus" and "subspecies".

If one regards taxonomy as part of the biological science, one had to take the consequences. Therefore, in my opinion, a modern biologist can only be a lumpner, leaving space for future knowledge, accepting incompleteness, and not essentially concerned with the interest of collectors and dealers. If one chooses for the splitters view, one has to keep in mind that this system is very arbitrary and designed to meet man's need for completeness. Therefore, I am afraid that both ends will never meet!

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## SHELLING UPDATE

Steve Rosenthal

This past spring I was fortunate enough to get out collecting for a full day on two separate occasions with a few other members of the Long Island Shell Club (New York). Thanks to information supplied by Rich Kelly we were able to take full advantage of two good weekend low tides.

Our first outing, on April 25, 1998, was to the area around the south end of the Ponquogue Bridge, in Shinnecock Bay. The area at the southeast end of the bridge produced the same species as at my previous visit, mostly "common" things like mud snails, mussels, etc., but also a few odd things like *Aligenia elevata*, *Lacuna vincta* and *Solemya velum* (the latter being found by Dave Johnson).

The area immediately to the southwest was more productive, and produced many of the same species as it had during my one prior visit, which had been quite brief as it came at the end of a winter day as darkness was falling (having been the last of several stops on that winter day). Our first success came as we hiked through the reeds to reach the small muddy coves along the shore. There were some large pieces of wood, and Romuald Czepulkowski noted that recently *Ovatella myosotis*, an air-breathing snail that favors such damp habitats, was becoming more common on Long Island. So naturally we each grabbed the end of the largest pieces of wood we could and flipped them over. Hey! The snails were actually there! We each began removing some from the bottoms of the two largest pieces of wood, only to have the euphoria disrupted a few minutes later by the sight of the first tick heading down the wood and towards me. A glance at the board Romuald was working with resulted in a similar discovery. I announced this to Romuald and we simultaneously headed to the safety of the bay!

Once at the bay, on this side of the bridge, we could see the effects of the low tide, as literally the whole cove was exposed by now (mid-afternoon). We quickly found the same species as from my previous visit, and, at the same spot, right by the shore. In fact, as the tide was so low, we were able to walk out quite far and Romuald and I agreed that the vast majority of what we found was, in fact, right by the shore! Species found included *Macoma balthica*, *M. tenta*, *Mulinia lateralis* and *Pitar morrhuana*. There were also quite a few freshly dead skates (is, the ones that swim) on the flats. Thus, on the basis of two visits this seems to be a consistently good place to find these burrowing bivalve species.

Our final stop this day was at the boat docks down by the Shinnecock Canal. On prior visits some club members had been able to obtain commercial species, such as

*Arctica islandica*, that were being brought in by the boats and loaded onto trucks. This time, as it was late in the day, there appeared to be no such activity. Nevertheless, in the middle of an empty parking lot Romuald found some debris that appeared to be of and/or from some old lobster pots, and we found a number of decent single valve and paired specimens of *Hiattella arctica*. During this, of course, a policeman cruised up to us in his patrol car to ask what we were doing. We barely even looked up from our work to address him (in retrospect I think we barely answered him at all) and I guess he realized these two guys sitting on the ground in the middle of an empty parking lot holding what probably to him looked like sand were harmless, so off he went. An amusing end to an enjoyable day.

My second major spring collecting trip was on Sunday, May 24, 1998. This was, again, a date corresponding to a good low tide. Of course it did not occur to us until the date actually approached that this would be the Sunday of the Memorial Day weekend!

A decision was made to try Ditch Plains and Montauk. Of course we knew that holiday traffic and parking restrictions could be a problem. And, as Frank Margiotta, Romuald Czepulkowski, my oldest daughter, Hilary, and I rumbled through the Hamptons, we did indeed hit the traffic. Being the first big weekend of the summer season, I guess that was inevitable.

We probably lost about a half hour to the traffic, but still arrived before the 1:30 PM low tide at Ditch Plains. Now, where to park? There is a parking area and a motel right there, but "NO PARKING" signs (without a town permit, except for motel guests) were everywhere, and seeing the same two truck at the two different places we considered parking at did not help either. After as much as a half hour lost to driving around, we finally found what looked like an ok place to park a few side streets away from the entrance to the beach at Ditch Plains, so we were able to hit the beach right in time for low tide. Indeed, the tide was really low and the day was absolutely beautiful. The water was warm and we immediately began exploring the rocky intertidal zone which was fully exposed. Frank found a live moon snail (*Lunatia heros*) stranded in a tidepool high up on the beach. As we headed just to the east we encountered the larger rocks and boulders, which were covered with barnacles, and snails! The fabled *Thais* (*Nucella*) *lapillus* were indeed present in good size (to about 40 mm) and large numbers, although there was not too much variety in color or pattern. A few were weakly scaled, a few were orange, and a few were banded, although all of these characteristics tended to turn up in juvenile or subadult-sized individuals. There were small but attractive oyster drills on many of the larger rocks too, plus mussels, etc. I had to admit this place did look a lot like some I had shelled in New England during my college days. While Hilary was having fun catching crabs under



the rocks, I started looking for limpets (*Notoacmaea testudinalis*) and in about an hour's time I managed to find eight, all alive and clinging to fairly small, clean, smooth rocks and pebbles in a few inches of water.

After about two hours here, with the tide coming in, we headed over to Montauk Inlet. Here the tide was still fairly low, and Romuald and Frank knew exactly where to go. Turning over rocks in a foot or two of water, the limpets were plentiful here, much more so than on the ocean. Oyster drills were also on the rocks and a good number of the white color form were present. The scene was quite colorful as many of the rocks had thick plumage of seaweed on them in all shades of green and brown, a veritable underwater forest. Also found, in large numbers, was *Lacuna vineta*, and Romuald took home several seaweed samples to be searched later for more *Lacuna* and small mussels and whatever else might be clinging to the seaweed.

On the way to the inlet we had spied what looked like some lobster traps behind a fence and some vegetation. As we drove back from the inlet we slowed down and saw them again. We pulled into a boatyard and drove to where we had seen the traps. Although there were some people around working on their boats, nobody seemed to care that we were there. There were a good number of lobster traps and the usual associated species in them, on them, or on the ground under and around them, such as dove shells, oyster drills, moon snails, etc. Romuald found a bare patch of ground that was covered with unusually good sized specimens of the prickly jingle shell, *Anomia squamula*. Some were as big as an inch or so, much bigger than any I had seen at Orient. The lobster trap that had formerly been at that spot must have been in the water a long time for the shells to get that big. While we were scouring the ground for the smallest stuff, Hillary came over with her finds. Among these was a complete and very decent waved whelk, *Buccinum undatum*! To my knowledge, this is the first good specimen that anyone from the club had seen from a lobster trap. The LI Monograph notes these have been trawled in fairly deep water off Long Island in the past.

It was surely fun to collect at some beautiful places on such a beautiful day, flirting with species like *Thais*, *Acmaea*, *Buccinum*, etc. that essentially reach their southern limits around Long Island, and it was an enjoyable day for all, despite the obstacles in getting started!

## HAROLD LEWIS 1927-1998

Harold "Hal" Lewis died on Monday June 15, 1998 at age 70. He was born November 7, 1927 in Philadelphia, Pennsylvania.

Hal was trained as a graphic designer and, in 1963, founded Hal Lewis Design, Inc., later renamed The Hal Lewis Group, at which he spent the rest of his professional life.

Hal was at one time an avid shell collector. The picture on pages 135-36 of *Kingdom of the Seashell* (Abbott, 1972) shows scallop shells from his collection. He was also president of the Philadelphia Shell Club in 1970-72, and a charter member of the Wilmington (Delaware) Shell Club (1972). He specialized in the Ranellidae, assembling one of the world's best collections of the group, and becoming a world authority on their taxonomy. He named several species of ranellids including *Cymatium boschi* Abbott and Lewis, 1972, *Distorsio constricta habeii* Lewis, 1972, *Distorsio burgessi* Lewis, 1972, *Gyrineum louisae* Lewis, 1974, and *Ranularia oblita* Lewis and Beu, 1976. At least two species have been named after Hal, *Distorsio (Distorsionella) lewisi* Beau, 1978 and *Sassia lewisi* Harasewych and Petuch, 1980. He donated his ranellid collection to the Academy of Natural Sciences of Philadelphia around 1975.

Gary Rosenberg, PhD. (on the internet)

## ENDANGERED CLAMS

All species of the bivalve family Tridacnidae are on the international endangered species list and thus are illegal to import into the United States. There is an exception made for specimens grown in aquaculture.

There are a number of places (some in the Solomon Islands) which commercially grow specimens for food, with a portion set aside to restock the reefs. While some species can be seen in "normal" quantity in some places, there are many areas where the species have been reduced to near extinction - caused by collection locally for food and for export as food. Palau is an example of where this has occurred.

(excerpts from Internet discussions)





Fig. 1. *Euglandina cumingi* devouring *Bulimulus unicolor*. The predator has entered the aperture of its prey while seizing and immobilizing it with the hind part of its foot. Then, with mouthparts everted, just visible through the transparent shell, is eating ever deeper into and through it as most of its foot will enter into the other snail's shell.

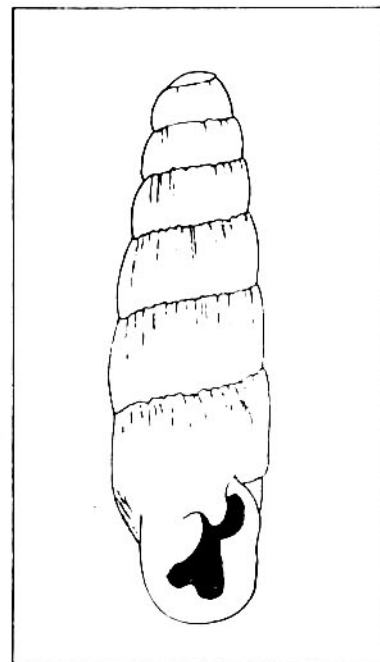


Fig. 2. *Huttonella bicolor*, (from Auffenberg & Strange, 1986). The shell itself is transparent, light brown, but the animal is bright orange. It hunts very actively for Subulinidae, especially *Subulina octona*, an agricultural pest.

***Huttonella bicolor* and *Euglandina cumingi*  
carnivores of the Nicaragua Tropical  
Snail World**

AL LOPEZ, S.J.

Wise Mother Nature knows how to regulate animal populations so they will not cause demographic explosions. Her methods, though quite effective, sometimes seem crude, even cruel to our human way of thinking, like the role of predators in nature, especially if they are cannibalistic, preying on their own kind.

The presence of snails in nature is usually discrete, hardly noticeable, often hidden under ground litter, but given the right conditions of humidity and food available, they can be incredibly numerous. Solem (1974) quotes the figure of between 4.5 to 11.5 MILLION snails "quietly scraping away at decaying leaves and bits of fungi" in a single acre of damp hardwood forest, and 566,000 snails and 87,000 slugs in an acre of open meadow. There is obviously need for some kind of control to avoid overpopulation, and in the world of mollusks we do have predators, whose job it is to ensure nature will not be overrun with snails or slimy slugs, the bane of gardeners and farmers.

In tropical Central America, among the large predators are the members of the Spiraxidae family, and the smaller,

even minute ones, belong in the Streptaxidae. For our present purpose the villains we will consider are *Euglandina cumingi* (Beck, 1863), of the first family (Fig. 1), and *Huttonella bicolor* in the second family (Fig. 2).

The *Euglandina* are good sized shells, some of them reaching 100 mm in Central America (Thompson, 1987). Though our *E. cumingi* is only half that size, it makes up for it in ferocity, and has an insatiable appetite to boot. The other killer, *H. bicolor* is a dainty, colorful little creature, 5 to 7 mm long, with a strange, convoluted aperture that is very bad news for the members of the Subulinidae family in the genera *Lamellaxis*, *Opeas*, *Leptinaria* and *Subulina*. These are a real pest and cause so much destruction in crops like sugar cane and pineapple by attacking the roots of these plants (Monie).

When the prey is small, *Euglandina* will simply swallow it, shell and all if it is a snail. For larger meals the process is more complicated and fascinating to watch (López & Pérez, 1998). A slug is tracked, dealt a cut that eviscerates it and cut up into pieces which are swallowed, while being held in a tight grip by *Euglandina*'s foot, and trashing violently all the time. In fact, by this reaction it is able to escape sometimes, but usually will not get very far, depending on the seriousness of damage inflicted by the *Euglandina*.

When *Euglandina* attempts to eat a larger snail it cannot swallow, like *Praticolella griseola* or *Bulimulus unicolor*, it is faced with the problem of getting inside the shell of its prey, often tough and resistant. There have been reports that it can drill the shell and consume the animal through the orifice, much like the marine *Natica* will do on bivalves (Harry, 1983). But the usual way we have observed is for it to evert its mouthparts and stretch out to a small diameter so it can fit into the aperture of the helpless prey which has withdrawn as far as it can (Fig. 2). Then at its leisure, *Euglandina* eats its way into and through the animal as deeply as possible, often to the very end of the gut. If the prey is too small, *Euglandina* may not be able to reach the last portion, and it remains uncaten as the predator emerges from its victim. Once outside, it is in no hurry to leave, but simply "curls up" and sleeps for a day or more, till it is ready for another meal.

When the intended meal is a prosobranch with a very tough horny or calcareous operculum, the problem of getting into the shell through the operc becomes quite thorny, although "horny" would be better said. Another of the apiraxid predators common to the Nicaragua rain forest, *Streptostyla turgidula*, deals with the difficulty by first gently psyching its victim to emerge from the shell and then using violence to sever its operculum, thus

opening the way to a forced entry and subsequent meal. The whole process lasts over 20 hours and has been recently described in fascinating detail (López and Pérez, 1998), which includes taking the pulse of the animal, a very human rate of 68 per minute.

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email alosi@ns.edu.uca.nic

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O.K., we'll just sit and wait for the tide to go out!

## SHOWS, Etc.

Jan. 16-17, 1999. Space Coast Shell Festival, Melbourne, Florida. Jim & Bobbi Cordy; 385 Needle Blvd.; Merritt Island, FL 32953. (407) 452-5736 or E-mail: CORDY@YOURLINK.NET

Jan. 22-24. Greater Miami Shell Show. Miami Beach, Florida. Lillian Shin; 14913 SW 104th St., Apt. 24; Miami, FL 33196. (305) 388-1467

January 30-31. 11th Paris International Shell Show. Paris, France. D. Wantiez; 88 rue du Général Leclerc; F-95210 Saint Gratien, France. Tel: (33) 134.170039 or G. Jaux; 3 rue Saint Honoré; F-78000 Versailles, France. Tel: (33) 139.538046

February 5-7. Naples Shell Show. Naples, Florida. Howard & Susan Roux; 152 Coral Vine Dr.; (941) 514-0541. E-mail: conchman@naplesnet.com

Feb. 12-14. Broward Shell Show. Pompano Beach, Florida. David Kempfer; 1685 NW 65th Ave.; Margate, FL 33063. (954) 970-3636. E-mail: seanotes@aol.com

Feb. 19-21. Sarasota Shell Club. Sarasota, Florida. Peggy Williams; P.O. Box 575; Tallevast, FL 34270 (941) 355-2291. e-mail: shellelegant@mindspring.com

Feb. 26-28. St. Petersburg Shell Show. Treasure Island, Florida. Betty & Bob Lipe; 348 Corey Ave.; St. Petersburg Beach, FL 33706. (813) 360-0586. E-mail: shelstr@gte.net

Feb. 27. Mid-Atlantic Malacologists. Delaware Museum of Natural History, Wilmington. Timothy A. Pearce, Curator of Mollusks; Delaware Museum of Natural History; Box 3937; 4840 Kennett Pike, 19807-0937. Tel. (302) 658-9111, ext. 319; Fax: (302) 658-2610. e-mail: tpearce@delmnh.org

March 4-7. Sanibel Shell Show. Sanibel Island, Florida. c/o Jon Greenlaw; 2813 SW 43rd Lane; Cape Coral, FL 33914. (941) 454-8659. E-mail: jsg@lline.com

March 11-13. Marco Island Shell Club Show XIX. Marco Island, Florida. Sharon Rice; 1283 Treasure Court; Marco Island, FL 34145. (941) 389-2903

April 17-18. 1st International Shell Show. Tokyo, Japan. ISSJ Office 6; 36 Midoricho 3 chome; Tanashi City; Tokyo 188-0002, Japan. (81) 424.61.1752.

April 25-26. Port Phillip Bay Shell Group Shell Show. Melbourne, Victoria, Australia. Chris Bunyard; 21 Hillcrest Road; Eltham North, Vic. 3095, Australia. (3) 94 39 31 47

May 8-9. IX Belgium International Shell Show. Aarschot, Belgium. R. De Roover; Vorsterslaan 7; B-2180 Ekeren-Donk, Belgium. (3) 644-3429

June 12-13. XVIIème Salon International du Coquillage. Lutry, Switzerland. Dr. ted W. Baer; CH-1602 La Croix, Switzerland. (21) 791-3771 or Fax: (21) 792-1411

June 12-13. Oregon Shell Show. Portland, Oregon. Tom & Maxine Hale; 347 NE 136th Ave.; Portland, OR 97230. (503) 253-5379

June 13-17. Western Society of Malacologists California State University, Fullerton, California Lindsey T. Groves, Malacology & Paleo. Sections; Natural History Museum, LA County; 900 Exposition Blvd.; Los Angeles, CA 90007. Tel: (213) 763-3376 or e-mail: lgroves@nhm.org

June 21-26, 1999. 16th Baltic Marine Biologists Symposium Klaipeda, Lithuania. Secretariat: Centre for System Analysis; Klaipeda University; Manto 84, LT-5808 Klaipeda, Lithuania. E-mail: bmb16org@hgf.ku.lt

June 27 - July 1, 1999. Conchologists of America Louisville, Kentucky. Gene Everson; 500 Nottingham Pkwy.; Louisville, KY 40222. (502) 253-5379. E-mail: AmConch@ix.netcom.com

July 4-8. American Malacological Society\* 65th Annual Meeting Pittsburgh, Pennsylvania. Robert S. Prezant; Office of the Dean; Div. Mathematics & Natural Sciences; Queens College of the City University of New York; Flushing, NY 11367-1597

\* new name for American Malacological Union

September 6-9, 1999. V International Symposium on Cephalopods - Present & Past. Vienna, Austria; Dr. Kathleen Histon; Geologische Bundesanstalt; Raasdorfsgasse, 23; A-1031 Wien, Austria. Tel: 43-1-712567416; Fax: 712567456

September 6-10, IV Congreso Latinoamericano de Malacología (IV CLAMA). Coquimbo, Chile. Comité Organizador del IV CLAMA y III EIMCH; Casilla 117; Coquimbo, Chile. Fax: (56) (51) 209812

September 14-17, 1999. The Biology & Evolution of Bivalves. Cambridge, England. Malacological Society of London hosts "The Biology and Evolution of Bivalves". E.M. Harper; Dept. Earth Sciences, Downing St., Cambridge CB2 3EQ, U.K. Tel: 1223 332846; 1223 333450; e-mail: amh21@cus.cam.ac.uk

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**BOOK REVIEW***The Search for the Giant Squid*

Richard Ellis. 1998. 322pp

The Lyons Press (NY). Hardcover. \$35.00

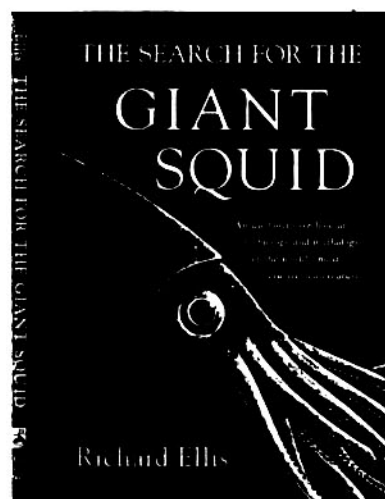
The estimable Richard Ellis has written another excellent book about deep sea life, this time concentrating on that elusive creature, the giant squid. His previous works include *The Book of Sharks*, *Monsters of the Deep* and *Deep Atlantic*. *The Search for the Giant Squid* starts with the history of sea monster reports and sightings that might be attributable to giant squid. It then goes on to describe the biology of the beast, its taxonomy, the status of current knowledge about the animal, descriptions of other large squid, giant squid in literature and cinema, and models of giant squid, mostly in museums.

A plethora of giant squid stranded on the shore of Newfoundland in the 1870's sparked the modern interest in the world's largest invertebrate and largest mollusk. The giant squid still has never been seen alive, and the only specimens we have are from such strandings, from fishermen's nets, or from sperm whale stomachs or regurgitations. Stranded giant squid made a splash with early malacologists and the public. The carcasses were shown in museums and aquariums. There was a flurry of taxonomic activity at that time dealing with giant squid; no less than 18 species of *Architeuthis* were described. *Architeuthis* means "first squid," indicating it was the largest. Today, some scientists believe there is only one species - *A. dux*, ranging worldwide.

There was another flurry of strandings in Newfoundland in the 1960's. Noted teuthologist Frederick Alderich postulated there was a 90 year cycle in fluctuations in the Labrador Current responsible for casting these monsters on the shore.

More recently, in the 1990's, numerous giant squid were found "stranded" or trawled up by fishermen in New Zealand. This is an area where numerous sperm whales are found. Sperm whales are the main predator on giant squid. A recent expedition in search of the giant squid concentrated on this area because of the congregation of sperm whales there, but it came up empty-handed, in spite of using modern technology such as "critter cameras" mounted on whales and ROV's such as those used to find the *Titanic*.

Ellis debunks many of the myths associated with giant squid and verifies the few facts we do know about the beasts. We know the largest ever found was 57 feet long and must have weighed more than half a ton (most of this length is contained in its two long snaky tentacles). The eyes of the giant squid are the largest of any in the animal kingdom, up to 15 inches in diameter. The size of their suckers has been greatly exaggerated. Accurate reports of



sucker scars on whales and measurements of known squid specimens show the suckers to be up to 1½ inches across. While *Architeuthis* have teeth on the outer edge of their suckers, there are no chitinous hooks on their grasping tentacles (perhaps a monster squid 50 feet long doesn't need hooks to catch its prey!). No one has ever been killed by a giant squid, despite what has been depicted in literature and cinema.

Ellis compiles all known authenticated giant squid sightings and strandings, and gives us an extensive and comprehensive bibliography about the famed and infamous beasts. The book is profusely illustrated with historical illustrations, photographs and Ellis's own exemplary artwork. His writing style is an easy and entertaining read. I highly recommend this book to anyone who is intrigued by the earth's only true sea monster - the giant squid.

**REVIEW BY ROLAND ANDERSON**

The Seattle Aquarium

**International Workshop of Systematics, Phylogeny and Biology of Opisthobranch Molluscs**

To be held in Menfi, Sicily (Italy) from June 10 to 14, 1999. For further information contact Dr. Juan Lucas Cervera at: Facultad de Ciencias del Mar, Universidad de Cadiz, Ploigono del Rio San Pedro s/n Apdo. 40, E-11510 Puerto Real, Cadiz, Spain. Information will also be available at the following web sites:

<http://www.futurallink.it/vannarotolo> and  
<http://www.aicon.com/sim>

(from *The Festivus* XXXI(1) published by the San Diego Shell Club)



# ANOTHER *OCTOPUS GIGANTEUS* REBUTTAL - AGAIN! -

Gary S. Mangiacopra

In a recent issue of *Of Sea and Shore* (21:1:52), another article was reprinted in regards to the still ongoing debate on the infamous *Octopus giganteus* controversy concerning the correct zoological identification of what this 1896 beach carcass was. The reprinted article, originally published in Harvard University's *Occasional Papers on Mollusks* (5:76:456-57) by Dr. Richard I. Johnson of that school's Department of Mollusks, took the position that this 5-ton carcass was not an invertebrate (i.e. a giant octopus) based upon the test results conducted by Pierce, et al (1995).

In a prior paper, published in this same journal (5:67:1-143) ten years ago, Dr. Johnson had listed *Octopus giganteus* as a valid species of truly gigantic proportions. A position he only recently retracted in his most recent article on the subject.

Upon first reading of the *Of Sea and Shore* reprinted article, one would assume that this giant octopus controversy was finally settled. However, inquiries by this author to Dr. Johnson concerning his change of position revealed, instead, that things were not as they first seemed.

Dr. Johnson, in 1989, had published a very lengthy listing of 550 molluscan taxa which had been introduced by several researchers, one of whom was Professor Addison Emery Verrill, proposer of *Octopus giganteus*. The listing was as follows:

*giganteus* Verrill, *Octopus*

1897, *AJS* (4) 3: 163 (not figured) (beach, some miles south of) St. Augustine, Florida); 1897, *The American Naturalist* 31:364, pls 7,8, Fragment in USNM (lost) tests Gennaro (1971) who along with Mackal (1986) determined from a sample that it was an *Octopus*

Dr. Johnson included this reference, as he later confirmed to this author, since Harvard University receives the International Cryptozoology Society's annual journal *Cryptozoology* and in the 1986 issue an article presented the test results from the preserved tissue of this 1896 carcass by Dr. Roy P. Mackal. However, while Johnson had tried to include all of Verrill's molluscan taxa, he made no comments as to their validity.

In his brief retraction of 1998, Johnson quoted references that were supplied by a Dr. Alan R. Kabat. However, Dr. Kabat apparently did not possess all copies of the papers done by this author and published in this journal (18:1:5-12, 1995), nor, critically, the very lengthy open forum rebuttal (19:1:45-50, 1996) in which Pierce's test results were questioned.

Neither was Johnson aware of the final Part IV of the update series published in the Canadian *Cryptozoology Review* (1:3:13-18, 1997). This, in addition to numerous other articles pertaining to this giant octopus controversy published in many obscure American and foreign journals and magazines.

It is literally impossible for any researcher to have in his possession all the available information on a topic, especially if such sources are scattered in many references. It appears this was the situation here.

Upon receiving copies of these additional publications, Dr. Johnson replied: "I will study it carefully, and will not write anything more on the subject, without taking it into consideration." And concluded with a final optimistic comment: "I hope you eventually find another specimen."

In summary, the pro and con debate on this 1896 finding is still ongoing into the 21st century. Until further testing can be conducted on the still-surviving tissue samples to resolve its identification, the acceptance and rejection of this cephalopod's existence will remain a controversy.

## Acknowledgements

I wish to thank the following persons for their help in this matter:

Michel Raynal, of Franconville, France

Dr. Richard I. Johnson, Department of Mollusks, Harvard University, Cambridge, Massachusetts for his review and comments on this rebuttal.

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Answers to "Let's Look for Authors" pg. 206

1. There was a gloomy pall as the cortege rolled along.
2. Down by the river rill and weeping willows I first met you.
3. Tony Randall starred in The Odd Couple.
4. My TV has a gremlin next to the picture tube.
5. The capital of NY state is Albany, not Schenectady.
6. I think I ran my very best race yesterday and this morning.
7. That Lothario will woo doxies, lassies and dolls.
8. The village of Old Saybrook, CT, is picturesque and rustic.

9. She was grinning from ear to ear with a bee in her bonnet.
10. The girls went to Hobart School and the boys to Penn Academy.
11. The policeman in Basra fines queen the equivalent of \$500.00.
12. Penn State vowed to break OSU getting more TDs and fewer penalties.
13. He finally had a M.S. degree in malacology.
14. I'll bring food and silver if you'll grab bottles and ice.

#### B. Find the twisted authors.

(Example: it was clearly a simple case of fraud.)

1. With Cromwell it was always a matter of winning battles.
2. I just met Jacques but Rene I k now from kindergarten.
3. The leering satyr, reprehensible critter that he was, took off after the maidens.
4. I wonder why my brew ossified in the vat.
5. Open sesame, open. Ah suddenly a golden palace appeared.
6. Joseph steered her around the puddle.
7. Enamel, a derivative of who knows what, is usually glossy.
8. Hieronymus, Cavendish and Joslyn, G.I. brothers of Guinevere, all perished at Barino Bay.
9. Climbs up very high - cut epiphytes and parasites off the limb.
10. Wherever you see S.A.E., please write the name Society of Automotive Engineers.
11. Again, Ali will rise, KO Valdez, and become champ.
12. Although the shell was very red, no paint had been applied.
13. It's easy to miss a white epitonium hiding in the sand.
14. When you dial WNOS remember it is a country western station.



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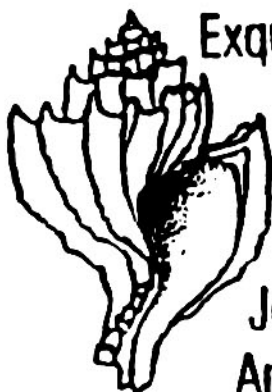
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