ISSN 0738-9388

Volume: 56 THE FESTIVUS ISSUE 3

Newly Identified Melanistic and Rostrate form of *Monetaria caputdraconis* from Easter Island

David B. Waller [1] & David P, Berschauer [2]
[1] 817 Kalpati Circle, Unit 113, Carlsbad, CA 92008 dwaller@dbwipmg.com
[2] Museum Associate, Santa Barbara Museum of Natural History
2559 Puesta del Sol, Santa Barbara, California 93105 shellcollection@hotmail.com

ABSTRACT A newly discovered population of *Monetaria caputdraconis* has been identified on Easter Island. This new population has a high occurrence of specimens expressing morphology that appear both melanistic and rostrate, and is named herein *Monetaria caputdraconis* form *darkini*. It is suggested that the geology of the island, which comprises Roiho basalt containing olivine tholeiite with relatively high concentrations of heavy metals, may contribute to this unique morphology.

KEY WORDS Cypreaidae, *Monetaria caputdraconis*, *Monetaria caputdraconis* f. *darkini*, melanistic, rostrate, Easter Island

INTRODUCTION

Easter Island (locally called Rapa Nui by native islanders) is located on the extreme southeastern corner of the Polynesian Triangle, and is comprised of a single volcanic island and several adjacent islets and rocks. Rapa Nui is almost as far from its nearest neighbor, Pitcairn Island, as it is from the Chilean coastline and is the farthest eastern part of Polynesia. Rapa Nui and its small neighboring island Salas y Gómez to the east-northeast comprise the Rapanuian Molluscan Province and contain a large number of endemic species (Petuch & Berschauer, 2021). Rapa Nui has a large number of endemic cypraid species, which include: *Monetaria caputdraconis*, *Monetaria caputdraconis poppei*, *Cribrarula garciai*, *Naria englerti*, and *Naria leforti* (Petuch & Berschauer, 2021). Intrepid diver and naturalist Val Darkin recently found and provided the authors with a number of specimens of melanistic and rostrate *Monetaria caputdraconis*, which he collected intertidally on the windward side of Rapa Nui, living mixed in a normal *M. caputdraconis* population. These newly found melanistic and rostrate *Monetaria caputdraconis* are given a new form name herein, and the possible causal factors of this morphology are explored. The holotype and paratype no. 1 will be deposited in the Santa Barbara Museum of Natural History and will bear SBMNH numbers.

MATERIAL EXAMINED

Fourteen specimens of melanistic and rostrate *Monetaria caputdraconis* collected by Val Darkin intertidally on Rapa Nui were examined in this study and compared to normal *Monetaria caputdraconis*, and *Monetaria caputdraconis poppei.*

SYSTEMATICS

Class:	Gastropoda Cuvier, 1795
Subclass:	Caenogastropoda Cox, 1960
Order:	Littorinimorpha Golikov & Starobogatov, 1975
Superfamily:	Cypraeoidea Rafinesque, 1815
Family:	Cypraeidae Rafinesque, 1815
Subfamily:	Erosariinae Schilder, 1924
Genus:	*Monetaria* Troschel, 1863

Monetaria caputdraconis Melvill, 1888
(Plate 1, Figures I-L; Figure 1)

Original Description. "*C. caput draconis* (*sp. nov*). C. testa ovata, convexa, solida, dorso elevato-rotundo, apertua latiore quam in C. capite serpentis, dentibus utrinque quinquedecim, dorso brunneo confuse et obscure reticulato, lateribus strictis, nequaquam depressis, extremitatibus cinereo-nigris, dentibus cinereo brunnescentibus, basi et aperturae fauce brunneonigris." (Melvill, J. C. 1888). A survey of the genus *Cypraea* (Linn.) its nomenclature, geographical distribution and distinctive affinites; with descriptions of two new species and several varieties. Memoirs and Proceedings of the Manchester Literary and Philosophical Society. 1890-1891, ser. 4, 1: 184-252.)

Translation. "*Cypraea* shell ovate convex, solid, raised-rounded back, opening wider than in C. snake's head, fifteen teeth on each side, brown back confusedly and darkly reticulated, narrow sides, not at all depressed, gray-black extremities, teeth brownish gray, base and the opening of the throat is brown-black." (Translation by Google)

Figure 1. *Monetaria caputdraconis* (Melville 1888), Anakena Beach Easter Island, 34.2 mm in length, in the David Waller collection.

Size Range. 15.0 to 45.0 mm in length.
Type Locality. Endemic to Rapa Nui (aka Easter Island).

Monetaria caputdraconis poppei (Martin 1989)
(Plate 1, Figures F-H; Figure 2)

Original Description: "Shell with the dorsal part of a milky white colour. The variability in colour is very slight from one specimen to another. The sides are obscured, the dorsal spots, characteristic of *E. caputdraconis* (Melivll, 1888) are just visible; they are almost completely invisible on the top of dorsum and reappear more clearly, but they are always faint, on the sides. The dorsal line is spread out, wide but difficult to distinguish. The base is concave, light brown in colour. The teeth are short, strong and white, as are the interstices. The aperture is arched on the anterior canal so that the fossula, of a uniform white colour, can be easily seen." (Martin 1989).

Figure 2. *Monetaria caputdraconis poppei* (Martin, 1989) Salas y Gómez, 24.0 mm in length. (Image from Rotterdam Museum, NMR 73315).

Size Range. 14.0 to 46.0 mm in length.
Type Locality. Endemic to Salas y Gómez.

ISSN 0738-9388

Monetaria caputdraconis form *darkini*
Waller & Berschauer, new form
(Plate 1, Figures A-E, Plates 2 and 3; Figure 3)

Description. Surface of dorsum textured and non-uniformly dark brown in color; extent of dark brown coloration depends on degree of melanization; perimeter edge coloration and distinct separation from the dorsal pattern are obscured; perimeter edge and dorsum of shell usually uniform in color and texture; dorsal spotting characteristic and dorsal line reduced or completely obscured based on extent of dorsal melanization; base concave, brown in color with lighter brown window on base reaching just beyond teeth about center of columellar side; short strong teeth; teeth and interstices cream to white in color; aperture arched, wider near anterior canal; fossula uniform color cream or white; anterior end often bulbous, extended laterally outward, bending downward from base of shell; anterior end extensions cream to brown in color.

Figure 3. *Monetaria caputdraconis* form *darkini.* South southeast side Rapa Nui (aka Easter Island), Paratype 4 measuring 36.1 mm in length, in the Val Darkin collection.

Type Material. Holotype SBMNH No. 235866 measuring 42.8 mm in length, 24.7 mm in width, and 19.1 mm in height; Paratype 1 SBMNH No. 235867 measuring 43.8 mm in length, 24.5 mm in width, and 17.5 mm in height; Paratype 2 in the research collection of the senior author measuring 39.5 mm in length, 23.2 mm in width, and 16.8 mm in height; Paratype 3 in the research collection of the junior author measuring 37.0 mm in length, 23.2 mm in width, and 17.0 mm in height; and, Paratypes 4 through 13 in the collection of Val Darkin, whose length, width, and height measurements in millimeters are set forth below:

	Length	Width	Height
Paratype 4	36.1	22.1	15.0
Paratype 5	46.4	26.0	18.3
Paratype 6	38.4	20.5	15.2
Paratype 7	38.4	23.5	16.9
Paratype 8	41.2	22.7	16.8
Paratype 9	39.4	25.8	18.0
Paratype 10	39.6	25.6	17.7
Paratype 11	31.4	19.9	14.5
Paratype 12	36.6	24.7	17.5
Paratype 13	32.0	20.8	15.1

Size Range. 36.0 to 47.0 mm

Type Locality. Collected live on volvanic rocks on the south southeast side of Rapa Nui intertidally from 0-3 meters.

Etymology. The name given to this form is in honor of Val Darkin of Vladivostok Russia an accomplished diver and avid shell collector who collected these specimens and donated the type specimens.

COMPARATIVE DIAGNOSIS

Monetaria caputdraconis form *darkini* differs from *M. caputdraconis* (Melvill 1888) and *M. caputdraconis poppei* (Martin 1989) in having extended anterior termini, thickening of the dorsal anterior end becoming bulbous in the most extreme cases, (Plate 2, Figures B & G, and Plate, Figures B & G) often with a dark textured enamel coating covering the dorsum and partially or completely hiding the regular dorsal pattern (Plate 1, Figure A, Plate 2, Figures A & F, and Plate 3, Figure A). While both *M. caputdraconis* (Melvill 1888) and *M. caputdraconis poppei* (Martin 1989) have relatively flat bases, the anterior terminal ends of *M. capurdraconis* form *darkini* often extend downward from the base of the shell (Plate 1, Figure C, Plate 2, Figure C & H, and Plate 3, Figures C & H).

DISCUSSION REGARDING PRESUMED CAUSATION

Populations of Cypreaidae species having a high occurrence of melanistic and rostrate morphology have been known for some time. In 1977, J.M. Chatenay published "Porcelaines Niger et Rostrees de Nouvelle Caledonia" and provided a comprehensive review of the niger and rostrate cypreaidae species of New Caledonia. Situated between the Tropic of Capricorn and the Equator, also referred to as the New Caledonian archipelago, New Caledonia is emerging from the ocean due to the tectonic plate subduction zone between New Caledonia and Vanuatu as the New Caledonia basin meets the Loyalty Ridge (Figure 4). Nickel (Ni), cobalt (Co) and magnesium (Mg) ore minerals are enriched in laterite, a material forming at the lower part of the weathering profile of the Peridotite Nappe (Maurizot, *et. al.,* 2020). The tropical climate provides perfect conditions for its formation through hydrolysis of olivine and pyroxenes in the rock (Pirard, 2007). This ore is often found in areas of high volcanic activity along with other ores enriched with chromium (Cr), manganese (Mn) and iron (Fe). It is believed that the increased concentration of these metals in the environment contributes to the large number of Cypreaidae species, which have been found exhibiting melanistic and rostrate morphology.

While Easter Island's geology is different from the geology of New Caledonia, the resulting exposure of similar geologic formations may cause or contribute to a similar effect on Cypreaidae species in this region. Easter island is located about 350 km east of the East Pacific Rise and lies within the Nazca Plate, bordering the Easter Microplate. The Nazca-Pacific relative plate spreading movement (~150 mm per year) has resulted in the Easter Seamount Chain, which merges into the Nazca Ridge further to the east. The island is the result of the amalgamation of three volcanoes that erupted between about 0.78 Ma to 0.11 Ma and is located a few hundred kilometers east of the southern East Pacific Rise spreading center (Figure 4). It is speculated that Easter Island is positioned on a potentially new plate boundary and the thin mantle in this region creates a "hotline" resulting in increased volcanic activity west of Easter Island, amidst the Ahu, Umu and Tupa submarine volcanic fields and the Pukao and Moai seamounts. The island's youngest flow, the Roiho basalt, is olivine tholeiite with distinctly more alkaline affinities and relatively high contents of Ni, Mg, and potassium (K) (Baker *et al.,* 1974). There is no industrial run off, man made structures, or shipwrecks in the vicinity of where these *Monetaria caputdraconis* f. *darkini* specimens were found (Val Darkin, personal communications). It is proposed that the concentrations of these heavy metals in the region may contribute to the melanistic and rostrate morphology of this population of *M. caputdraconis*.

An alternative hypothesis is that the melanistic and rostrate specimens are suffering from a viral infection. However, if the viral infection hypothesis were in fact seen in the environment, one would expect to see it spreading throughout any given localized population. That is not the case here, as the form *darkini* specimens are found side by side with normal specimens in their habitat, albeit in very low numbers (Val Darkin, personal communication).

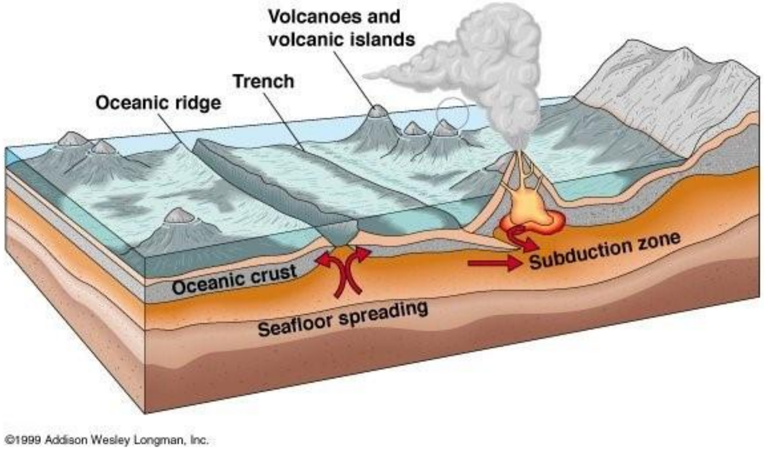

Figure 4. Diagrammatic representation of plate tectonics showing seafloor spreading and subduction. (https://www.mun.ca/biology/scarr/Plate_Tectonics.html Image prepared by Addison Wesley Longman, Inc. 1999. Fair Use Doctrine claimed herein).

Easter Island lies atop the Rano Kau Ridge and consists of three shield volcanoes with parallel geologic histories. Poike and Rano Kau exist on the east and south slopes of Terevaka, respectively. Rano Kau developed between 0.78 and 0.46 Ma from tholeiitic to alkalic basalts. This volcano possesses a clearly defined summit caldera. Benmoreitic lavas extruded about the rim from 0.35 to 0.34 Ma. Finally, between 0.24 and 0.11 Ma, a 6.5 km (4.0 mi) fissure developed along a NE–SW trend, forming monogenetic vents and rhyolitic intrusions. These include the cryptodome islets of Motu Nui and Motu Iti, the islet of Motu Kao Kao, the sheet intrusion of Te Kari Kari, the perlitic obsidian Te Manavai dome and the Maunga Orito dome.

Poike formed from tholeiitic to alkali basalts from 0.78 to 0.41 Ma. Its summit collapsed into a caldera that was subsequently filled by the Puakatiki lava cone pahoehoe flows at 0.36 Ma. The trachytic lava domes of Maunga Vai a Heva, Maunga Tea Tea, and Maunga Parehe then formed along a NE-SW trending fissure (Vezzoli & Acocella, 2009).

Rano Raraku and Maunga Toa Toa are isolated tuff cones of about 0.21 Ma. The crater of Rano Raraku contains a freshwater lake. The stratified tuff is composed of sideromelane, slightly altered to palagonite, and somewhat lithified. The tuff contains lithic fragments of older lava flows and the northwest sector of Rano Raraku contains reddish volcanic ash. (Bandy, 1937).

Terevaka formed around 0.77 Ma of tholeiitic to alkali basalts, followed by the collapse of its summit into a caldera. Cinder cones formed along a NNE-SSW trend on the western rim about 0.3Ma and porphyritic benmoreitic lava filled the caldera. Pahoehoe lava flowed towards the northern coast, forming lava tubes. Lava domes and a vent complex formed in the Maunga Puka area, while breccias formed along the vents on the western portion of Rano Aroi crater. This volcano's southern and southeastern flanks are composed of younger flows consisting of basalt, alkali basalt, hawaiite, mugearite, and benmoreite from eruptive fissures starting at 0.24 Ma. The youngest lava flow, Roiho, is dated 0.11 Ma. (Vezzoli & Acocella, 2009). The Roiho basalt, is composed of olivine tholeiite with distinctly more alkaline affinities having relatively high contents of Mg, Ni and K. (Baker *et al.,* 1974) (Figure 5).

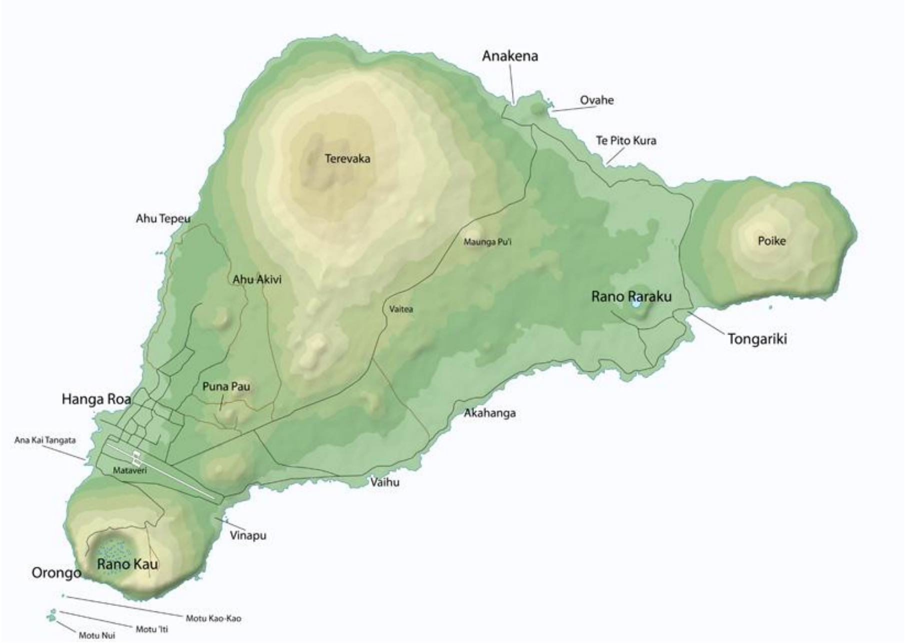

Figure 5. Topographical representation of Easter Island (www.easterisland.travel. Fair Use Doctrine claimed herein).

It is hypothesized that the melanistic appearance of the dorsum of these shells is due to the effects of heavy metal concentrations in the environment at this population's location, *i.e.* that the morphology exhibited by these shells is an ecophenotype. More specifically, it affects the genetic expression of certain proteins and enzymatic reactions involved in the deposition of pigment. Of the heavy metal containing enzymes that could be affected, Urease may be the likely protein involved in the deposition of pigment in mollusks. Urease is not produced in humans, but does occur in some invertebrates, specifically mollusks (en.wikipedia.org/wiki/Urease - re: biomineral-ization and promoting the formation of calcium carbonate). "Urease contains a di-nuclear nickel metallocenter that catalyzes the decomposition of urea to produce ammonia" (Carter *et al*., 2009).

Further, aqueous ammonia production in solutions containing iron produces dark iron oxides. More specifically, aqueous ammonia reacts with Fe(II) ions to produce white gelatinous $Fe(OH)_2$ that oxidizes to form red-brown $Fe(OH)_3$." "Ammonia also reacts with Fe(III) ions to produce red-brown $Fe(OH)_3$." (Birk, J.P., 2023). Consequently, if Urease is hyperactivated by higher levels of heavy metals in the environment, increasing production of ammonia, then the presence of iron in the environment could result in increased production of iron oxides. Further research is required to determine if this may be the mechanism of action. However, if iron oxide is responsible for the melanistic appearance of these shells then determining the concentration of iron present in affected versus unaffected shells could provide an answer.

Alternatively, these darker areas could be the effect of over deposition of melanin. This black/brown pigment in humans “is localized in melanosome (membrane-bound organelles) found in melanocytes in the basal layer of the epidermis. Melanosomes contain tyrosinase, a major enzyme involved in melanin synthesis. They are responsible for melanin pigmentation in the skin and can be influenced by genetic, hormonal, and environmental factors, which all play a role in levels of melanization.” (Lambert *et al.,* 2019) Tyrosinase is a copper-containing enzyme “that catalyzes the production of melanin and other pigments from tyrosine by oxidation. It is found inside melanosomes, which are synthesized in the skin melanocytes. All tyrosinases have in common a binuclear, copper center within their active sites. If uncontrolled during the synthesis of melanin, it results in increased melanin deposition.” (en.wikipedia.com/wiki/Tyrosinase)

Metalloenzymes like tyrosinase are broadly distributed in nature and cover a spectrum of activities (Torres & Ayala, 2013). “The metals required for a specific task vary depending on the nature of the reaction. Heavy metals such as Mg^{2+}, Ca^{2+}, Zn^{2+} and Mn^{2+} are mostly useful for substrate activation by coordination or electrostatic field, whereas Fe^{2+} and Cu^{2+} are commonly employed in redox catalysis (Andreini *et al*., 2008). “The employment of each of these metals for a specific metalloenzyme seems to be majorly related to its availability in the environment.…” (Castro *et al*., 2021). Consequently, increased concentrations of heavy metals in the environment can increase the production and/or activity of these metalloenzymes.

.

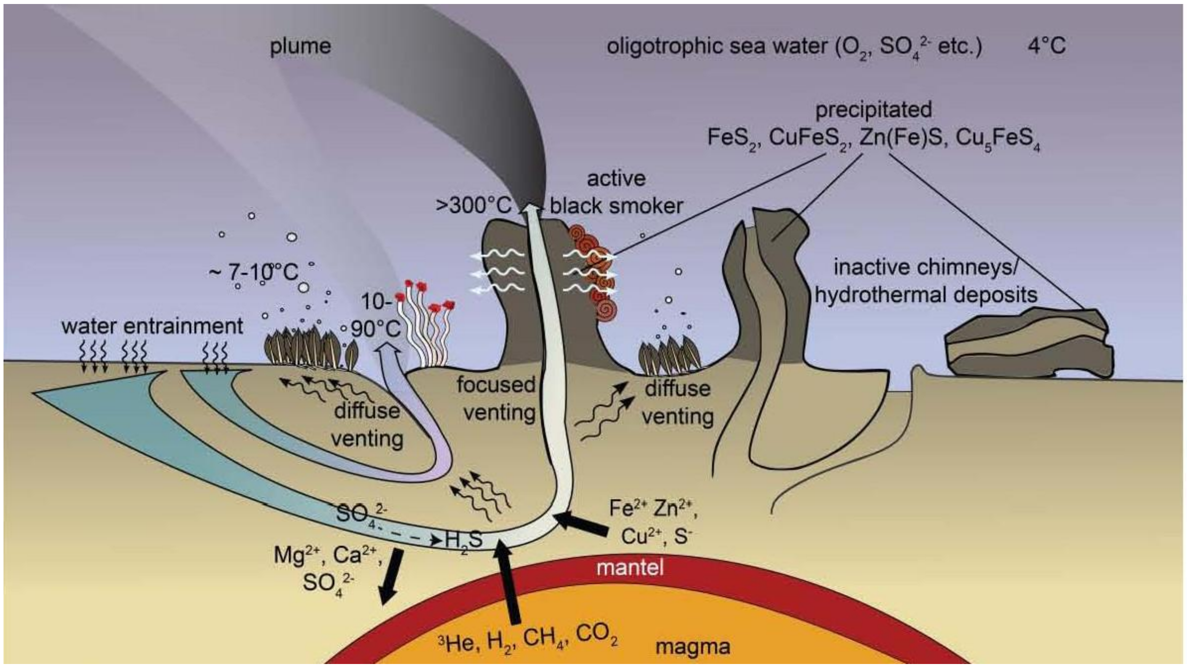

Figure 6. A schematic overview of the geological settings at hydrothermal vents. Sea water is entrained into the oceanic crust and heats up gradually. Magnesium and calcium are precipitated. Sulfate precipitates with calcium or is reduced to hydrogen sulfide. Various reduced compounds such as iron, zinc, copper and sulfide are dissolved from igneous rock. (https://www.mpi-bremen.de/en/Hydrothermal-vent-ecology.html. Fair Use Doctrine claimed herein).

Elevated concentrations of heavy metal could be the result of hydrothermal activity (Figure 6). Heavy metal rich deposits from heated water circulating through fishers in the Earth's crust become supersaturated and precipitate ore minerals. These hydrothermal deposits are divided into six main subcategories. Of these, three, porphyry, skarn, and volcanogenic massive sulfide (VMS) contain high deposits of copper (Cu) (Wikipedia.com/wiki/Hydrothermal_mineral_deposit), tyrosinase's heavy metal core

The thin mantle in this potentially new plate boundary region near Easter Island creates a "hotline" resulting in increased volcanic and hydrothermal activity as well as increased heavy metal concentrations, such as copper, in the environment. The resulting effect in those animals susceptible to elevated levels of heavy metals could be increased deposition of melanin on the surface of these shells.

While melanin and or iron oxides may result in the darker pigmentation of these specimens, other mechanisms are likely involved in the excessive over-deposition of enamel on certain areas of the shell. Shells are formed "when the organism extracts the necessary ingredients - dissolved calcium and bicarbonate- from their environment." (science.org.au/curious/earth-environment/sea-shells). "In Cypreaidae, the shell is synthesized by the mantle in two stages. In the first stage, a thin, transparent sheet of protein called the periostracum emerges from a fold in the mantle that curls out and around the outside of the shell creating a pouch at the edge of the shell called the extrapallial space. In the second stage, the mantle epithelium secretes proteins into the extrapallial space, and together with the calcium and bicarbonate ions, will combine to form calcium carbonate." At the same time as it is releasing these soluble proteins, the mantle also secretes insoluble proteins that become a permanent organic framework containing voids into which the crystals will grow (Ballerini & Neuer, 2007 www.americanscientist.org/article/secrets-in-the-shell).

F. Lorenz suggests that "transparent enamel and white or grey repair callus can be deposited by both mantle lobes throughout the animal's life." Lorenz further stated: "In the pathological hyper-pigmented (melanistic or niger) cowries, the inhibiting signal that stops the production of dark pigment is not working and the pattern is continuously deposited to form such thick layers that at a certain growth stage, it can be seen and felt as a surface structure. In addition, the formtion of callus is not regulated, resulting in rostration and aberrant deposition of layers of callus at the extremities, along the margins, and along the base." (Lorenz 2017). The authors hypothesize that while the mechanism of enamel deposition by inhibition of a repressor signal resulting in uncontrolled deposition (*i.e.,* a turn-off biological switch) could be true, it may well be that the heavy metals in the environment are the causative factor activating the deposition of enamel (*i.e.,* a turn-on biological switch) appearing as though the deposition is uncontrolled when in fact it is hyperactivated.

In these specimens, it appears that the increased deposition area is isolated to the anterior end of the shell. This could be explained by a simple observation. Cypraeid species in the wild extend their head and foot during mobility. However, the mantle is not always exposed. It appears that during grazing and/or feeding the mantle is often extended acting to camouflage the animal when in the open. From this observation it can be presumed that the foot and anterior head parts are exposed when the animal is active with the mantle being utilized during periods when the animal is exposed to potential predation.

Consequently, if there is an expression abnormality in the enamel depositing organs, it could be concluded that excessive deposition would be observed on the surfaces that are contacted more often than other areas of the shell. This would explain why the anterior ends of rostrate shells could have higher amounts of deposition as opposed to other areas of the shell.

These specimens were found together with normal appearing *M. caputdraconis* (Val Darkin, personal communication). However, based primarily on the shell's morphology they do not appear to be new species, subspecies or variety. A form usually designates a group with a noticeable morphological deviation and may be applicable here (Cowries, A guide to the gastropod family Cypreaidae, F. Lorenz, 2000 2 volume series). The authors were unable to find a clear definition of the term "form" as used to describe molluscs. However, in botany a form "is a secondary taxon rank, even below "variety". It denotes a special form (*e.g.,* a different color) of that species or variety" (www.capturingcaliforniasflowers.org). Some form names used in describing Cypreaidae have been based on collection location, physical structure and/or color. Some well-known geographic forms include *Luria pulchra f. siniaensis*, Heiman & Mienis, 2000 from the Sunai gulf, Gulf of Aquba and Suez and *Zoila venusta episema sorrentensis*, Schilder 1963 from Perth, near Sorrento Beach, Marmion Lagoon and Rottnest Island. Color forms include *Monetaria caputserpentis f. aruni,* Lorenz 2017 having a transverse orange to red band on the left or right margin and *Monetaria annulus f. camelorum*, Rochebrune 1884, an all-white shell, possibly albanistic. Rostrate forms include *Monetaria annulus f. appendiculata,* Lorenz 2017 with the anterior end having protuberances resulting from over deposition of enamel in this area of the shell, and *Naria biovinii f. cuatoni*, (Kosuge 1983) having broad marginal callouses, possibly an over deposition of enamel along the perimeter edge extending partially up the dorsum. Consequently, the authors have chosen to use the term form in describing and naming this melanistic and rostrate *Monetaria caputdraconis* from Rapa Nui.

Further research is required to identify the biological mechanism or mechanisms involved that produce the melanistic coloration and rostrate structure of these molluscs. While similar effects are found in Cypreaidae species from New Caledonia, the increased concentrations of heavy metals in the environment are occurring from volcanic activity from two distinctly different geologic events subduction and plate separation. Whether the heavy metals are concentrated in particular areas due to erosion of heavy metal rich ores on the surface or provided in heavy metal concentrate effluent from hydrothermal vents, it is likely that these specific locations are areas where dissipation is not immediate. Such factors could produce localized areas of higher concentrations of these metals in the environment, and would explain the intermixing of *M. caputdraconis* and *M. caputdraconis* f. *darkini* within a single population.

ACKNOWLEDGEMENTS

Special thanks to Val Darkin for his field work, for collecting the type lot used in this article, and for donating the type specimens referenced herein. Thanks to Marcus Coltro for the use of his images of *Monetaria caputdraconis poppei* herein.

LITERATURE CITED

Baker, P.E., F. Buckley & J.G. Holland. 1974. Contributions to Mineralogy and Petrology 44:58-100.

Ballarini, R. & A.H. Heuer. 2007. American Scientist 95(5):422-*. [www.american scientist.org/ article/secrets-in-the-shell](www.americanscientist.org/article/secrets-in-the-shell) doi:10.1511/2007/ 67/422

Bandy, M. 1937. "Geology and Petrology of Easter Island". Bulletin of the Geological Society of America. 48(11):1599–1602, 1605–1606, Plate 4.

Birk, J.P. 2023. Characteristic Reactions of Iron (Fe^{+3}), chemlibretexts.org.

Carter, E.L., N. Flugga, J.L. Boer, S.B. Mulrooney and R.P. Hausinger. 2009. "*In vitro* activation of urease also has been achieved with manganese and cobalt" Interplay of Metal Ions and Urease, Metallomics 1(3):207-221.

Castro, C.B., M.P. Ferreira, & C.G.C. Marques Netto. 2021. Metalloenzyme mechanisms correlated to their turnover number and metal lability, Current research in Chemical Biology 1:100004.

Chatenay, J.M. 1977 Pocelaines Niger et Rostrees de Nouvelle Caledonia, 109 pgs.

Conchological Club of Southern California, Minutes. 102:3-7.

Lambert, W.M., S. Maddukuri, K. Karanfilian, M.L. Elias and W.C. Lambert. 2019. The physiology of melanin deposition in health and disease, https://doi.org/10.1016/j.clindermatol.2019.07.

Lorenz, F. 2017. A Guide to the Gastropod Family Cypreaidae, Lorenz 2017 Vol. I, page 35.

Martin, P. 1989. Description of a new subspecies of *Erosaria* (Ravitrona) *caputdraconis* (Melvill, 1888) from the Central Pacific. La Conchiglia 242:3-6

Maurizot, P., B. Sevin, S. Lesimple, L. Bailly, M. Iseppi, & B. Robineau. 2020. "Chapter 10 Mineral resources and prospectivity of the ultramafic rocks of New Caledonia". Geological Society, London, Memoirs. 51:247-277. doi:10.1144/M51-2016-17. S2CID 219688916

Petuch, E.J. & D.P. Berschauer. 2021. Tropical Marine Mollusks: An Illustrated Biogeographical Guide. CRC Press, London, New York, Boca Raton. 357 pp.

Pirard, C. 2007. New Caledonia: Geology and Mining. JogMeg Mineral Ressource Informtion. p. 58. Retrieved 2 October 2021.

Torres, E. & M. Ayala. 2013. Biocatalysis by Metalloenzymes, Comprehensive Inorganic Chemistry II 2013 pgs. 686-735, researchggate.net.

Vezzoli, L. & V. Acocella. 2009. "Easter Island, SE Pacific: An end-member type of hotspot volcanism". Geological Society of America Bulletin. 121(5/6):869-886.

Cite as:
Waller. D.B. & D.P. Berschauer. 2024. Newly Identified Melanistic and Rostrate form of *Monetaria caputdraconis* from Easter Island. The Festivus 56(3):174-186.
http://doi:10.54173/F563174

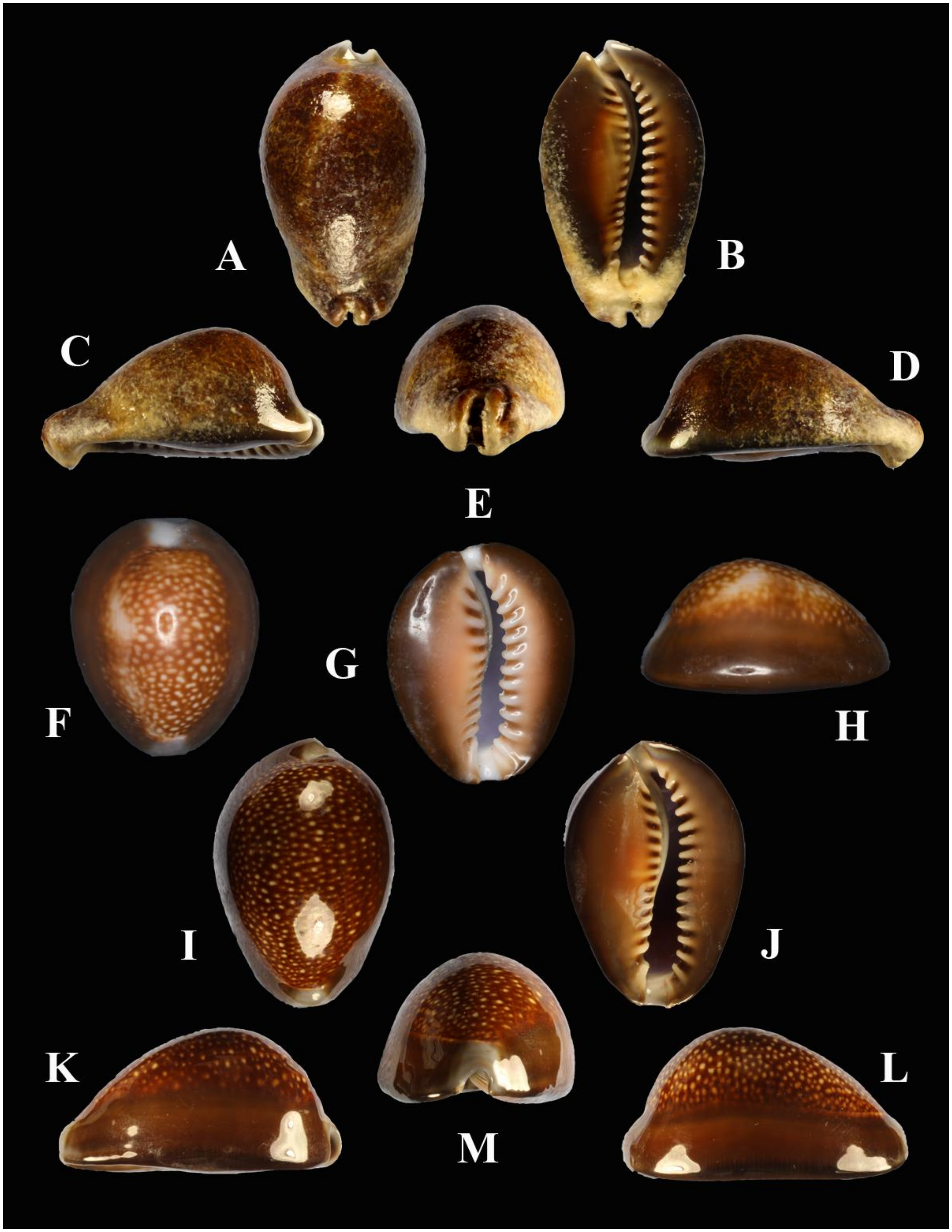

Plate 1. Figures A-E *Monetaria caputdraconis* form *darkini* (Holotype) 42.8 mm x 24.7 mm x 19.1 mm in the Santa Barbara Natural History Museum; **F-H** - *Monetaria caputdraconis f. poppei* 19.9 mm x 15.3 mm x 11.5 mm (images courtesy of Marcus Coltro); **I-M** - *Monetaria caputdraconis* 37.9 mm x 25.7 mm x 19.4 mm in the Berschauer Collection.

ISSN 0738-9388

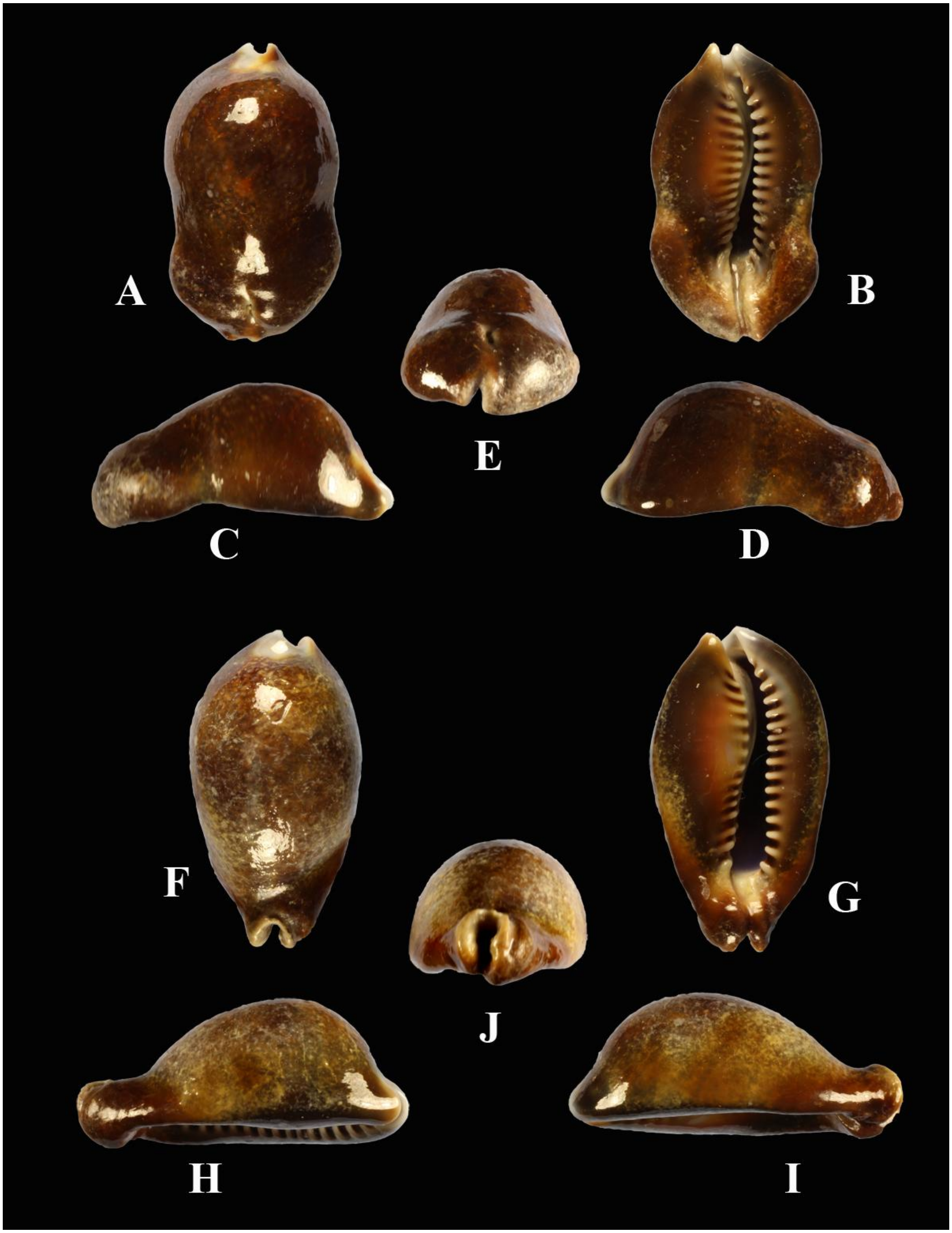

Plate 2. Figures A-E *Monetaria caputdraconis* form *darkini* (Paratype 4) 36.1 mm x 22.1 mm x 15.0 mm in the Val Darkin collection; **F-I** - *Monetaria caputdraconis* form *darkini* (Paratype 7) 41.2 mm x 22.7 mm x 16.8 mm in the Val Darkin Collection.

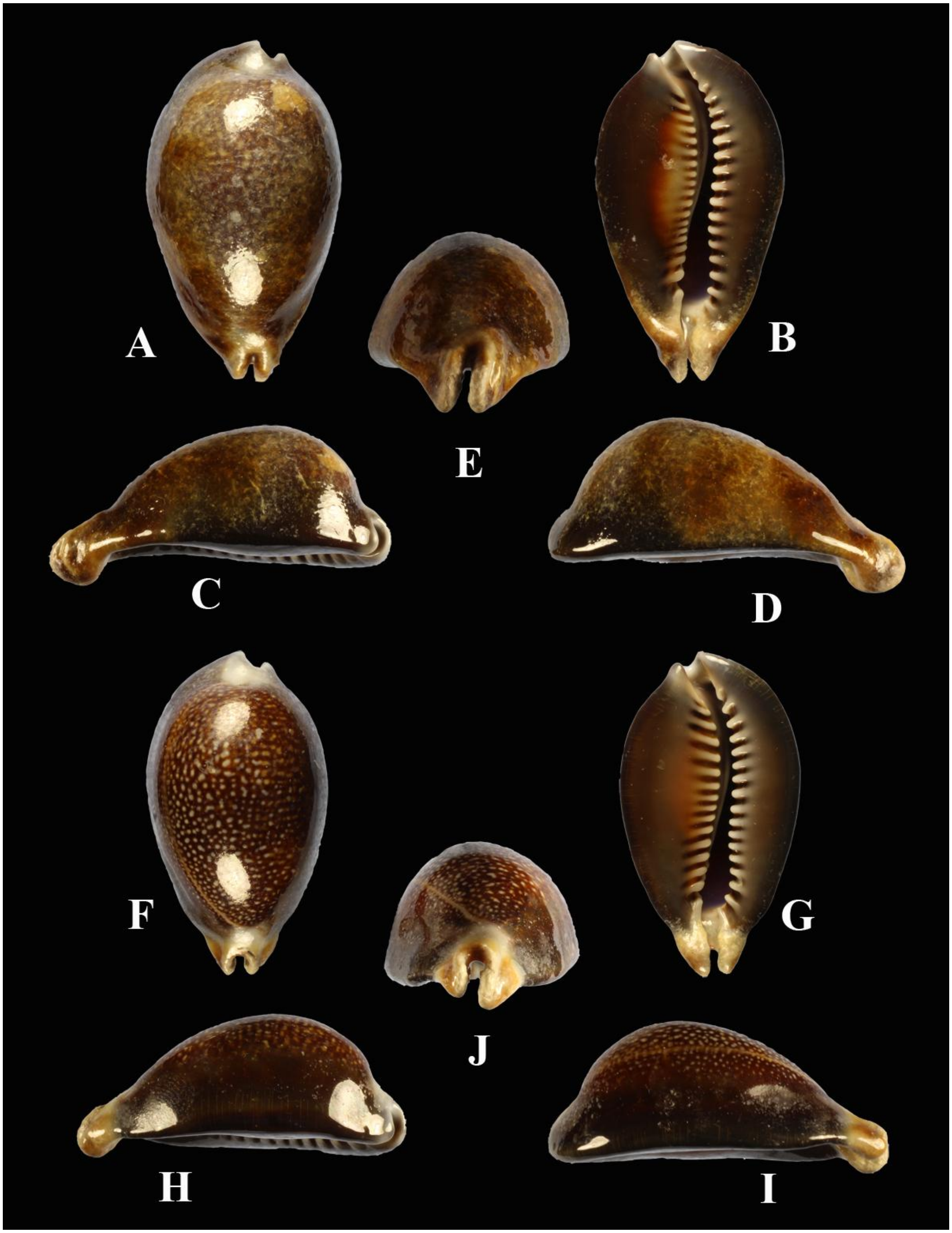

Plate 3. Figures A-E *Monetaria caputdraconis* form *darkini* (Paratype 5) 46.4 mm x 26.0 mm x 18.3 mm in the Val Darkin collection. **F-I** - *Monetaria caputdraconis* form *darkini* (Paratype 1) 43.8 mm x 24.5 mm x 17.5 mm in the Santa Barbara Natural History Museum.