



<http://dx.doi.org/10.11646/zootaxa.3838.1.6>

<http://zoobank.org/urn:lsid:zoobank.org:pub:E25D118D-52D7-44A5-B998-490DA7E7798E>

A new species of *Haliotis* (Gastropoda) from São Tomé & Príncipe Islands, Gulf of Guinea, with comparisons to other *Haliotis* found in the Eastern Atlantic and Mediterranean

BUZZ OWEN

P.O. Box 601, Gualala, CA 95445. USA. E-mail: buzabman@mcn.org

Abstract

The Haliotidae from the Gulf of Guinea, West Africa are reviewed. The distribution of the mainland species *Haliotis marmorata* Linnaeus, 1758 is confirmed and compared to the insular species from the island nation of São Tomé and Príncipe which is described as *Haliotis geigeri* n. sp. Both species are illustrated and compared to the other known Haliotidae from the eastern Atlantic.

Key words: Gastropoda, Haliotidae, Eastern Atlantic, Africa

Introduction

The Gulf of Guinea represents an important tropical marine biodiversity hotspot in the Eastern Atlantic Ocean, particularly the isolated oceanic volcanic islands of Annobón, São Tomé, and Príncipe (Jones 1994; Roberts *et al.* 2002). These islands form the oceanic crustal extension of the Cameroon Volcanic Line, a 1600 km long chain of volcanoes that extends from Annobón in the southwest to the African continental volcanoes of the Western Cameroon Highlands in the northeast (Lee *et al.* 1994; Marzoli *et al.* 2000). The Gulf of Guinea is geologically and biogeographically complex and while taxonomic research on the marine fauna remains rather limited, a number of recent studies provide a better understanding of this marine ecoregion (Wirtz *et al.* 2007; Carrison-Stone *et al.* 2013). These biological surveys and studies note a marine fauna characterized by relatively low endemism and a high proportion of ampho-Atlantic species (i.e., reef fish, decapods, and asteroids) associated with the eastern flowing Equatorial Current and widespread Eastern Atlantic species that may extend from northwestern Africa (and associated islands) to Angola (i.e., reef fish and nudibranchs; Wirtz 2003, 2004; Wirtz *et al.* 2007; Floeter *et al.* 2008; Wirtz & d'Udekem d'Acoz 2008). While endemism is low for some of the groups in the Gulf of Guinea, the marine invertebrate fauna of São Tomé & Príncipe contains a number of endemic genera, species, and subspecies including several taxa within the Archaeobalanidae, Marginellidae, and Muricidae (Gofas & Fernandes 1988; Rólan & Fernandes 1991; Carrison-Stone *et al.* 2013).

Here I describe a new species of *Haliotis* endemic to the islands of São Tomé & Príncipe. Currently, *Haliotis marmorata* Linnaeus, 1758 is the only recognized species of abalone located in the Gulf of Guinea and occurs in Ivory Coast, Ghana, Bioko Island (Equatorial Guinea), and Gabon (Geiger & Owen 2012). This species belongs to a clade that has a propensity to develop narrowly distributed insular taxa (Geiger & Owen 2012). This clade dominates the Eastern Atlantic and also includes the widespread North Atlantic and Mediterranean *Haliotis tuberculata* Linnaeus, 1758, the eastern and central Mediterranean *Haliotis mykonosensis* Owen, Hanavan & Hall, 2001, and the northwestern African *Haliotis speciosa* Reeve, 1846 (Geiger & Owen 2012).

The island nation of São Tomé & Príncipe is considered a major conservation priority due to its isolation, coral reefs, species richness, marine invertebrate endemism, and increased environmental threat levels (Jones 1994; Roberts *et al.* 2002). The continued discovery of new endemics highlights the biological and ecological significance of these islands' marine fauna and the need for their protection and conservation.

Haliotis tuberculata fernandesi (Fig. 3.9–12) is elongate, frequently of a red-purple coloration, and has weak spiral ribbing. The spire is located approximately 12% from the posterior margin and is not visible in ventral view. It is generally marked with irregular flammules or patches of a wax yellow color.

Haliotis tuberculata tuberculata form *lamellosa* (Fig. 3.13–16) has a variable number of strong lamellae in addition to having medium-width scaly spiral ribs. It is marked with varied patterns of a wide variety of colors including orange, red, yellow, brown and black. The shell has a brilliant silver nacreous interior, which is highly irregular and lumpy due to very jagged sculpture on dorsal surface.

Haliotis speciosa (Fig. 3.17–20) has numerous white to greenish white flammules and irregular patches, has 4–5 quite large, elevated and slightly elongate open holes, and possesses a wider columella. It tends to lack the red line connecting the holes, and is a much larger species, occasionally attaining a length over 70 mm.

Comparisons made to other species found nearby in the Mediterranean Sea. *Haliotis mykonosensis* (Fig. 3.21–22) has different color patterns and tent markings of mixed colors of white, brown, orange, green, tan and occasionally almost black. Uniformly colored specimens of orange and green (rare) also exist as well as banded specimens of brown and orange. Specimens of a similar red color to *H. geigeri* are not known.

Haliotis stomatiaeformis (Fig. 3.23–24) is more elongate with a spire located approximately 15% from the posterior end of shell. Usually has 4 (occasionally 5) open holes located closer to the anterior margin. Colors are highly variable with irregular blotches and patches of green, brown, white, wax yellow, red, and tan. Almost uniformly orange specimens are known, but no entirely red specimens.

Remarks. Spire position appears to be diagnostic and ontogenetically invariant since similarly sized individuals of *Haliotis geigeri* and *H. marmorata* do not overlap in this characteristic (Fig. 2).

The significant morphological differences between the new species and its continental neighbor are likely due to its isolation from the African mainland populations, separated by the Gabon Basin with depths of 2000–3500 m and a horizontal distance of between 200–250 km. São Tomé & Príncipe, while geographically close to the continent, has been isolated from the mainland since the initial oceanic archipelago formed in the Oligocene, around 31 million years ago (Lee *et al.* 1994).

Haliotis rosacea Reeve, 1846, is a synonym of *H. marmorata*. None of the syntypes are conspecific with *H. geigeri*. One of the syntypes was figured by Reeve (1846: pl.16, no. 60) and has the color pattern, spire position, and red line running through the holes indicative of *H. marmorata*. In addition, the types, located at NHMUK, do not bear resemblance to *H. geigeri* and clearly represent *H. marmorata*. In addition, *Haliotis guineensis* Gmelin, 1791 is also likely a synonym of *H. marmorata*. Gmelin's original type material has been lost and no illustrations are known. However, based on the stated geographic provenance of his material (Ghana), Gmelin's species likely represented *H. marmorata*.

Additional specimens of each species have been illustrated by Geiger & Owen (2012).

Acknowledgements

Daniel L. Geiger and Dai Herbert reviewed the manuscript and offered helpful suggestions. A. Pan wrote the introduction, did the scatterplot, and edited the manuscript. A. Raffety proofread and edited the manuscript. P. Ryall read the manuscript and offered a large number of helpful suggestions. P. Maestrati of MNHN provided photographs of Museum specimens. D. Dinucci reviewed the manuscript and offered comments. I would also like to thank the two journal reviewers for their suggestions that improved this paper.

References

- Carrison-Stone, D., Van Syoc, R., Williams, G. & Simison, W.B. (2013) Two new species of the gorgonian inhabiting barnacle, *Conopea* (Crustacea, Cirripedia, Thoracica), from the Gulf of Guinea. *ZooKeys*, 270, 1–20.
<http://dx.doi.org/10.3897/zookeys.270.3736>
- Floeter, S.R., Rocha, L.A., Robertson, D.R., Joyeux, J.C., Smith-Vaniz, W.F., Wirtz, P., Edwards, A.J., Barreiros, J.P., Ferreira, C.E.L., Gasparini, J.L., Brito, A., Falcón, J.M., Bowen, B.W. & Bernardi, G. (2008) Atlantic reef fish biogeography and evolution. *Journal of Biogeography*, 35, 22–47.
- Geiger, D.L. & Owen, B. (2012) *Abalone: Worldwide Haliotidae*. ConchBooks, Hackenheim, 361 pp., 92 pls.

- Gmelin, J.H. (1791) *Systema Naturae Per Regna Tria Naturae. Tome 1, Pars. VI. 13th Edition*. Beer, Leipzig, pp. 3021–3910.
- Gofas, S. & Fernandes, F. (1988) The marginellids of São Tomé, West Africa. *Journal of Conchology*, 33, 1–30.
- Jones, P.J. (1994) Biodiversity in the Gulf of Guinea: an overview. *Biodiversity and Conservation*, 3, 772–784.
<http://dx.doi.org/10.1007/bf00129657>
- Lamarck, J.B. (1822) *Histoire Naturelle des Animaux sans Vertèbres. Tome 6. Part 2*. Author, Paris, 232 pp.
- Lee D.-C., Halliday, A.N., Fitton, J.G. & Poli, G. (1994) Isotopic variations with distance and time in the volcanic islands of the Cameroon line: evidence for a mantle plume origin. *Earth and Planetary Science Letters*, 123, 119–138.
[http://dx.doi.org/10.1016/0012-821x\(94\)90262-3](http://dx.doi.org/10.1016/0012-821x(94)90262-3)
- Linnaeus, C. (1758) *Systema Naturae. Editio Decima, Reformata. Vol. 1*. Salvius, Stockholm, 824 pp.
- Marzoli, A., Piccirillo, E.M., Renne, Bellieni, G., Iacumin, M., Nyobe, J.B. & Tongwa, A.T. (2000) The Cameroon Volcanic Line revisited: petrogenesis of continental basaltic magmas from lithospheric and asthenospheric mantle sources. *Journal of Petrology*, 41, 87–109.
- Reeve, L. (1846) *A Monograph of the Genus Haliotis*. L. Reeve & Co, London, 24 pp., 17 pls.
- Roberts, C.M., McClean, C.J., Veron, J.E.N., Hawkins, J.P., Allen, G.R., McAllister, D.E., Mittermeier, C.G., Schueler, F.W., Splanding, M., Wells, F., Vynne, C. & Werner, T.B. (2002) Marine biodiversity hotspots and conservation priorities for tropical reefs. *Science*, 295, 1280–1284.
- Rolán, E. & Fernandes, F. (1991) *Muricopsis (Risomurex)* (Gastropoda, Muricidae) de las islas de São Tomé y Príncipe (Golfo de Guinea, Africa occidental). *Apex*, 6, 11–21.
- Wirtz, P. (2003) New records of marine invertebrates from São Tomé Island (Gulf of Guinea). *Journal of the Marine Biological Association of the United Kingdom*, 83, 735–736.
- Wirtz, P. (2004) A note on nudibranchs (Mollusca: Opisthobranchia) from Príncipe Island (eastern central Atlantic). *Arquipélago*, 21A, 81–82.
- Wirtz, P. & d’Udekem d’Acoz, C. (2008) Crustaceans associated with Cnidaria, Bivalvia, Echinoidea and Pisces at São Tomé and Príncipe islands. *Arquipélago*, 25, 63–69.
- Wirtz, P., Ferreira, C.E.L., Floeter, S.R., Fricke, R., Gasparini, J.L., Iwamoto, T., Rocha, L., Sampaio, C.L.S. & Schlieven, U.K. (2007) Coastal Fishes of São Tomé and Príncipe islands, Gulf of Guinea (Eastern Atlantic Ocean) – an update. *Zootaxa*, 1523, 1–48.