FOSSILS OF THE SILEX-BEARING MARL (MIOCENE) OF BALLAST POINT, HILLSBORO BAY.

GASTEROPODA.

Genus **WAGNERIA**, Heilprin.

I propose this genus for a very remarkable shell, distinguished by peculiarities of structure which broadly separate it from all other Gasteropoda. These peculiarities are: firstly, that the inner or columellar lip is so largely developed as to cause it to envelop a very large, if not the greater, part of the shell, duplicating the outer wall and labrum; and secondly, that through an apparent conjunction of both folds of the mantle, a dome of shell is built over the spire, from which its own walls are separated by a free air-space. This part of the shell appears, therefore, as a second section, completely separated from the basal or apertural division. In what precise manner this dome was formed it is impossible to say, but manifestly the lobes of the mantle must have extended upward from the aperture, arched over, and deposited the shell-layer. The free space which separates the dome from the spire would seem to indicate that the mantle possessed a special rigidity, by which it retained itself. The genus may be briefly characterized as follows:

Shell irregularly oval or rounded-fusiform, intumescently knobbed; spire elevated, broadly scalariform, concealed in a pointed dome which is formed over it by a free upward extension of both lobes of the mantle; aperture narrow, deflected forward in its upper course, where it is reduced to a mere slit, appressed to the body of the shell by a pseudalar expansion of the outer lip; inner lip developed to a most extraordinary extent, covering by its expansion almost the entire, or the whole, shell, duplicating the outer lip.

This extraordinary genus of shells, which I take pleasure in naming after the late Prof. William Wagner, the generous founder of the Wagner Free Institute of Science, of this city, is apparently a near ally of Orthaulax of Gabb (Proc. Acad. Nat. Sciences Phila., 1872, p. 272, pl. ix, figs. 3, 4; Trans. Am. Phil. Soc., xv, p. 234), a form evidently closely related to some of the Rostellariæ, as Calyptrophorus and Hippochrenes (Macroptera), in which the inner lip is frequently abnormally developed. The remarkable duplication seen in Wagneria, produced by the complete backward prolongation of the labium, which actually overlaps a large, if not the greater,

of the body-whorl, and the subsutural impression. There is no trace of coronation. The form is intermediate between Voluta proper and Lyria, perhaps nearer to the latter.

Voluta (Lyria) zebra, nov. sp. Fig. 46.

Shell cylindriform, with an elevated, slightly scalariform spire of about six volutions; whorls costated, the costæ (about twenty on the body-whorl) closely-placed, sharply-defined, oblique, forming a pseudo-coronation on top of the whorls; outer lip greatly thickened on the border, slightly ascending; inner lip irregularly plicated over its entire extent, the three or four basal plicæ much the strongest; aperture somewhat more than half the length of shell, narrow, elliptical, contracted basally into a short open canal; surface of shell, barring the costæ, smooth over almost its entire extent, with a few impressed revolving lines on the base of the body-whorl.

Length, an inch and a quarter; greatest width, .6 inch.

This shell most nearly resembles *Voluta pulchella* of Sowerby, a Miocene fossil of Santo Domingo (Q. J. Geol. Soc. London, vi, p. 46, pl. ix, fig. 4), but may be distinguished by its narrower spire, the greater number (best seen on the spire) and more direct obliquity of the costæ, and the costal coronation on top of the whorls. Exceptionally the costæ are equally crowded in *V. pulchella*, but the regular convexity of the whorls, and the absence of the subsutural coronation, seem invariably to distinguish that form. Much the same characters separate it from *Otocheilus* (*Fulgoraria*) *Mississippiensis* of Conrad, from the Vicksburg (Oligocene) group, which is also a narrower shell. In its ornamentation the Florida fossil more nearly approaches the recent *V. Delessertiana*.

Mitra (Conomitra) angulata, nov. sp. Fig. 47.

Shell ovately cylindriform, longitudinally plicated; whorls of the spire very convex, slightly angulated above; body-whorl more prominently angulated; revolving lines absent or obsolete, except from the base of the shell; aperture somewhat exceeding one-half the length of shell; columellar folds four, the upper nearly oblique.

Length, .4 inch; width, .17 inch.

Conus planiceps, nov. sp. Fig. 48.

Shell broadly conical, rapidly tapering toward the base; spire reduced to a minimum, represented in most specimens by an exceedingly gentle rise, crowned by a papilla (apex); whorls about seven, all of them fully exposed on the crown, the shoulders concentrically lined; revolving lines nearly obsolete over the greater extent of the body-whorl, prominent on the basal portion; notch?

Length, 1.4 inches; width of crown, .8 inch.

Very closely resembles *Conus Haitensis* of Sowerby, a Santo Domingo fossil, from which it may be distinguished by its more regularly depressed crown, and the character of its ornamentation. The latter species is so variable, however, that not impossibly the Florida form may ultimately prove to be only a variety, although in the extensive series of specimens contained in the Gabb collection, illustrating Sowerby's species, I fail to find anything which fully agrees with it.

? Pleurotoma ostrearum, Stearns.

I identify with this species a small Pleurotoma which appears to differ (?) from the living form only in having the costæ more distantly removed from one another, and possibly also a little more prominent. It very closely resembles *P. abundans*, of Conrad, from the Vicksburg deposits of Mississippi.

Cypræa tumulus, nov. sp. Fig. 49.

Shell completely involute, inflated, very convex, the greatest elevation being immediately back of the apex; the dome abruptly truncated posteriorly, sloping more gradually in the direction of the anterior extremity; aperture narrow, subcentral, slightly flexuous, directed obliquely over the apex; outer lip produced somewhat beyond the inner lip posteriorly, with about twenty-five evenly placed dental plications; columellar surface flattened, the teeth less prominent; surface of shell covered with very fine revolving lines, which, however (in the specimens before me), are only visible in immediate proximity to the aperture; base gently convex.

Length, 1.6 inch; width, one inch; greatest elevation, .9 inch.

This species may be readily recognized by the marked elevation of its dome, which is more pronounced than in the case of any other American species of the genus, except *C. sphæroides*, Conr., from the Vicksburg (Oligocene) beds, in which this character is still more emphasized. The latter species may be distinguished by its globose form, contracted aperture, and the absence of revolving striæ.

Oniscia Domingensis, Sowerby (1850).

Q. Journ. Geol. Soc. London, vi, p. 47, pl. 10, fig. 3.
Gabb, "Santo Domingo," Trans. Am. Philos. Soc., xv, p. 223 (as *Morum*).

A single individual, measuring .7 inch in length, in which the granules are largely wanting on the columellar surface, a condition which, according to Sowerby, also characterizes the young of the Dominican form. Mr. Gabb affirms that this species is "very different from *Oniscia harpula*, Conr., from the Vicksburg Eocene [Oligocene], although Mr. Conrad has asserted their identity." I must admit, however, that an examination of the type of Conrad's species, described in the Journal of the Academy of Natural Sciences for 1848 (p. 119), inclines me to the

another; dorsal (hinge) line not much more than half the length of shell; anterior border projecting forward basally; posterior border acutely angulated with the base; beaks anterior, not very prominent, nor very widely separated; ligamental area narrow; teeth almost obsolete in the middle of the hinge-line, becoming oblique toward either extremity; interior of shell deep; external surface closely ribbed, the ribs strongly imbricated by the rugose lines of growth; ribs most prominent on the posterior slope, where they are echinated.

Length, 1.7 inch; height to top of umbo, one inch.

Leda flexuosa, nov. sp. Fig. 66.

Shell subequal, the posterior portion somewhat the longest; basal margin evenly rounded, not sinuous; posterior or ligamental slope feebly arched, nearly direct; teeth crowded, v-shaped; external surface covered with concentric, not very fine, lines, which are gently angulated and flexed on the posterior slope.

Length, .55 inch; height, .25 inch.

This shell most nearly resembles the recent *Leda costellata* of Sowerby, but differs from that species in the non-flexed basal outline, and in lacking the very pronounced angulation of the concentric lines on the posterior slope. From *L. acuta* it differs in the comparative coarseness of its ornamentation, its larger size, and the posterior flexion in its lines.

Lithodomus, sp.?

Two casts, very much like *L. inflatus* or *L. corrugatus.*

? Lima scabra, Born.

Mus. Cæs., p. 110.

Two valves which are undistinguishable from the less spinose variety of the recent species inhabiting the West Indian seas. The echination is very fine, appearing somewhat like a raised tessellation. Possibly this form may represent a variety of the East Indian *L. tenera,* of Chemnitz.

List of Species occurring in the Miocene deposits of Ballast Point, Hillsboro Bay.

Wagneria pugnax,
Murex larvæcosta,
" crispangula,
" tritonopsis,
" trophoniformis,
" spinulosa,
Latirus Floridanus,
Turbo heliciformis,
Delphinula (?) solariella,
Pseudotrochus turbinatus,
Cerithium precursor,
Potamides (Pyrazisinus) campanulatus,
Partula Americana,

Fulgur coronatum,
" spiniger?
Turbinella polygonata,
Vasum subcapitellum,
Voluta musicina,
" (Lyria) zebra.
Mitra (Conomitra) angulata,
Conus planiceps,
*Pleurotoma ostrearum,
Cypræa tumulus,
Oniscia Domingensis,
Natica amphora,
" streptostoma,
Amaura Guppyi,
Turritella pagodæformis,
" Tampæ,
Turbo crenorugatus,
Helicina sp.?
*Strophia incana?
Venus penita,
* " magnifica,
Cytherea staminea?
" Sayana?
" nuciformis,
*Chama macrophylla?
Lucina Hillsboroensis,
Crassatella deformis,
Carditamera serricosta,
*Arca imbricata,
* " Listeri,
" arcula,
Leda flexuosa,
*Lithodomus inflatus?
*Lima scabra.

The species preceded by an asterisk are living forms.

Of the forty-seven species here enumerated from four to eight are living forms, so that the representation of the recent fauna might perhaps in a general way be assumed to be about 13–15 per cent. The Miocene age of the deposit is thus placed beyond question; and if the proportion of living forms determined for this limited collection be assumed to be approximately correct for a more extended series, then manifestly the exact position of the horizon will be not far from the base of the Miocene. This accords well with the location of the formation, and its own special faunal relationship. None of the fossils—possibly, with one exception—appear to be identical with forms found in the Oligocene deposits of the southern United States; on the other hand, some six or more—*Oniscia Domingensis, Amaura Guppyi, Venus magnifica, ?Chama macrophylla, Arca imbricata, ?Arca Listeri, Lithodomus,* sp.?—are common to the deposits of Santo Domingo. In these deposits the proportion of recent to extinct forms is claimed by Gabb to be as high as 30 to 33 per cent. ("Topography and Geology of Santo Domingo," Trans. Am. Philos. Soc., xv, p. 101), which would make the formation of considerably newer date than is indicated by the Florida fossils. I have not had an opportunity to verify Mr. Gabb's determination, but from a casual examination of his collection it appears to me that strong exceptions might be taken to many of the specific determinations. Comparisons with a number of forms satisfy me that in at least several cases the selected distinctive characters cannot be relied upon, being more imaginary than real, and this criticism applies as well to cases of specific identification as to those of specific separation. But with all necessary

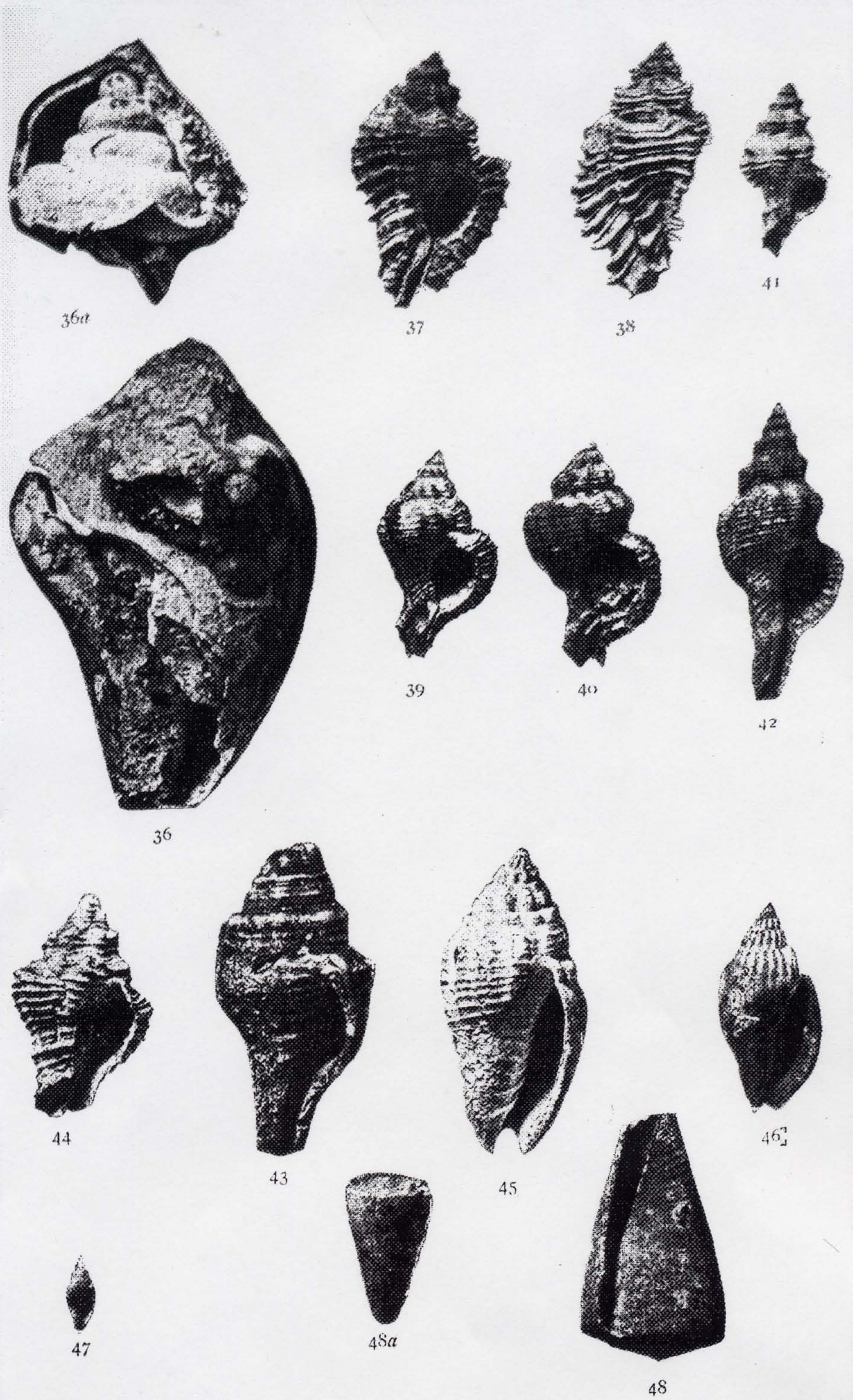
allowances for imperfections and deficiencies, it would still be impossible to determine whether the percentage of recent forms ought rather to be increased or diminished, unless a critical re-examination of all the species were entered into. It is, however, a significant fact, that the percentage, as determined by geologists who preceded Mr. Gabb, is placed very much lower than by Gabb himself. Thus, by Guppy the proportion is reduced to 20 per cent,, and by Carrick Moore to from 17 to 8 or 9 per cent. (Q. Journ. Geol. Soc. London, xxii, p. 577). Mr. Guppy further recognizes the proportion of living forms among the Jamaican fossils, nearly all of which are stated by Gabb to occur also in Santo Domingo, to be likewise 20 per cent., but in all these cases the material upon which the determination was made was much less complete than that which served as a basis for Gabb's computation, so that not unlikely the latter's figures are more nearly correct than those furnished by his predecessors. Granting the accuracy of Mr. Gabb's conclusions, the Santo Domingo formation would then seem to represent a horizon somewhat higher in the Miocene scale than is represented by the Florida deposits, in which, as has already been shown, the proportion of recent forms is reduced to 13-15 per cent. This conclusion is in a measure borne out by the comparatively limited number of forms that are held in common by the two series of deposits, a fact significantly emphasized when the proximity to each other of the two areas under discussion is taken into consideration. Still, it is not safe to premise on too scanty material, and while it may be admitted without reservation that the silex-bearing deposit of Ballast Point is of Miocene age, its exact horizon in the Miocene scale may be considered to be as yet undetermined, although the strong probability points to its representing a part of the "Virginian" series. It is surprising that so few of the distinctly Miocene fossils of the Atlantic border should be found here, the more especially as on the Big Manatee River, not more than some thirty miles distant (almost due south), such fossils—*Pecten Madisonius*, *Pecten Jeffersonius*, *Venus alveata*, etc.—are prominent by their abundance.

The fact that the silex-bearing deposit of Ballast Point can be shown to be unequivocally of Miocene age is important as bearing directly upon the age of the foraminiferal rock occurring at the same locality, and at Magbey's Spring, about a quarter of a mile above Tampa, on the Hillsboro River. It will be remembered that this rock was correlated by Conrad with the white limestone of the Vicksburg (Oligocene) group, and merely from the circumstance of its containing in abundance the remains of a foraminifer, supposed to be a nummulite (*Nummulites* [*Assilina*] *Floridanus*). This supposed nummulite is, however, no nummulite at all, but an orbitolite, so that whatever inference may have been drawn from the occurrence of a form considered to be nearly related

to the foraminiferal exponent of the Vicksburg beds counts for naught, although in itself the presence in great quantity of an orbitolite would, if not exactly indicate, at least suggest, the Oligocene period. But the genus is also fairly abundant in the periods preceding and succeeding—*i. e.*, Eocene and Miocene—so that corroborative evidence of one kind or another is needed before we can definitely assign its true position as a constituent of rock masses. Now, it is a significant circumstance that the Oligocene rock proper of the Floridian peninsula—that which I have indicated as the "Orbitoitic"—which is characterized by an abundance of remains of the genera Orbitoides and Nummulites (either of the one or the other, or of both), is wholly wanting in the genus Orbitolites, at least no indications of that genus have as yet come to light there. On the other hand, the genus is represented in the Miocene deposits of the island of Santo Domingo, and by a form which differs but little, if at all, from that which is so abundantly developed in the cream-colored or yellowish limestone of Ballast Point and Magbey's Spring. This form appears to be closely related to, if not identical with, *Orbitolites complanata*, a well-known fossil of the European Tertiaries, whose range extends from the base of the Eocene possibly to the present time. Again, in the orbitolite rock of the localities just referred to, I failed to detect even as much as a trace of either Nummulites or Orbitoides, a circumstance of no little significance when the proximity of this formation to the recognized Orbitoitic of the North is taken into account. The conjunction of these circumstances leads naturally to the supposition that the rock in question is *not* a member of the Oligocene series, as has been very generally supposed. Its geographical position, and the fact that the genus Orbitolites is a member of the Dominican fauna, lends strong support toward considering the true age as Miocene, a conclusion which receives further confirmation from the evidence carried by the fossils associated with Orbitolites. These are in most cases in the form of casts and impressions, mainly undeterminable, but a few of them are sufficiently distinct and characteristic to permit of definite location. One of these, and possibly the form that is most abundantly represented, is *Venus penita*, from the casts and impressions of which in this rock the species was originally described by Conrad. This shell figures very prominently among the silicified fossils of Ballast Point, but is, as far as I am aware, entirely wanting in the Cerithium rock of the Hillsboro River, which, as has already been shown, underlies the rock containing Orbitolites. Other species apparently identical with forms occurring in the silex-bearing "marl" of this locality are *Cytherea staminea* and *C. nuciformis*. A large cone, possibly identical with *Conus planiceps*, is represented by several casts.

It is to be further remarked, that the Cerithium—*C. Hillsboroensis*—

which constitutes the distinctive faunal feature of the underlying cherty-rock of the Hillsboro, and of the tough blue rock which crops out at Ballast Point, is wholly absent from the rock with orbitolites; similarly, the orbitolite appears to be wanting in the Cerithium rock. What the precise age of the latter deposit may be cannot be determined from its faunal features alone, since the Cerithium, which, as far as my own experience goes, constitutes the only clearly definable species among the numerous molluscan impressions, has thus far not been met with in any other formation, and consequently gives no clue as to the horizon represented by it; but from the position occupied by the rock—stratigraphically underlying the Miocene (probably the lowest member of the Miocene) and geographically wedged in between the Oligocene and Miocene—from both of which it differs widely in faunal characters—I think it may be fairly assumed that it lies on the border horizon of the two series, forming the transition ground.



Figs. 36, 36a, Wagneria pugnax. 37, Murex [illegible]. 38, Murex crispangula. 39, Murex triton[illegible]. 40, Murex [illegible]iformis. 41, Murex [illegible]. 42, Latirus Floridanus. 43, Turbinella polygonata. 44, Vasum subcapitellum. 45, Voluta musicina. 46, Voluta (Lyria) zebra. 47, Mitra (Conomitra) angulata. 48, 48a, Conus planiceps.

MIOCENE FOSSILS OF FLORIDA.

LEVYTYPE AUTOGLYPHIC PROCESS, PHILA.