## FAUNA OF THE GATUN FORMATION, ISTHMUS OF PANAMA.

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The collection of fossils studied in this paper was made by one of us (Brown) during two visits to the Isthmus in April and in August, 1910. With the exception of a tooth of a shark[1] and a few specimens of *Oliva* from Monkey Hill, all come from the excavations for the locks at Gatun. The *Oliva* taken at Monkey Hill is the same species found plentifully at the Gatun excavation. The specimens were collected from dumps and fills along the railway as well as from the dumps in the vicinity of Gatun.

A rapid reconnaissance of the stratigraphy along the line of the railway from Colon to Empire and along the canal from Colon to Gatun seemed to indicate that the formations, from the highest exposures at Monkey Hill (Mount Hope) to the lowest that contain molluscan remains at Bohio, form one stratigraphic unit, the base of which is to be found at Bohio and the top at Monkey Hill. This was the impression formed by a study of the stratigraphy on the ground. As shown below, the study of the fossils collected, and a survey of the literature on the Isthmian formations, bears out his impression formed in the field. The thickness of this Gatun formation is probably not much above 400 feet, judging from exposures and borings at Gatun. It is dredged from the canal at more than four miles north of Gatun, being here encountered at 18 feet below water level.

If this is correct that the mollusk-bearing formations from Bohio to the sea at Colon form one stratigraphic unit (and they appear to be one faunal unit), the Gatun Formation will include beds that have been variously called Bohio, Gatun, Monkey Hill, Culebra and Vamos-Vamos.

The recognition of Eocene in the Isthmian section rests upon fossils from the "Vamos á Vamos or Gatun beds" collected by Robert T. Hill and examined by Dr. Wm. H. Dall. These fossils occur as "pseudomorphs in calcite in a tough matrix, and difficult to extract in good condition." The following Eocene (Claiborne) species were "noted on a rapid examination"[2] by Dr. Dall:

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[1] *Carcharias megalodon* Ag.

[2] *Bull. Mus. Comp. Zool.*, vol. 28, p. 273. The genera noted without specific identifications are such as are found in the Oligocene beds.

## ACTEONIDÆ.

***Bullina chipolana** Dall.

*Bullina (Abderospira) chipolana* Dall, Proc. U. S. Nat. Mus., XVIII, p. 32.

Chipola beds, Chipola River, Florida; near Gatun, Rowell (Dall).

## SCAPHANDRIDÆ.

***Volvulella** sp. undet.

*Bulla (Volvula) cf. oxytata* Bush, Toula, Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt, LVIII, 1908 (April 15, 1909), p. 709, Pl. 28, fig. 4.

Gatun.

## TEREBRIDÆ.

**Terebra subsulcifera** n. sp. Pl. XXII, fig. 7.

The shell is slender, the diameter contained about 7½ times in the length, composed of about 15 whorls in a length of 31 mm. Sculpture: A prominent band below the suture, fully one-third the width of the whorl; below it, and separated by a sulcus, another band half as wide, below which there are weak, nearly obsolete spiral striæ; the whole crossed by rather sharp vertical riblets narrower than their intervals. These are very slightly oblique on the upper band, vertical on the sunken lower part of the whorl. The riblets gradually weaken below the middle of the last whorl, leaving the base smooth. The columella is strongly biplicate, the folds subobsolete at the aperture.

Length 31, diam. 7 mm.

This species has much in common with *T. haitensis* Dall, but it differs by having two columellar folds among other minor differences. A comparison kindly made by Dr. Dall shows them to be distinct. *T. sulcifera* Sowerby, of the Santo Domingo Oligocene, is described as having a third subobsolete spiral sulcus, while the species under consideration has only two sulci.

**Terebra gatunensis** Toula. Pl. XXII, fig. 2 (× 2½).

*Terebra (Oxymeria) gatunensis* Toula, Jahrb., p. 705, Pl. 25, fig. 14.

This fine species reaches a length of 50 to 60 mm. The subsutural band is about one-fourth the width of the whorl, with sculpture of straight, vertical ribs, and is followed by a rather wide furrow, below which there are seven rounded spiral cords, the upper one larger. Fine, slightly bent, longitudinal ribs run from suture to suture over cords and intervals, forming rounded knots at the intersections. These ribs are about twice as far apart as the spiral cords on the upper whorls, but on the later ones the cords and ribs are about equally spaced. On the last whorl the siphonal fasciole is marked with rude

growth-lines and lamellæ and bounded by a keel. Aperture narrow and long. The specimen figured, broken at both ends, is 51 mm. long, composed of 13 whorls. Toula's description and figure were from a young shell.

Fig. 2 is typical. Six specimens seen. We doubt whether the following form is specifically distinct, so widely it varies in sculpture. The recent *T. panamensis* Dall has some resemblance to this species. A complete specimen measures, length 52, diam. 10.5 mm.

**Terebra wolfgangi** Toula. Pl. XXII, figs. 1, 3–6 (× 2½).

*Terebra (Oxymeria) wolfgangi* Toula, Jahrb., p. 705, Pl. 28, fig. 7.

Very closely related to *T. gatunensis*, perhaps only a form of that species, from which it differs by having several weak spirals on the sutural band, running over ribs and intervals, and in the smaller number of spiral cords below the band, there being five, equally spaced, on the penultimate whorl, four on the median and upper whorls. The rate of increase of the whorls is about the same as in *T. gatunensis*. Judging from a number of incomplete shells, an adult of 50 mm. length should have about 20 whorls, of which fully 3 form a narrow, high, smooth embryonic shell.

This species is somewhat related to the Pliocene and recent *T. dislocata* Say, and especially to the preceding species. It varies widely in sculpture, as follows:

1. Sutural band differentiated on the early whorls, but on the last 3 or 4 not set off from the other spirals by a deeper furrow; 4 spiral cords as wide as their intervals below it; vertical sculpture fine and low on the later whorls, weak in the intervals of the spirals. One specimen (Pl. 22, fig. 1).

2. Typical form, described above, 2 specimens.

3. Sutural band divided by one shallow sulcus in the intercostal spaces only. Spiral cords unequal, three in a group, followed by two separated by wider spaces. Only 12 spirals on the last whorl below the band. One specimen (figs. 3, 4).

4. Sutural band with several spiral striæ indenting the ribs and intervals. Spiral cords unequally spaced. Two specimens (figs. 5, 6).

**Terebra gausapata** n. sp. Pl. XXII, figs. 8, 9.

A small, slowly tapering species, with very slightly convex whorls and well-impressed, undulating suture. Sutural band limited by a deep, narrow sulcus and, like the rest of the whorl, sculptured with close, unequal, spiral threads. There are three threads upon the band, eight below it. There are fourteen high, rather narrow, longitudinal

ribs on each whorl, the threads obsolete on their summits. The imperfect shell figured measures, length 9, diam. 2.8 mm., of 6⅓ whorls.

## CONIDÆ.

**Conus concavitectum** n. sp. Pl. XXIII, figs. 5, 6.

A cone about twice as long as wide. Spire very concavely conic or mucronate, the inner whorls forming a very steep, acute cone, its whorls carinate below the middle of each, sloping and usually marked with a faint impressed spiral line or two above the carina, or having several striæ on the lower part of the slope, where the carina lies in the suture. The last 3 or 4 whorls revolve nearly in a plane, are markedly concave, with the outer edge raised in an erect flange or keel, the concavity marked with one or several spiral threads and distinct, arched growth-striæ. Last whorl slightly convex below the shoulder-angle, straight and slender below, marked below the middle with unequal, low spirals, most of them beaded. Length 37.5, diam. 19 mm. Incomplete adult shells are much larger, diam. 28 mm., with about 15 whorls.

This species differs from *C. domingensis* Gabb by having the outer edge of the later whorls raised in a flange and by the smooth, not tuberculate early whorls. None of the larger specimens is complete.

**Conus haytensis** Sowb.

*Conus haytensis* Sowb., Journ. Geol. Soc. Lond., VI, p. 44.

A perfect, but small specimen, length 26 mm., agrees with Santo Domingo examples.

**Conus domingensis** Sowerby (?).

*C. domingensis* Sowb., Journ. Geol. Soc. Lond., VI, p. 45.

A fragment, the spire only, agrees well with this species, so far as it goes.

**Conus consobrinus** Sowb.

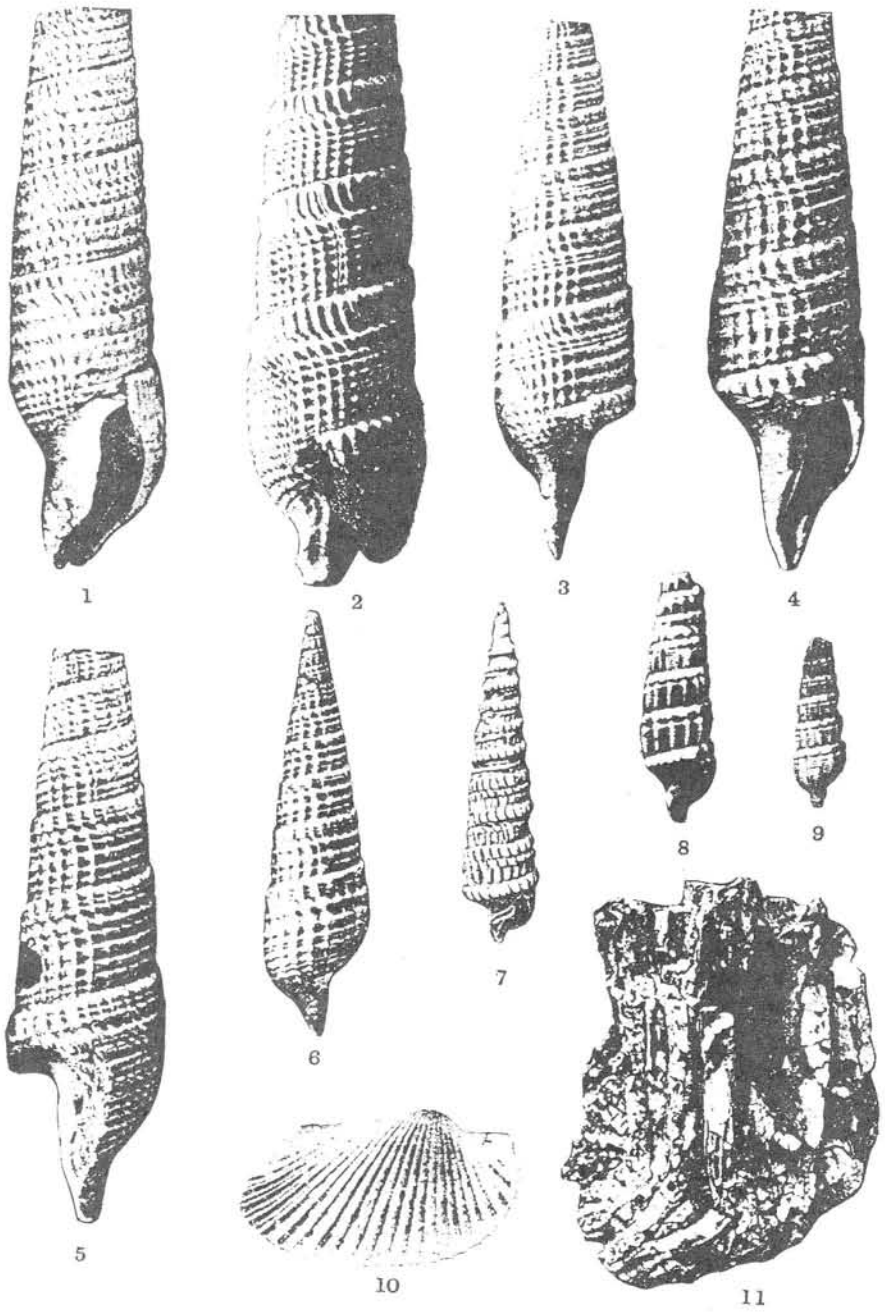
*Conus consobrinus* Sowb., Journ. Geol. Soc. Lond., VI, p. 45.

A Gatun specimen is about 30 mm. long, of the highly sculptured typical form.

**Conus granozonatus** Guppy.

*C. granozonatus* Guppy, Quart. Journ. Geol. Soc. Lond., XXII, p. 287, Pl. 16, fig. 5.
*C. gracilissimus* Guppy, t. c., p. 288, Pl. 16, fig. 4.

Not uncommon at Gatun. While closely related to *C. consobrinus*, this seems to be a distinct species. In our series from Bowden the *C. gracilissimus* does not seem distinguishable specifically.




BROWN AND PILSBRY: GATUN FOSSILS.