

9669 (W 163 F). Gonave Island, trail from Anse-à-Galets to Picmi, about 2 kilometers north of Picmi, altitude 180 meters above sea level. W. P. Woodring, collector. December 19, 1920.

9670 (W 164 F). Gonave Island, trail from Anse-à-Galets to Picmi, float about 1.5 kilometers north of Picmi, altitude 70 meters above sea level. W. P. Woodring, collector. December 19, 1920.

9668 (W 162 F). Gonave Island, trail from Anse-à-Galets to Picmi, bottom of ravine at spring north of Picmi. W. P. Woodring, collector. December 19, 1920.

9665 (W 158 F). Gonave Island, trail leading southwestward from Anse-à-Galets, about 4 kilometers from Anse-à-Galets, altitude 310 meters above sea level. W. P. Woodring, collector. December 18, 1920.

9681 (W 176 F). Gonave Island, trail from Anse-à-Galets to Fond-l'Aurore, about 6 kilometers southeast of Anse-à-Galets. Altitude 380 meters above sea level. W. P. Woodring, collector. December 26, 1920.

9671 (W 165 F). Gonave Island, trail from Anse-à-Galets to Plaine des Mapoux, about 2 kilometers west-northwest of triangulation station on Morne Chien Content. W. P. Woodring, collector. December 20, 1920.

9672 (W 166 F). Gonave Island, trail from Anse-à-Galets to Plaine des Mapoux, about a kilometer east of east end of Plaine des Mapoux, altitude 525 meters above sea level. W. P. Woodring, collector. December 20, 1920.

9673 (W 167 F). Gonave Island, northwest corner of Plaine des Mapoux, altitude 540 meters above sea level. W. P. Woodring, collector. December 21, 1920.

9674 (W 168 F). Gonave Island, north slope of Morne la Pierre, about half a kilometer northeast of triangulation station, altitude 700 meters above sea level. W. P. Woodring, collector. December 21, 1920.

OLIGOCENE SERIES.

Oligocene deposits in narrow bands usually border upper Eocene limestone along the lower slopes of the mountain ranges. These Oligocene bands consist principally of limestone that can scarcely be distinguished from the upper Eocene limestone except by the fossils it contains.

LOWER OLIGOCENE.

None of the deposits seen during the reconnaissance are considered of undoubted lower Oligocene (Lattorfian) age, as none of them contain *Lepidocyclinas* of the type of *L. mantelli* (Morton), a species which, in the southeastern United States, is confined to the lower part of the Vicksburg group (Marianna limestone). Some of the limestone in the Chaîne des Mateux, on the north slope of Morne Hôpital (pp. 130-131), east and south of Dondon (pp. 111-112) and elsewhere, described as upper Eocene, may be lower Oligocene. These deposits are unfossiliferous or contain fossils that have no stratigraphic value. Deposits of lower Oligocene age might be expected in such regions as the Chaîne des Mateux, where the series from upper Eocene to Miocene seems to be conformable.

MIDDLE OLIGOCENE.

Middle Oligocene deposits were seen principally in isolated exposures or as float, and at most places their stratigraphic and structural relations are obscure. As their lithology differs at different places no general description of them can be given.

DESCRIPTION BY REGIONS.

Massif du Nord.

A typical middle Oligocene fauna was obtained from a float boulder of yellowish white limestone in a ravine a few hundred meters northwest of the town of Bahon (see list, p. 150, station 9884). The country rock at this place is quartz diorite, and the float in the ravine consists principally of quartz diorite and of slaty argillite of supposed lower or middle Cretaceous age, but limestone boulders, which have probably been transported from an unexplored locality some kilometers to the southwest, are fairly common.

Rocks of known or supposed middle Oligocene age are exposed in a large area along the northern border of the Central Plain near St.-Raphaël. They were examined along the trail from St.-Raphaël to Dondon for a distance of about 3 kilometers, where they overlie limestone of supposed upper Eocene age (see pp. 111-112) and dip southward or southeastward beneath the younger rocks of the plain.

The lowest beds, which are exposed farthest north, consist mainly of brown or gray marl and fine-grained sandstone in very even, rather soft beds, from 2 to 5 centimeters thick, which occupy a small lowland along the narrow valley of Rivière Bouyaha. Lithologically they are similar to some Miocene rocks. A few beds of coarser material containing small pebbles of white limestone, presumably upper Eocene, suggest an erosional unconformity. Interbedded with the sand and marl are thicker beds of brown crystalline limestone containing the Foraminifera listed on page 150, stations 9877 and 9878.

Overlying these clastic beds to the south, at the border of the plain, is pure limestone, white and partly crystalline, thick-bedded or massive, and hard, forming steep walls along the gorge of Rivière Bouyaha. The Foraminifera listed on p. 150, station 9876, were collected from this limestone.

As the dips along the trail appear to be invariably to the south or southeast, and as the width of outcrop is at least 3 kilometers, the total thickness of middle Oligocene at this locality is several hundred meters.

Massive limestone underlies the Pic de Pignon, a conspicuous conical hill north of Pignon. The middle Oligocene Foraminifera listed on page 150, station 9940, were collected from loose pieces of limestone at the foot of the hill. This limestone, which is apparently the same as the massive

limestone along Rivière Bouyaha below St.-Raphaël, forms the ridge extending southeastward from Pignon.¹

Northwest Peninsula.

Trois Rivières Valley.—Rocks of middle Oligocene age are apparently widely distributed in the Trois Rivières Valley north of Gros-Morne. All the rocks in this trough are folded in narrow anticlines and synclines which are parallel to the length of the trough. The relations of the middle Oligocene to the upper Oligocene south of Gros-Morne and to the Miocene in the lower part of the valley were not determined. The middle Oligocene rocks were seen on the east side of Les Trois Rivières along an unfrequented trail from Gros-Morne to Port-de-Paix. The corals listed on page 150, station 9756, were collected from pieces of hard gray limestone weathered from an outcropping ledge about 9 kilometers north of Gros-Morne. Float containing similar corals was collected a short distance farther north (see list, p. 150, station 9757). Beds of marl, shale, sandstone, and a conglomerate consisting entirely of large cobbles of basaltic rock crop out along the trail north and south of this locality. These beds were seen only in isolated exposures, and as their folding is complex the question whether all the rocks involved are of middle Oligocene age could not be determined.

Montagnes de Jean Rabel.—A series of brown or gray marls containing many thick beds of dense yellowish limestone is exposed along the trail from Jean Rabel to Anse Rouge just south of the crest of the Montagnes de Jean Rabel. These beds overlie upper Eocene limestone and probably overlap it in the area to the north, where they rest on quartz diorite. To the south they dip beneath marly beds of supposed Miocene age underlying the Arbre Plain. An *Operculina*, apparently a common undescribed middle Oligocene species, was collected from one of the beds of limestone. (See list, p. 150, station 9962). The boundary between Oligocene and Miocene in this locality was not determined.

Montagnes de Terre-Neuve.—About 5 kilometers southeast of Terre-Neuve, at a place known as Hilaire, just east of the mineral prospects known as Casseus and Germinie, the mountain side is covered with large float blocks of limestone, gray on weathered surfaces and white in the interior, similar to the prevailing upper Eocene limestone. Some of the boulders contain numerous specimens of *Operculina*, apparently of middle Oligocene age, etched out on weathered surfaces. (See list, p. 150, stations 9810 and 9812.) The collection listed at page 144, station 9813, probably of upper Eocene age, was obtained in the same locality. The middle Oligocene float probably represents rock in place somewhere on the high mountain ridge to the east, at the locality just north of Habitation Dumuraille.

¹ On the map of the Central Plain, Pl. XXXVI, the limestone near Pignon and St.-Raphaël is incorrectly shown as upper Oligocene.

Montagnes Noires.

Thin-bedded chalky limestone crops out on the northeast slope of the Montagnes Noires, in the section called Bois-Joli, along the trail from Mirebalais through Dufailly to Thomonde. The beds strike N. 40° W. and dip 20° NE. Pieces of chert lying on the surface of the limestone contain numerous specimens of the middle Oligocene Foraminifera listed on page 150, station 9918. The chert probably came from bands or nodules in the chalky limestone, although none were seen in the exposure. Lithologically this limestone is indistinguishable from thin-bedded chalky upper Eocene limestone containing bands of chert.

Chaîne des Mateux.

Some of the limestone on the north flank of the Chaîne des Mateux is of middle Oligocene age. Thin-bedded white brittle limestone containing chert nodules crops out at the foot of the mountains south of Savane Madame Michel, on the trail from Saut d'Eau to Fond-des-Orangers. A piece of chert lying loose on the trail contained the middle Oligocene Foraminifera listed on page 150, station 9658. The nephelite basalt described on pages 314-318 overlies this limestone. Farther northwest, on both flanks of the Chaîne des Mateux, limestone of supposed Oligocene age crops out. It is described on page 153.

Montagnes du Trou d'Eau.

Middle Oligocene limestone probably extends eastward from the Chaîne des Mateux, as a *Lepidocyclina* similar to *L. canellei yurnagunensis* Cushman was obtained from float on the south slope of the Montagnes du Trou d'Eau along the road from Port-au-Prince to Mirebalais (see list, p. 150, station 9900).

Near Jacmel.

Granular white limestone containing nodules of chert is exposed in the northernmost sea cliff on the west side of Jacmel Bay, just south of the mouth of a small stream. The bedding in this exposure is not apparent, but the rock is probably crumpled, as pieces from almost any part of the exposure are slickensided. A network of thin seams in the rock contains dark-brown clay. This limestone contains the largest foraminiferal fauna discovered in any of the Tertiary rocks of Haiti. In addition to the species listed on page 150, station 9601, the limestone contains some small undetermined Foraminifera. This is one of the few localities where it is possible to obtain entire tests from the rock. The tests stand out in relief on weathered surfaces and can easily be dug out, as the rock is soft. This is the only locality on the south coast where fossils of middle Oligocene age were collected.

FOSSILS.

Foraminifera are the most abundant middle Oligocene fossils. They include species of *Lepidocyclina* described by Cushman from Antigua and Cuba and an undescribed species of *Operculina* found in Antigua and other regions. Foraminifera are particularly abundant at station 9601, on the west side of Jacmel Bay, where hand specimens containing hundreds of tests of *Lepidocyclina* can be obtained. The few corals collected are similar to species from Antigua. The same fauna has been found at many localities in the Dominican Republic, in other parts of the West Indies, and in Georgia. The Antigua formation of the island of Antigua, which contains an unusually rich coral fauna, is the type formation of this horizon. On account of its stratigraphic relations in Georgia and of its corals it is correlated with the Rupelian of Italy.¹

Stations—Middle Oligocene.

9884 (B 298 F). Arrondissement of Grande-Rivière du Nord, float in ravine about a kilometer west of Bahon. J. S. Brown, collector. March 10, 1921.

9876 (B 290 F). Arrondissement of Grande-Rivière du Nord, trail from St.-Raphaël to Dondon, about a kilometer north of St.-Raphaël. J. S. Brown, collector. March 7, 1921.

9877 (B 291 F). Arrondissement of Grande-Rivière du Nord, trail from St.-Raphaël to Dondon, about 3 kilometers north of St.-Raphaël. J. S. Brown, collector. March 7, 1921.

9878 (B 292 F). Arrondissement of Grande-Rivière du Nord, trail from St.-Raphaël to Dondon, about 200 meters north of 9877. J. S. Brown, collector. March 9, 1921.

9940 (W 264 F). Arrondissement of Grande-Rivière du Nord, float at foot of Pic de Pignon, 0.5 kilometer east of Pignon, altitude 365 meters above sea level. W. P. Woodring, collector. February 7, 1921.

9756 (W 291 F). Arrondissement of Port-de-Paix, trail from Gros-Morne to Port-de-Paix on right side of Les Trois Rivières, about 2 kilometers north of crossing of Rivière l'Aqui. W. P. Woodring, collector. February 17, 1921.

9757 (W 292 F). Arrondissement of Port-de-Paix, trail from Gros-Morne to Port-de-Paix on right side of Les Trois Rivières, float about 4 kilometers north of crossing of Rivière l'Aqui. W. P. Woodring, collector. February 17, 1921.

9962 (K 125 F). Arrondissement of Môle St.-Nicolas, trail from Jean Rabel to Anse Rouge, south slope of mountains in valley of Rivière de Port-à-Piment, about 20 kilometers south of Jean Rabel. W. S. Burbank, collector. February 3, 1921.

9810 (B 160 F). Arrondissement of Gonaïves, float at Germinie, in Terre-Neuve region, south of Casseus prospect. J. S. Brown, collector. January 12, 1921.

9812 (B 162 F). Arrondissement of Gonaïves, float south of Germinie in Terre-Neuve region. J. S. Brown, collector. January 12, 1921.

9918 (W 219 F). Arrondissement of Las Cahobas, trail from Thomonde to Mirebalais, float on northeast slope of mountains at Bois-Joli, near crest, altitude 610 meters above sea level. W. P. Woodring, collector. January 17, 1921.

¹ Vaughan, T. W., Fossil corals from Central America, Cuba, and Porto Rico, with an account of the American Tertiary, Pleistocene, and Recent coral reefs: U. S. National Museum Bull. 103, pp. 199 and 202, 1919.

UPPER OLIGOCENE.

Rocks of upper Oligocene age seem to be confined to the northern and central parts of the Republic. They consist principally of limestone, generally massive, resembling the massive limestone of Eocene and middle Oligocene age. The upper Oligocene deposits probably are conformable to the middle Oligocene, although the actual contact was not seen. The lithology and thickness differ in the regions where rocks of this age were examined, as is shown below.

DESCRIPTION BY REGIONS.

Tortue Island.

The limestone that covers the interior of Tortue Island is at least 100 meters thick. It is massive, and most of the weathered outcrops on the surface of the plateau are stained red by recemented residual clay. It rests unconformably on a basement of schistose limestone. The structure of the limestone was not determined, but the surface features indicate that it is arched in a broad anticline. The only fossils obtained are the Foraminifera and mollusks listed on page 156 (stations 9761 and 9762). The evidence with regard to age furnished by these fossils is not conclusive, and the limestone may be of Miocene age.

The relation of this limestone to the water supply of the island is discussed on page 541.

Arrondissement of Borgne.

Massive white or grayish limestone crops out in the coastal ridge east of Anse-à-Foleur, in the western part of the Arrondissement of Borgne. The Foraminifera and corals listed on page 156 (stations 9766, 9767, and 9768) were obtained from this limestone. Its stratigraphic and structural relations to the upper Eocene limestone in the same ridge farther east are not known.

Trois Rivières Valley.

The surface rocks in virtually all the southern part of the trough known as the Trois Rivières Valley, which extends northward from Gonaïves to Port-de-Paix, are of upper Oligocene age. These deposits consist of limestone, gray or brown marl, fine-grained sandstone, and shale. Brownish-yellow limestone is interbedded with the marl. The limestone, which is in thick or thin beds, is harder than the marl and crops out in conspicuous ledges. Partly crystalline massive limestone and sandy limestone in thinner beds are exposed in low, bare hills along the west side of the road from Gonaïves to Gros-Morne south of the divide. The Foraminifera listed on page 156 (station 9751) were collected from the massive limestone. The marl is well exposed in cuts along the same road just south of the divide. It has a conchoidal fracture and closely resembles Miocene marl. A bed of limestone interbedded with the marl at a locality about a

kilometer north of the divide contained the Foraminifera listed on page 156 (station 9943).

Along the east and west borders of the trough there are a number of exposures of a white thin-bedded unfossiliferous limestone that commonly is sheeted transverse to the bedding. It seems to be in fault contact with upper Eocene limestone or older volcanic rocks. As the trough has probably been formed by normal faulting (see p. 121), this limestone appears to be younger than Eocene. It is tentatively referred to the upper Oligocene.

The upper Oligocene rocks, like other rocks in the trough, are folded in narrow anticlines and synclines, and the dip and strike change within short distances.

Borders of the Central Plain.

Limestone of upper Oligocene age crops out in the lower slopes of the mountains bordering the southeastern half of the Central Plain. At the northwestern extremity of the plain this limestone seems to be concealed by flood-plain deposits, which are not shown on the map (Pl. I).

The limestone in the mountains bordering the plain from St.-Raphaël southeastward an unknown distance beyond Pignon is middle Oligocene. At Bassin Zinn, northeast of Hinche, where Rivière Samaná cascades down the dip slope of the limestone into the plain, the limestone is of upper Oligocene age. The surface of the limestone along the stream is covered with travertine. A piece of limestone at the foot of the cascade contained the Foraminifera listed on page 156 (station 9936). At this locality the limestone has the same strike and dip as the overlying Miocene conglomerate.

The same limestone was examined along the trail from Thomassique to Cerca-la-Source, where it crops out in the ridge bordering the plain. The Miocene beds in the plain and the upper Oligocene limestone in the ridge dip about 20° SW. The southwest slope of the ridge, which faces the plain, is a dip slope. The northeast slope, which overlooks the valley of Rivière l'Océan, is a steep scarp, apparently a fault scarp. The limestone appears massive in outcropping ledges. The coral listed on page 156 (station 9949) was collected from a loose piece of limestone on the northeast slope.

Massive limestone of supposed upper Oligocene age flanks upper Eocene limestone on the north slope of the Montagnes Noires, along the south side of the plain. It also crops out on the south side of the mountains facing the valley of Rivière Fer-à-Cheval.

On the southwest side of the plain the upper Oligocene limestone crops out in the lower slopes of the Montagnes Noires. It forms the conspicuous hill northwest of Thomonde, on the crest of the Thomonde anticline. The corals listed on page 156 (stations 9934 and 9741) were collected at the foot of this hill. Massive gray limestone of upper Oligocene age was seen on the northeast slope of the mountains on the trail from Thomonde to

Mirebalais through Bois-Joli. The fossils listed on page 156 (stations 9786, 9787, 9917, and 9788) were collected from float derived from this limestone.

Low, isolated hills, which rise above the cover of flood-plain deposits in the northwestern extremity of the plain, between St.-Michel de l'Atalaye and Pignon, are composed of limestone, probably of upper Oligocene age, although it may be middle Oligocene. An indeterminate species of *Goniopora* was collected from this limestone (station 9875).

Chaîne des Mateux.

Along the trail from l'Arcahaie through Couyau to Marché Désarmes a band of limestone of supposed Oligocene age, from 2 to 4 kilometers in width, flanks upper Eocene limestone on the limbs of the anticlinal arch of the Chaîne des Mateux. The band of Oligocene rocks is narrower on the northeast side than on the southwest side because of the steeper dips. The structural relations are shown in Figure 5 (p. 128). On the southwest slope of the mountains the Oligocene rocks are thrust southwestward over Miocene rocks. No fossils were found in the beds of supposed Oligocene age and their age is not definitely known.

The supposed Oligocene limestone rests without apparent discordance on upper Eocene limestone. It is white and partly chalky and contains no chert. In many exposures it is sheeted transverse to the beddings, apparently as a result of fractures produced in folding. The sheeting may obscure the bedding and at places resembles bedding. Most of the sheeting planes are only 2 to 5 centimeters apart and the bedding planes are farther apart. The thickness of this limestone, as can be seen from Figure 5, is at least several hundred meters if not more than 1,000 meters.

Montagnes du Trou d'Eau.

The surface rock in virtually the entire eastern part of the Montagnes du Trou d'Eau east of Morne Trou d'Eau, is limestone of upper Oligocene age. The thickness of this limestone is probably several hundred meters. Its structural relations are obscure because at almost all the localities examined it appears massive.

The limestone is gray or yellowish on weathered surfaces and white on unweathered surfaces. Weathered surfaces in most places are deeply pitted, and at some places the rock forms a solution breccia. The limestone rests on the nephelite basalt described on page 315. A conglomerate at the base of the limestone contains large cobbles of basalt and smaller pebbles of limestone, presumably of upper Eocene age. This conglomerate is well exposed on the trail from Thomazeau to Cornillon, about 1.5 kilometers from Thomazeau.

Numerous collections of fossils were obtained from this limestone along the north shore of Étang Saumâtre and along the trails from Thomazeau

to Cornillon, from Cornillon to St.-Pierre, and from Cornillon to Marché Canard. (See list, p. 156, stations 9898, 9521, 9657, 9556, 9557, 9558, 9451, 9449, 9450, 9559, 9452, 9453, 9560, 9454, and 9561.) Corals are particularly abundant, and at some places—for example, on the crest of the first ridge northwest of Cornillon on the trail to Marché Canard, where large heads of *Orbicella* and branches of *Stylophora* and *Porites* are strewn along the trail—the limestone is a reef rock.

FOSSILS.

Foraminifera are less abundant in the upper Oligocene limestones than in the older Tertiary rocks. *Sorites americana* (Cushman), described from the Emperador limestone of Panama, and *Miogypsina antillea* (Cushman), described from the Anguilla formation of the island of Anguilla, are the most common species. The deposits south of Gros-Morne contain *Lepidocyclina giraudi*, described by R. Douvillé from beds on the island of Martinique that are considered to be of Aquitanian age by Giraud and of Burdigalian age by Douvillé.¹ This species duplicates in a remarkable fashion the surface sculpture of the Cretaceous species *Orbitoides media* (d'Archiac).

At some localities, particularly in the Montagnes du Trou d'Eau, corals are abundant in the upper Oligocene deposits. Some of the species, such as *Orbicella imperatoris* Vaughan, *Orbicella canalis* Vaughan, and *Siderastrea silencensis* Vaughan, have been described from upper Oligocene rocks in adjacent regions. At least two species, *Stephanocoenia* sp. cf. *S. intersepta* (Esper) and *Goniopora jacobiana* Vaughan, are of Miocene aspect.

The upper Oligocene deposits of the Haitian Republic seem to be of the same age as the upper part of the Culebra formation and the Emperador limestone of Panama and the Anguilla formation of Anguilla. This horizon probably is the equivalent of the Aquitanian, which is called Miocene by most European geologists.

Stations—Upper Oligocene.

9761 (W 298 F). Tortue Island, trail from La Vallée to Pointe des Oiseaux, about 8 kilometers east of La Vallée, altitude 265 meters above sea level. W. P. Woodring, collector. February 20, 1921.

9762 (W 299 F). Tortue Island, trail from La Vallée to Pointe des Oiseaux, steep slope leading down to coast about 3 kilometers northwest of Pointe des Oiseaux, altitude 235 meters above sea level. W. P. Woodring, collector. February 20, 1921.

9766 (W 302 F). Arrondissement of Borgne, trail from Anse-à-Foleur to Le Borgne, float in small stream about 2 kilometers east of Anse-à-Foleur. W. P. Woodring, collector. February 22, 1921.

¹ Douvillé, R., Sur des Lépidocyclines nouvelles: Soc. géol. France Bull., 4th ser., vol. 7, pp. 307-311, pl. 10, figs. 9, 10, 15, 16, text figs. 1, 2, 1907.

9767 (W 303 F). Arrondissement of Borgne, trail from Anse-à-Foleur to Le Borgne, first ridge along coast on east side of Anse-à-Foleur. W. P. Woodring, collector. February 22, 1921.

9768 (W 304 F). Arrondissement of Borgne, float in mountains about 7 kilometers west-northwest of Le Borgne, altitude 195 meters above sea level. W. P. Woodring, collector. February 22, 1921.

9751 (W 276 F). Arrondissement of Gonaïves, road from Gonaïves to Gros-Morne, low hill on northwest side of road about 4 kilometers from Gonaïves. W. P. Woodring and J. S. Brown, collectors. February 15, 1921.

9943 (W 280 F). Arrondissement of Gonaïves, road from Gonaïves to Gros-Morne, about 7 kilometers south of Gros-Morne. W. P. Woodring and J. S. Brown, collectors. February 15, 1921.

9936 (W 244 F). Arrondissement of Hinche, float at foot of cascade on Rivière Samaná at Bassin Zinn. W. P. Woodring, collector. January 31, 1921.

9949 (W 324 F). Arrondissement of Vallière, trail from Thomassique to Cerca-la-Source, float on north slope of ridge overlooking valley of Rivière l'Océan, altitude 435 meters above sea level. W. P. Woodring, collector. March 13, 1921.

9741 (W 240 F). Arrondissement of Las Cahobas, crest of Thomonde anticline, foot of Morne Mamont, about 4 kilometers west-northwest of Thomonde, altitude 360 meters above sea level. W. P. Woodring, collector. January 29, 1921.

9934 (W 241 F). Arrondissement of Las Cahobas, float at same locality as 9741. W. P. Woodring, collector. January 29, 1921.

9786 (W 215 F). Arrondissement of Las Cahobas, trail from Thomonde to Mirebalais, float about a kilometer southwest of cemetery at Caille-Pain, altitude 480 meters above sea level. W. P. Woodring, collector. January 17, 1921.

9787 (W 216 F). Arrondissement of Las Cahobas, trail from Thomonde to Mirebalais, about 1.5 kilometers southwest of cemetery at Caille-Pain, altitude 485 meters above sea level. W. P. Woodring, collector. January 17, 1921.

9917 (W 217 F). Arrondissement of Las Cahobas, trail from Thomonde to Mirebalais, float about 3.5 kilometers southwest of cemetery at Caille-Pain, altitude 570 meters above sea level. W. P. Woodring, collector. January 17, 1921.

9788 (W 218 F). Arrondissement of Las Cahobas, trail from Thomonde to Mirebalais, float on northeast slope of mountains at Bois-Joli, near crest, altitude 610 meters above sea level; same locality as 9918. W. P. Woodring, collector. January 17, 1921.

9875 (B 289 F). Arrondissement of Grande-Rivière du Nord, float on road from St.-Michel de l'Atalaye to St.-Raphaël, about 8 kilometers southwest of St.-Raphaël. J. S. Brown, collector. March 6, 1921.

9898 (B 350 F). Arrondissement of Port-au-Prince, float 50 meters west of Source Maneville. J. S. Brown, collector. March 30, 1921.

9657 (W 105 F). Arrondissement of Port-au-Prince, float on small island along north shore of Étang Saumâtre, about 6 kilometers southeast of Maneville. W. P. Woodring, collector. November 23, 1920.

9521 (W 104 F). Arrondissement of Port-au-Prince, float short distance east of 9657. W. P. Woodring, collector. November 23, 1921.

9556 (W 114 F). Arrondissement of Port-au-Prince, trail from Thomazeau to Cornillon, south slope of mountains about 10 kilometers northeast of Thomazeau, altitude 640 meters above sea level. W. P. Woodring, collector. December 3, 1920.

9557 (W 116 F). Arrondissement of Mirebalais, trail from Thomazeau to Cornillon, about 2 kilometers northwest of Cornillon, altitude 905 meters above sea level. W. P. Woodring, collector. December 3, 1920.

9558 (W 118 F). Arrondissement of Mirebalais, entrance to cave on north side of trail from Thomazeau to Cornillon, about 3 kilometers northwest of Cornillon, altitude 915 meters above sea level. W. P. Woodring, collector. December 3, 1920.

9449 (W 119 F). Arrondissement of Mirebalais, trail from Cornillon to St.-Pierre, cliff along east side of trail about 1 kilometer east of Cornillon. W. P. Woodring, collector. December 3, 1920.

9450 (W 120 F). Arrondissement of Mirebalais, float at same locality as 9449. W. P. Woodring, collector. December 3, 1920.

9559 (W 121 F). Arrondissement of Mirebalais, trail from Cornillon to St.-Pierre, float about 2.5 kilometers east of Cornillon, altitude 1,035 meters above sea level. W. P. Woodring, collector. December 3, 1920.

9451 (W 122 F). Arrondissement of Mirebalais, trail from Cornillon to St.-Pierre, about 5 kilometers southeast of Cornillon, altitude 1,055 meters above sea level. W. P. Woodring, collector. December 3, 1920.

9452 (W 123 F). Arrondissement of Mirebalais, trail from Cornillon to Thoma-zeau and Mirebalais, float about 2.5 kilometers northwest of Cornillon, altitude 900 meters above sea level. W. P. Woodring, collector. December 4, 1920.

9453 (W 124 F). Arrondissement of Mirebalais, trail from Cornillon to Mirebalais, about 3.5 kilometers northwest of Cornillon, altitude 980 meters above sea level. W. P. Woodring, collector. December 4, 1921.

9560 (W 125 F). Arrondissement of Mirebalais, trail from Cornillon to Mirebalais, float about 3.6 kilometers northwest of Cornillon, altitude 980 meters above sea level. W. P. Woodring, collector. December 4, 1920.

9454 (W 126 F). Arrondissement of Mirebalais, trail from Cornillon to Mirebalais, crest of ridge about 5 kilometers northwest of Cornillon, altitude 1,115 meters above sea level. W. P. Woodring, collector. December 4, 1920.

9561 (W 128 F). Arrondissement of Mirebalais, trail from Cornillon to Mirebalais, float on north slope of mountains about 10 kilometers northwest of Cornillon, altitude 870 meters above sea level. W. P. Woodring, collector. December 4, 1920.

MIOCENE SERIES.

Rocks of Miocene age are widely distributed in the plains and lowlands of the Republic and have a maximum thickness of more than a thousand meters. Probably all of them are lower and middle Miocene. The Miocene fossils in the different regions are so diverse that a short account of them is given for each region.

GENERAL FEATURES.

Areal distribution.—The largest areas of Miocene deposits are in the Central Plain and the Artibonite Valley. Other areas are shown on Plate I. The larger areas shown are in plains or lowlands, and in other regions the Miocene rocks are restricted to lowlands; at few places are they found at altitudes of more than 400 meters above sea level. They were not seen on the crests of any of the mountain ranges, although they formerly extended over some ranges. Some lowlands, such as the Cul-de-Sac Plain, the lower part of the Artibonite Plain, and most of the Arbre Plain, contain Miocene rocks, but they are almost wholly concealed by Quaternary alluvium.

Stratigraphic relations.—The transgression of the Miocene sea was extensive, and at places the Miocene overlaps the Eocene or even older rocks. Around the borders of the Central Plain and at other places where