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THE GENUS MODULUS IN THE WESTERN ATLANTIC

BY
R. TUCKER ABBOTT

The family *Modulidae* possesses but a single genus, *Modulus*, which contains about a dozen species. Nearly all of these are found in shallow waters in tropical and semi-tropical areas. There are only two species in the Western Atlantic and, to judge by the number of specimens in museums, our own *Modulus modulus* Linné is the only really abundant one of all the world forms. This species is mainly intertidal and consequently accessible to collectors. Others in the genus live well below the low-water line and are consequently less frequently collected.

There is considerable variation among specimens of a *Modulus* species even at the same locality. The several characters of *Modulus modulus* appear in any number of combinations in many widely scattered regions of the Western Atlantic and this has given rise to a rather long list of synonyms. A careful study of a large series of this species shows no line of demarcation among the variously formed individuals.

Genus **Modulus** *Gray*

[?] *Aplodon* Rafinesque 1819, Jour. de Physique, de Chimie, d'Historie Naturelle **88**, p. 425 [Pilsbry 1930, Proc. Acad. Nat. Sci. Philadelphia **82**, p. 324, Genotype, *A. nodosum* Rafinesque].

Modulus Gray 1842, Synopsis of the contents of the British Museum, ed. 44, p. 60; Gray 1847, Proc. Zool. Soc. London, **15**, p. 150.

Haplodon Agassiz 1846 (emendation for *Aplodon* Raf.) Nomen. Zool. Index Univ. p. 172; non *Haplodon* Wagler 1830; *non* Haplodon Muenster 1840.

Turbinopsis Conrad 1860, Jour. Acad. Nat. Sci. Philadelphia (2), **4**, p. 289.

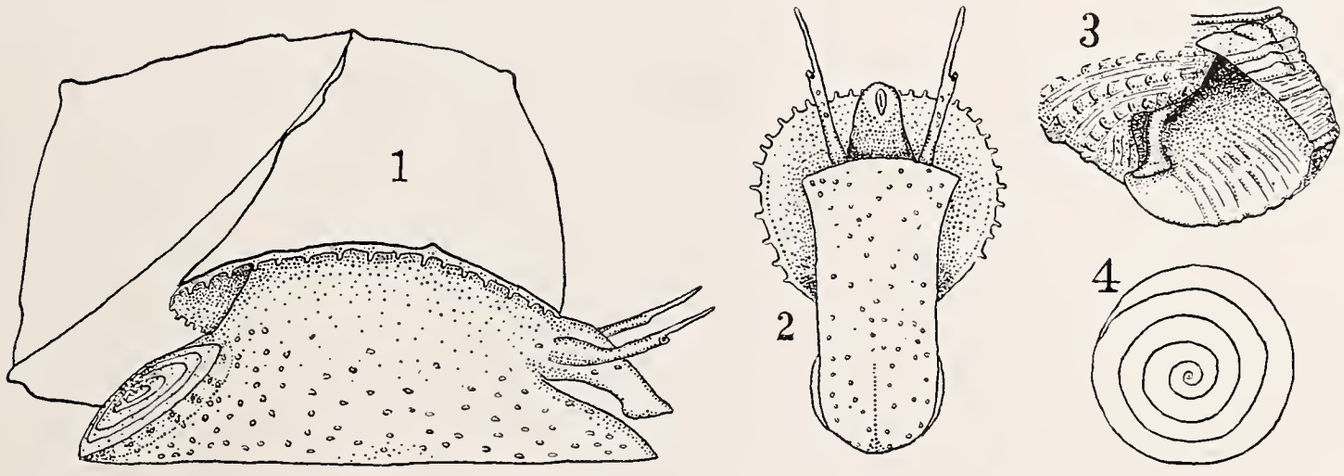

Plate 1. *Modulus modulus* Linné. Fig. 1. Lateral view of animal showing position of operculum. Fig. 2. Ventral view showing foot, head and under edge of mantle. Fig. 3. Aperture view of shell. Fig. 4. Dorsal view of operculum (all about 3×). Drawn by R. T. Abbott.

Pseudotrochus Heilprin 1887, Trans. Wagner Free Inst. Sci. Philadelphia, **1**, p. 114 (non Mörch 1852; non Kittl 1899).

Note. An earlier name, *Modolus*, was first used by Potiez and Michaud 1838, Galerie des Mollusques **1**, p. 319. This was mentioned under *Monodonta modulus* Linné as a generic name proposed by Beck but was never published until the above two authors gave it mention. If this use is admissible, the name *Modolus* 'Beck' Potiez and Michaud 1838 will replace *Modulus* Gray 1842, both having the same type species, *Trochus modulus* Linné.

Genotype, *Trochus modulus* Linné (subsequent designation by Gray 1847).

Shell top-shaped to more or less depressed with a well developed tooth-like lamella near the base of the columella. Last whorl often descending slightly. Animal without a siphon. Mantle edge bearing tooth-like filaments. Eyes placed midway on the tentacles. The radula is similar to that of *Cerithium*. Operculum multispiral, corneous and thin.

According to Dall (1892, Trans. Wagner Free Inst. Sci. Philadelphia, **3**, p. 294), this genus has existed in America continuously since Cretaceous times.

It seems to us that Pilsbry's use of *Aplodon* Rafinesque in place of *Modulus* Gray is both unwise and untenable. To change a well known and unquestioned name for one unknown and poorly defined is only to set the stage for future trouble. To *suppose* Rafinesque had a *Modulus* as a "stray marine shell" mixed in with his Kentucky shells, is only to suggest that others among the marine gastropods fitting his brief description could be used equally as well. There are a few trochoids that this description would cover as well as it does *Modulus*.

Modulus modulus *Linné*, Plate 2, fig. 1–4

Trochus modulus Linné 1758, Syst. Nat. ed. 10, p. 757 (locality unknown); Linné 1767, Syst. Nat. ed. 12, p. 1228, [refers to Seba **3**, pl. 34, fig. 12]; Gmelin 1790, Syst. Nat. ed. 13, p. 3568 (Red Sea) [refers to Lister 1688, pl. 653, fig. 52].

Trochus filosus Helbling 1779, Abhandl. Privatgesellsch. Böhmer **4**, p. 123, pl. 2, fig. 32–33 (no locality).

Trochus perlatus Gmelin 1790, Syst. Nat. ed. 13, p. 3577, [refers to Kaemmerer 1786, Conchy. Cat. Erbprinzen Schwarzburg-Rudolstadt, pl. 12, fig. 1].

[?] *Aplodon nodosum* Rafinesque 1819, Jour. de Physique, de Chimie, d'Histoire Naturelle **88**, p. 425 (Kentucky).

Trochilus unidens 'Lister' d'Orbigny 1842 [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques **2**, p. 57 [d'Orbigny refers to Lister 1688, quoting figures 52–54 which are figures of three different species. We here restrict d'Orbigny's reference to figure 52 which is *Modulus modulus*].

Trochus lenticularis 'Chemnitz' d'Orbigny 1842 [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques, **2**, p. 57.

Cricostoma striatum 'Klein' d'Orbigny 1842 [in] Ramon de la Sagra, Hist. L'Isle de Cuba, Mollusques, **2**, p. 57.

Modulus floridanus Conrad 1869, American Jour. Conch. **5**, p. 107, pl. 12, fig. 6 (Florida).

Modulus krebsii Mörch 1876, Malak. Blätt. **23**, p. 129, (Anguilla [West Indies]).

Modulus convexior 'Beck' Mörch 1876, Malak. Blätt. **23**, p. 129 (St. Croix [Virgin Islands]).

Modulus pisum 'Beck' Mörch 1876, Malak. Blätt. **23**, p. 130 (St. Bartholomew; Bermuda).

Modulus canaliculatus 'Beck' Mörch 1876, Malak. Blätt. **23**, p. 131 (Antilles).

Ethalia tasmanica Tenison Woods 1877, Proc. Royal Soc. Tasmania, p. 146 (north coast, Tasmania) [see C. Hedley 1902, Nautilus **16**, p. 49].

Modulus corrugatus 'Stimpson' Dall 1884, Proc. United States Nat. Mus. **6**, p. 335; 'Stimpson' Dall 1892, Trans. Wagner Free Inst. Sci. Philadelphia, **3**, pt. 2, p. 295.

Description. Shell 10 to 16 mm. in length, umbilicate, solid, rugose and sculptured with a series of coarse spiral cords. Whorls 5 to 6, strongly convex, the last descending just before the aperture in adults. Color grayish white with occasional specimens show-

ing a flecking of purplish-brown. Spire moderately depressed, turbinate and usually obtuse. Aperture subcircular. Outer lip rather thin and reinforced within with a series of short tooth-like ridges in spiral arrangement. Parietal wall glazed purplish. Columella rather thick, arched and terminated by a prominent tooth-like lamella. Umbilicus small, deep and only slightly covered by the columellar fold. In young specimens, it is entirely open. Suture slightly impressed and irregular. Sculpture consists of numerous well developed cords with the strongest cord at the periphery of the whorl. Above the peripheral cord there is a series of axial nodules or costae which may be absent in occasional specimens. The entire spire may be smooth, or almost so, in many cases. Base of shell possesses about 5 well developed cords. Operculum circular, multispiral, thin and colored a transparent amber. Periostracum thin and deciduous.

Animal (see Plate 1) of medium size with the expanded oblong foot slightly shorter than the shell. Head bears a short rounded proboscis and two thin, round tentacles. Eye midway on each tentacle. Mantle lining the inside of the shell thin and bordered by a series of small white fleshy knobs. General color of animal a soft moss green with a dusting of minute chalk-white dots. Color of underside of foot a light pea green; sides moss green with white dots; band running around operculum has series of bars alternately white and green. Base of tentacles green, areas beyond eye are a clear yellow green. Upper part of foot, mantle within the shell, and visceral mass variously shaded with brilliant, glistening yellows and greens.

	length	width	
(large)	14	15 mm.	Charlotte Harbor, Florida
(average)	11	12	Cienfuegos Bay, Cuba
(small)	9	9.5	Agars Island., Bermuda

Types. We here select Lister 1688, Historiae Conchyliorum, **2**, pl. 653, fig. 52, as the type figure and Barbados, originally given by Lister, as the type locality.

Common name. Atlantic Modulus.

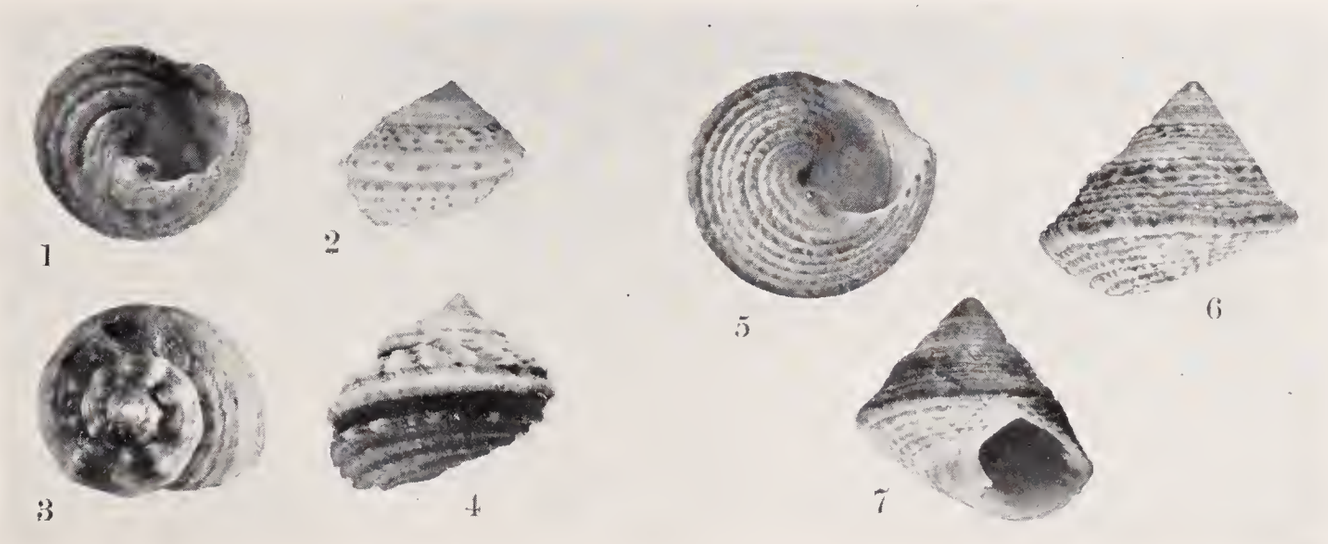

Plate 2. Fig. 1. *Modulus modulus* Linné, Tampa Bay, Florida. Fig. 2. *M. modulus* Linné, East side of Boca Chica Key, Florida. Fig. 3–4. *M. modulus* Linné, Tarpon Bay, Sanibel Id., Florida. Fig. 5–6. *M. carchedonius* Lamarck, Gulf of Paria, off Pointe-à-Pierre, Trinidad. Fig. 7. *M. carchedonius* Lamarck, Jamaica (all 2×).

Remarks. A common species found abundantly on shallow water eel-grass flats, especially in sheltered bays. In particularly quiet warm waters, the shells become covered with algae and live barnacles. Young slipper shells, *Crepidula fornicata* Linné, often attach themselves to the backs of this species. Commonly found in beach drift in a smooth wave-worn condition. The moss green color of the animal blends with the green eel-grass.

Heavily nodulous and rounded specimens found in many localities in west Florida and the entire West Indies were erroneously considered a distinct species by Conrad (*M. floridanus*). A study of specimens from a number of localities indicates that *modulus* varies greatly in size, sculpturing and coloring and that actually there are only two living species in the Western Atlantic. The second species (*M. carchedonius* Lamarck) is limited to the West Indies and not, so far, recorded from Florida. Corroded and beach-worn specimens of *modulus* are likely to be confused at first with *carchedonius*, but the traces of worn down nodules and coarse, irregularly-sized threads on the last whorl will identify it as *modulus*. We have also seen specimens from Hispaniola, Virgin Islands and Brasil which show a remarkable enlargement of the nodules into almost blunt spines. The spire is somewhat elongated in certain of these shells.

No figure or locality reference was given by Linné in his 1758 Systema Naturae (10th ed.) when describing *modulus*. In the 12th edition he refers in error to a wood cut of a fish (Seba, **3**, pl. 34, fig. 12). Gmelin in the 13th edition correctly refers to Lister, pl. 653, fig. 52, a figure readily recognized as this species. Although Lister gave the locality as Barbados, Gmelin erroneously assigned it to the Red Sea. (See *types.*)

Dall's record (1902, p. 295) of this species from 25 miles off Hatteras, North Carolina, is possibly an accidental specimen that had been transported by some migrating fish or other mechanical means. It is not known to occur between Hatteras and east Florida.

Range. Bermuda, Florida, the Gulf of Mexico and south through the West Indies to Brasil.

Records. Florida: Lake Worth; Madera Bay; Key West; Tortugas; Charlotte Harbor; Boca Grande; Sarasota; Tampa Bay; Cedar Keys (all MCZ). Louisiana: Chandeleur Id. (USNM). Texas: Port Aransas; Olivia (both MCZ); Pass Cabella (USNM). Bermuda: Castle Harbor and Agars Id. (both MCZ). Bahamas: West End, Grand Bahama; Strangers Cay, Little Abaco; Bimini Islands; Nassau, New Providence; Arthurstown, Cat Island; Mangrove Cay, Andros Island; Simms, Long Island (all MCZ). Cuba: Habana; Bahía Honda; Guantánamo; Cienfuegos Bay (all MCZ); Caibarién; Matanzas; Cabana Bay (all P.J. Bermúdez). Isle of Pines: Nueva Gerona (MCZ). Hispaniola: Jérémie (MCZ); Cap Haitien; Miragoane (both W. J. Eyerdam); Monte Cristi; Puerto Plata; Santa Bárbara de Samaná (all MCZ). Puerto Rico: San Juan (MCZ); Desecheo Id. (USNM). Jamaica: Montego Bay (MCZ); Kingston (USNM). Virgin Islands: St. Thomas; St. John (both MCZ); Tortola and Virgin Gorda (both M. Dewey). Lesser Antilles: Antigua; Barbados (both USNM); Guadeloupe (MCZ); Carenage and Chaguaramas Bays, Trinidad (both H. G. Kugler). Caribbean Islands: Cozumel Id.; Ruatan Id. (both USNM). Central America: Yucatan, Mexico; Colón, Panama (both USNM). South America: Cartagena and Santa Marta, Colombia (both MCZ); Cumaná, Venezuela (MCZ); Cabo de São Roque; Brasil (USNM).

Modulus carchedonius *Lamarck*, Plate 2, fig. 5–7

Monodonta carchedonius Lamarck 1822, Anim. s. Vert. **7**, p. 33 (locality unknown) [refers to Chemnitz 1788, Conchy.-Cab. (1) **10**, pl. 165, fig. 1583–1584 (Barbados)].

Monodonta angulata C.B.Adams 1845, Proc. Boston Soc. Nat. Hist. **2**, p. 7 (Jamaica).

Modulus carchedonicus 'Lamarck' A. Adams 1851, Proc. Zool. Soc. London 1850 [1851] p. 203 (Atooi, California).

Monodonta sayii 'Nuttall' A. Adams 1851, Proc. Zool. Soc. London 1850 [1851] p. 203. [This reference was based upon a nude name of Jay (1839) A Catalogue of the Shells in the Collection of J. C. Jay, New York, p. 72 (Atooi)].

Description. Shell 10 to 16 mm. in length, narrowly umbilicate, solid and sculptured with a series of strong spiral threads which may be slightly nodulose. Whorls 6 to 7, flat to slightly concave with the last sharply angulated at the periphery. The last whorl in adults is slightly descending before the aperture. Color grayish white with the threads spotted more or less regularly with purplish brown. An occasional specimen will have the peripheral thread a solid purplish color. Spire extended, conical and acute. Aperture subquadrangular. Outer lip rather thin and reinforced within by a series of short tooth-like ridges in spiral arrangement. Parietal wall glazed white. Columella rather thick, arched, and terminated by a prominent tooth-like lamella. Umbilicus very small, deep and nearly covered by the columellar fold. In young specimens it is usually entirely closed. Suture minutely impressed and usually bordered by two strong threads. Sculpture consists of numerous slightly beaded spiral threads or fine cords with the strongest at the periphery. Above the peripheral cord there are no axial costae. Base of shell possesses about 8 fine cords. Operculum circular, multispiral, thin and amber colored. Periostracum thin and tinged a light blue-green.

	length	width	
(large)	17	16 mm.	off Point-à-Pierre, Trinidad
(average)	11	11	Jamaica
(small)	10	10	La Punta, Santa Clara Prov., Cuba

Types. The location of Lamarck's types is unknown to us. We select the island of Barbados as given by Chemnitz as the type locality, based upon Lamarck's reference. The holotype of *M. angulatus* C. B. Adams from Jamaica is No. 149300, Museum of Comparative Zoölogy.

Common name. Angled Modulus.

Remarks. Modulus carchedonius Lamarck is not a very common species and is likely to live in water deeper than six feet. It shows very little variation in its characteristics and may best be separated from *M. modulus* Linné by its angulate contours, lack of nodules, neatness of its spiral sculpturing and, especially in the young, by its nearly closed umbilicus.

The columellar tooth in *carchedonius* is never colored, while in *modulus* is is frequently touched with purplish brown.

Monodonta sayii, a nude name, was listed, probably erroneously, as a synonym by A. Adams under *Modulus carchedonius* Lamarck and given the locality of Atooi, California. Atooi is an old and alternate name for Kauai Island in the Hawaiian Islands.

A nude name listed as a synonym of a species automatically takes the description of that species. As far as we have been able to trace the history of this name, A. Adams was the first to make the name valid. Thus *M. sayii* must be considered a synonym of *Modulus carchedonius* Lamarck. Nuttall's original specimens from Hawaii will have to be renamed or, more probably, assigned to some other described genus and species.

Range. Greater Antilles south to the northern coast of South America.

Records. Cuba: La Punta, Isabela de Sagua; Caibarién (both P.J. Bermúdez); Santiago; Cabanas; Mariel (all USNM); Cienfuegos Bay (MCZ). Hispaniola: Port au Prince (USNM); Monte Cristi; Santa Bárbara de Samaná; Puerto Sosuá (all MCZ). Puerto Rico: San Juan; Mayagüez; Desecheo Id. (all USNM). Jamaica: Kingston (USNM). Virgin Islands: St. Thomas (USNM). Lesser Antilles: off Pointe-à-Pierre, Trinidad, in 3 fathoms (H.G. Kugler). Caribbean Islands: Curaçao (USNM). Central America: Belize, British Honduras (USNM); Fox Bay, Colón, Panama (USNM). South America: Puerto Colombia and Cartagena, Colombia (both USNM).

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During the studies made on the Western Atlantic *Modulus*, the following notes were obtained on the Eastern Pacific species which has frequently been confused with our Atlantic *M. carchedonius*.

Modulus catenulatus *Philippi*

Modulus catenulatus Philippi 1849, Conchy.-Cab. (2), **2**, pt. 3, p. 110, pl. 18, fig. 4 (locality not given).
Modulus trochiformis Eydoux and Souleyet 1852, Voyage de la Bonite, Zoologie **2**, p. 598, pl. 36, fig. 1–5, pl. 37, fig. 25–31 (Isla de Puná, Guayaquil, Ecuador).

As Philippi did not give a type locality, that of Guayaquil, Ecuador, is here selected, based upon the voyage of the *Bonite*.

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Book Review

Dall, W.H. and C.T. Stimpson 1901: The Mollusca of Porto Rico, Bulletin United States Fish Commission **1**, pp. 351-524, 6 plates, 1900 [1901]. This excellent report deals with the land, freshwater and marine species of the island of Puerto Rico. The report is based mainly upon the mollusks collected by the *Fish Hawk* in 1899, though many additional data have been added, obtained from the literature published up to 1900. A systematic catalogue is appended to the main report in which the classification is considered to the subgenus. A list of the dredging stations by the *Fish Hawk* in Puerto Rican waters is included with the number, date, depth, locality and other pertinent data. 535 marine species are listed, many old species fully described and many figured including the 42 species considered as new.— W. J. Clench

Harvard-Bahama Expedition, 1904

During the month of July, 1904, an investigation was made of Grand Bahama, Little and Great Abaco Islands and a few of the many islands that fringe Great Abaco to the east and north. The party consisted of Glover Allen, Thomas Barbour and Owen Bryant. Collections were made mainly of mammals, reptiles, amphibians and mollusks, though other groups of animals were collected as well. Incidental collecting was also made on the Island of New Providence and, during August, Owen Bryant made an independent visit to Mangrove Cay in the southern portion of Andros Island where many marine shells were collected as well as a series of land and freshwater mollusks of this hitherto unexplored island.

A sixty ton schooner, the *William H. Albury*, was chartered for the expedition. She was fifty-nine feet overall and drew about six feet of water. Six men composed her captain and crew. The expedition left Nassau for Hopetown, Elbow Cay, Great Abaco Island, a distance of some 98 miles north of New Providence. This trip was made over the deep water of the North East Providence Channel which lies open to the big swells of the Atlantic. Shore collecting was done at Hopetown for two days and from there the expedition left for the main island of Great Abaco.

Shallow water dredging was done with a 20 inch "Blake" dredge in 3–20 fathoms. Collections were also made by aid of a water glass as well as through shore collecting.

Marine collecting was excellent along the outer shores of Great and Little Abaco and their associated cays. That on the north coast of Grand Bahama Island on the shallow bank side was very poor. This area has much marl along the shallow shore and but few marine species can exist there. This shallow coast is composed of badly weathered lime stone with the pockets between the rocks filled with mud from a few inches to a few feet in depth. In addition there are long stretches of mangrove fringing the coast and existing as islands along the shore. The high land which doesn't exceed 25 feet is covered with Bahama pine and an exceedingly tough tangle of xerophytic plants which make collecting very difficult and sometimes impossible.

Many records obtained by this expedition have appeared in Johnsonia and there are many more to follow. The following are the important stations where most of the marine shells were collected.

Great Abaco Island: Hopetown, Elbow Cay, Marsh Harbour; Sweetings Village; The Marls; Great Guana Cay; Whale City Channel. Little Abaco Island: Cedar Harbour; Pensacola Cays; Moraine Cay; Stranger Cay; Great Sale Cay. Grand Bahama Island: Riding Point. Andros Island: Mangrove Cay.

A more detailed account of this important trip was published privately by G. M. Allen and Thomas Barbour. The marine bivalves collected have been listed by W. J. Clench and R. A. McLean. The land shells collected by Mr. Bryant on Mangrove Cay, Andros Island, as well as the other land and freshwater shells collected by the party have been reported on by W. H. Dall.

Allen, G.M. and T.Barbour 1904, Narrative of a Trip to the Bahamas. Cambridge, Mass., pp. 1-10, 3 plates.

Dall, W.H. 1905, Report on the Land and Freshwater Shells Collected in the Bahamas in 1904 by Mr. Owen Bryant and Others. Smithsonian Miscellaneous Collections **47**, pt. 4, pp. 433–452, 2 plates.

Clench, W.J. and R.A.McLean 1937, Marine Bivalves from Little and Great Abaco, Grand Bahama and Eleuthera, Bahama Islands. Mem. Soc. Cubana Hist. Nat. **11**, pp. 31–42, 2 plates.

This last reference also includes the records of the material collected on the Harvard-Grand Bahama Expedition in 1936.—W. J. Clench

Harvard-Grand Bahama Expedition, 1936

In April 1936, I had the experience of collecting on several islands on the Little Bahama Bank in the northern Bahamas with James C. and Gilbert Greenway. Gilbert Greenway had his sea-plane in Nassau when I arrived and two days after my arrival in early April, we left Nassau for West End, Grand Bahama Island. We made daily trips, mainly to Great and Little Abaco, as there was but meager collecting on the north coast of Grand Bahama and the rough seas on the south coast made plane landings impossible. After two weeks, Gilbert Greenway left for Nassau and James Greenway and I took a motor boat to Eight Mile Rock about 25 miles east of the western end of Grand Bahama. This little settlement is at the south entrance of Hawksbill Creek, a tidal rreek which cuts through the island to the north coast. At the end of three weeks, I left Jim with his bird collecting and I proceeded to Nassau and Eleuthera Island.

Marine collecting at West End was fair, particularly for the larger species, such as *Strombus* and *Cassis*. Time for collecting at this locality was limited as it was more important, having a plane, to visit many of the small and rather inaccessible islands in the Abaco Island chain. The week spent on Eight Mile Rock was quite profitable for marine shells. Long stretches of beaches exist both east and west of the settlement and rock collecting was rich enough to be called "good pickings," especially in the more protected areas at the mouth of Hawksbill Creek.

Island collecting in the Abacos was a real joy. To pick your island on the chart, see it come into view five miles away and 2000 feet up was a thrill that I should not want to forget. Gil would pick out a "soft spot," taxi up to a beach and Jim and I would wade ashore, hunt for the land material and then for the marine shells. Most of these islands were tough going with their tangle of xerophytic vegetation. Occasionally we would find some really lush growth such as existed on Water Cay, north of Grand Bahama where the vegetation was rank and the soil deep and moist. Such places are rare in the Bahamas.

The real island was the center of three little cays known as Joe Cays. These were north of Little Abaco. This small cay was about one-fourth of a mile long and about 20 odd feet high. It faced deep water on the open Atlantic on the east, and the shallow water of the bank on the west. Its outer rocky slopes were covered with a tough tangle of bushes, but its inner area was flat, grass-floored and spotted with palmettos. Each dead palmetto frond had 20 to 30 land snails underneath, *Plagioptycha abacoensis* v. Mts., a rather rare land shell which is limited to the northern Bahama Islands.

Marine localities follow and the references lead to more detailed information.

Grand Bahama Island: West End; Wood Cay; Eight Mile Rock; Holmes Cay; East End Bush. Little Abaco Island: Foxtown; Joe Cay; Cave Cay. Great Abaco Island: Angel Fish Point; Sand Bank, Crossing Bay; Great Abaco opposite Whale Cay; Mores Island.

Clench, W. J. 1937, Descriptions of New Land and Marine Shells from the Bahama Islands. Proc. New England Zoological Club, **16**, p. 17–26, 1 plate.

Clench, W. J. and McLean, R. A., 1937, see previous page.

Clench, W. J. 1938, Land and Freshwater Mollusks of Grand Bahama and the Abaco Islands, Bahama Islands, Mem. Soc. Cubana Hist. Nat. **12**, p. 303–333, 2 plates.

Two marine species were described as new, namely *Strombus samba* Cl. and *Oliva reticularis greenwayae* Cl.—W. J. Clench