

9680 (W 175 F). Gonave Island, trail from Étroit to Anse-à-Galets, about 4 kilometers northwest of Anse-à-Galets. W. P. Woodring, collector. December 25, 1920.

9675 (W 169 F). Gonave Island, trail from Grande-Ravine to Fond-Negre, about 5 kilometers northwest of Grande Ravine; altitude 410 meters above sea level. W. P. Woodring, collector. December 22, 1920.

9677 (W 171 F). Gonave Island, trail from Fond-Negre to Dandeville, about 8 kilometers west-northwest of Fond-Negre; altitude 190 meters above sea level. W. P. Woodring, collector. December 23, 1920.

9678 (W 172 F). Gonave Island, trail from Fond-Negre to Dandeville, about 15 kilometers west-northwest of Fond-Negre; altitude 275 meters above sea level. W. P. Woodring, collector. December 23, 1920.

*Miocene fossils from Gonave Island.*

Species.	9661	9663	9680	9675	9677	9678
<b>Corals:</b>						
Stylophora sp. ....	x	x	....	....	....	....
Stephanocoenia intersepta (Esper).....	....	....	x	....	....	....
Meandrina sp. apparently new.....	....	x	....	....	....	....
Orbicella sp. cf. O. altissima (Duncan).....	....	x	....	....	....	....
<b>Mollusca:</b>						
<b>Gastropoda:</b>						
Conus sp. ....	....	x	....	....	....	....
Xancus ? sp.....	....	x	....	....	....	....
Cerithium sp. ....	....	....	....	....	x	....
Emarginula ? sp.....	....	....	....	....	....	x
<b>Pelecypoda:</b>						
Chlamys (Aequipecten) sp.....	....	....	....	x	....	....
Lucina ? sp.....	....	x	....	....	....	....

**PLIOCENE SERIES.**

Faunal evidence and the degree of deformation of the rocks are the criteria used in recognizing marine deposits of Pliocene age in Haiti. Judged by these criteria marine Pliocene deposits appear to be confined to relatively small areas in the Southern Peninsula. Some of the coralliferous limestones and other marine beds called Quaternary may really be Pliocene, but all the beds classed as Quaternary are undeformed or only slightly deformed and have approximately the same fauna. Nonmarine deposits of Pliocene age are known in some of the larger valleys and plains. They are more dissected than similar Quaternary beds and may consist of different material.

**MARINE DEPOSITS.**

**VALLEY OF RIVIÈRE GAUCHE.**

The lowland that is drained by Rivière Gauche, extending northwestward from Jacmel for at least 17 kilometers, contains marine deposits of Pliocene age. On the northeast side of the lowland these beds rest unconformably on upper Eocene limestone, although at some localities they

have about the same strike and dip as the upper Eocene rocks. The relation to the older rocks along the foot of the steep, cliff-broken slope on the southwest side of the lowland are not known. The Pliocene beds are folded, and along the trail following Rivière Gauche they dip steeply southwestward. They consist principally of conglomerate and marl. The conglomerate is firmly consolidated, except certain very coarse beds, and contains pebbles and cobbles of different kinds of limestone, which have a maximum diameter of half a meter. It contains also cobbles of chert and basalt, which, however, are much less numerous. At some places the conglomerate is made up of pebbles of uniform size, 5 or 6 centimeters in diameter. Interbedded with the conglomerate are beds of gray and yellow marl containing sandy and clayey layers. Some of the beds of marl carry perfectly preserved fossils. Fossils were collected from thin marl beds at two localities. (See list, p. 242, stations 9529 and 9530.) There are also a few beds of limestone containing poorly preserved corals and mollusks.

The strike of the beds along Rivière Gauche below Boucicaut is parallel to the longer diameter of the lowland and the dip is southwestward at angles of  $40^{\circ}$  to  $50^{\circ}$ . The thickness of these beds is not known but is probably more than 100 meters.

Near the mouth of Rivière Gauche and on Rivière Gosseline, at the southeast end of the lowland, the Pliocene beds dip more gently southwestward at angles of  $10^{\circ}$  to  $25^{\circ}$ , having virtually the same strike and dip as the underlying upper Eocene limestone. A bluff on the right bank of Rivière Gosseline exposes marly sandstone and sandy marl containing casts of the mollusks listed on page 242, station 9604.

#### TAPION DU PETIT-GOAVE.

The beds in the gap south of Tapion du Petit-Goave seem to consist chiefly of the Miocene rocks that are described on page 224. Along the road on the west slope a thick coralliferous limestone overlies the Miocene rocks. It is more massive than the coralliferous limestones interbedded with the Miocene conglomerate but seems to have about the same dip. An extensive series of corals (see list, p. 243, station 9793) collected along the road at an altitude of 150 meters above sea level contains only genera still living in the West Indies, and this limestone is believed to be either Pliocene or Quaternary—probably Pliocene, because the beds are more greatly deformed than those classed as Quaternary.

#### NONMARINE DEPOSITS.

Nonmarine deposits of Pliocene age probably underlie similar Quaternary deposits in most of the larger valleys and plains, but detailed work would be required to separate them. Most of the dissected nonmarine deposits in these regions are arbitrarily called Quaternary.

## CENTRAL PLAIN.

## Hinche formation.

In the Central Plain beds of silt, clay, sand, and gravel, usually unconsolidated or imperfectly consolidated, rest on the eroded surface of the folded rocks of the Artibonite group. These beds were apparently laid down along a drainage system that emptied southeastward into the San Juan Valley of the Dominican Republic. Jones<sup>1</sup> gave the name "Hinche beds," derived from the town of Hinche, to these stream deposits. So far as observed these rocks are undeformed. They closely resemble imperfectly consolidated rocks of similar origin in the Las Cahobas formation, and where the Las Cahobas rocks lie flat, as in the trough of the Central Plain syncline, the two formations can hardly be distinguished. The gravels of the Hinche beds contain a greater proportion of limestone pebbles than is found in poorly consolidated conglomerates in the upper part of the Las Cahobas formation, but they do not contain the large boulders of limestone and brown chert that are common in the Quaternary stream gravels. The Hinche beds underlie the extensive savanna in the northwestern part of the plain and patches of them are found at successively lower altitudes in the southeastern part. The estimated maximum thickness of this formation is 25 meters.

The Hinche formation is considered Pliocene because of its stratigraphic position. It is the equivalent of the Las Matas formation of the San Juan Valley in the Dominican Republic, and the two formations are probably continuous.

## FOSSILS.

The corals obtained from the Pliocene beds on Rivière Gauche have a more modern aspect than the Miocene corals collected in the Republic. Only five genera are represented, but these genera are all still living in the West Indian region. *Maeandra labyrinthiformis* (Linnaeus) and *Acropora muricata* (Linnaeus) have never been recorded from West Indian Miocene deposits.

The molluscan fauna seems to be intermediate between Miocene and Quaternary faunas. Species like *Fusinus* sp. cf. *F. ulcimus rushii* Dall, *Astrea* sp. cf. *A. caelata* Gmelin, *Calliostoma* sp. cf. *C. zonamesta* Reeve, and *Torinia* sp. cf. *T. cylindrica* (Gmelin) are more modern than any Miocene species. The *Sconsia* is intermediate between the Miocene *S. laevigata* (Sowerby) and the Recent *S. striata* (Lamarck). *Torinia rotundata* Gabb, recently figured by Pilsbry,<sup>2</sup> is the only *Torinia* recorded from West Indian Miocene deposits, although a similar species is listed on page 225, station 9481, from the Miocene at the west end of the Léogane

<sup>1</sup> Jones, W. F., A geological reconnaissance in Haiti; a contribution to Antillean geology: Jour. Geology, vol. 26, p. 748, 1918.

<sup>2</sup> Pilsbry, H. A., Revision of W. M. Gabb's Tertiary Mollusca of Santo Domingo: Acad. Nat. Sci. Philadelphia Proc., vol. 73, p. 379, pl. 34, figs. 19-20, 1922.

Plain. The species from the Pliocene beds is more similar to the Recent *T. cylindrica* (Gmelin). Other mollusks from these beds resemble Bowden and Gurabo (Miocene) species.

Marine deposits of Pliocene age have not been recognized in other West Indian islands, with the doubtful exception of Cuba, but beds of this age are known at Port Limon, Costa Rica.

Most of the corals from the limestone on the west slope of Tapion du Petit-Goave are Recent species, but the limestone is considered of doubtful Pliocene age because of its structural relations.

*Stations in arrondissement of Jacmel (Pliocene).*

9529 (K 30 F). Arrondissement of Jacmel, trail from Jacmel to Boucicaut, right bank of Rivière Gauche, about 7 kilometers northwest of Jacmel. W. S. Burbank, collector. November 16, 1920.

9530 (K 31 F). Arrondissement of Jacmel, trail from Jacmel to Boucicaut, left bank of Rivière Gauche, about 9 kilometers northwest of Jacmel. W. S. Burbank, collector. November 16, 1920.

9604 (W 68 F). Arrondissement of Jacmel, trail from Jacmel to Carrefour, right bank of Rivière Gosseline 100 meters above second crossing above Jacmel. W. P. Woodring, collector. November 3, 1920.

*Pliocene fossils from beds on Rivière Gauche, arrondissement of Jacmel.*

Species.	9529	9530	9604
<b>Corals:</b>			
<i>Solenastrea hyades</i> (Dana).....	x	....	....
<i>Maeandra labyrinthiformis</i> (Linnaeus).....	x	....	....
<i>Maeandra</i> ? sp.....	x	....	....
<i>Siderastrea</i> sp. aff. <i>S. siderea</i> (Ellis and Solander).....	x	....	....
<i>Agaricia</i> sp. ....	x	....	....
<i>Acropora muricata</i> (Linnaeus).....	....	x	....
<b>Mollusca:</b>			
<b>Pteropoda:</b>			
<i>Cavolina</i> sp. cf. <i>C. tridentata</i> Forskal.....	....	....	x
<b>Gastropoda:</b>			
<i>Oliva</i> sp. cf. <i>O. reticularis</i> Lamarck.....	....	x	....
<i>Olivella</i> sp. cf. <i>O. jaspidea rotunda</i> Dall.....	....	x	....
<i>Fusinus</i> sp. cf. <i>F. ulcimus rushii</i> Dall.....	....	x	....
<i>Phos</i> sp. cf. <i>P. moorei</i> Guppy.....	....	x	....
<i>Murex</i> sp. cf. <i>M. domingensis</i> Sowerby.....	....	x	....
<i>Sconsia</i> sp. cf. <i>S. laevigata</i> (Sowerby).....	....	x	?
<i>Colubraria</i> sp. ....	....	x	....
<i>Turritella</i> sp. cf. <i>T. submortoni</i> Maury.....	....	x	....
<i>Astrea</i> sp. cf. <i>A. caelata</i> (Gmelin).....	....	x	....
<i>Calliostoma</i> sp. cf. <i>C. zonamesta</i> Reeve.....	....	x	....
<i>Torinia</i> sp. cf. <i>T. cylindrica</i> (Gmelin).....	....	x	....
<b>Pelecypoda:</b>			
<i>Leda</i> sp. ....	....	....	x
<i>Glycymeris</i> sp. cf. <i>G. pennacea</i> (Lamarck).....	....	x	....
<i>Chlamys</i> ( <i>Aequipecten</i> ) sp. cf. <i>C. (A.) uselmae</i> Pilsbry and Johnson.....	....	x	....
<i>Cardium</i> ( <i>Fragum</i> ) <i>medium</i> Linnaeus.....	....	x	....

*Stations on west slope of Tapion du Petit-Goave (Pliocene ?).*

9793 (W 317 F). Arrondissement of Léogane, road from Léogane to Miragoâne, west slope of Tapion du Petit-Goave, altitude 150 meters above sea level. T. W. Vaughan and W. P. Woodring, collectors. March 6, 1921.

9470 (B 33 F). Arrondissement of Léogane, road from Léogane to Miragoâne, west slope of Tapion du Petit-Goave, altitude about 100 meters above sea level. J. S. Brown, collector. October 23, 1920.

*Pliocene (?) fossils from west slope of Tapion du Petit-Goave.*

Species.	9793	9470
<b>Corals:</b>		
Orbicella annularis (Ellis and Solander).....	x	....
Solenastrea bournoni Milne-Edwards and Haime.....	x	....
Solenastrea hyades (Dana).....	x	....
Maeandra labyrinthiformis (Linnaeus).....	x	....
Siderastrea sp. aff. S. sidera (Ellis and Solander).....	x	....
Agaricia agaricites var. purpurea (Le Sueur).....	x	....
Porites sp. cf. P. porites (Pallas).....	x	....
Porites sp. cf. P. astreoides Lamarck.....	x	....
<b>Mollusca:</b>		
<b>Gastropoda:</b>		
Bullaria ? sp.....	....	x
<b>Pelecypoda:</b>		
Arca umbonata Lamarck.....	....	x
Chlamys (Aequipecten) sp. cf. C. (A.) phrygium Dall.....	x	x
Chlamys (Plagiactenium) sp. cf. C. (P.) gibbus Lamarck.....	....	x
Ostrea sp. ....	x	....
Venus campechiensis Gmelin ?.....	x	....
Chione ? sp.....	x	x
Macrocallista ? sp.....	x	....

QUATERNARY SYSTEM.

GENERAL FEATURES.

The effects of the rise and decline of glaciation in the temperate regions are apparently not recognizable in the Republic, either directly or indirectly, and the limits of Pliocene, Pleistocene, and Recent time are poorly defined, depending on several criteria, none of which can be rigidly applied. Deposits that are poorly consolidated, that are undeformed or only slightly deformed, that are dissected by present streams, and that contain a fauna identical with or very similar to the living fauna are here considered Quaternary.

Quaternary sedimentary deposits are rather widely distributed in the Republic, although most of the areas in which they form the surface rocks are small. (See Pl. I.) They may be divided into marine and non-marine deposits.

MARINE DEPOSITS.

Marine Quaternary deposits are common only along the coast, where they form narrow fringes, at few places more than 1 or 2 kilometers wide.