No. 2. — *Reports on the Results of Dredging, under the Supervision of* Alexander Agassiz, *in the Gulf of Mexico* (1877–78), *in the Caribbean* (1878–79), *and along the Atlantic Coast of the United States, during the Summer of* 1880, *by the U. S. Coast Survey Steamer "Blake,"* Lieutenant-Commander C. D. Sigsbee, U. S. N., *and* Commander J. R. Bartlett, U. S. N., Commanding.

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XXVII.

Report on the Specimens of Bottom Deposits. By John Murray.

BLAKE DEPOSITS.[1]

1. *Specimens of deposits procured in the Gulf of Maine and along the Coast of North America between the Gulf of Maine and Cape Hatteras in* 1880 (*Stations* 301–312, *and* 330–347) *and in the Gulf of Maine in* 1875.

These deposits consist of blue or gray colored muds and sands, the latter being found only in depths less than 100 fathoms. They lie between the coast and the inner edge of the Gulf Stream. The greatest depths are 1394 and 1186 fathoms, situated between 30 and 40 miles outside the 100-fathom line. These deposits are chiefly made up of the débris of the land of the North American continent, the mineral particles and clayey matter making up usually from 80 to 85 per cent of the whole deposit.

[1] Mr. John Murray, to whom the specimens of bottom deposits collected by the "Blake" were sent for examination, has looked over the whole and selected some typical specimens. These have been described in detail, and he has added some general notes on the specimens characteristic, 1. of the Coast between the Gulf of Maine and Cape Hatteras; 2. of the coast between Cape Hatteras and Lat. 31° 48′ N.; 3. of the coasts around the greater and lesser Antilles; and, finally, of the Gulf of Mexico and Straits of Florida.

Alexander Agassiz.

Museum of Comparative Zoölogy,
Cambridge, July 10, 1885.

The mineral particles consist of fragments of ancient rocks, quartz, monoclinic and triclinic felspars, magnetite, hornblende, augite, mica, tourmaline, and occasionally glauconitic grains.

In 1240 fathoms, and Lat. 38° 34′ N. off this coast, the "Challenger" dredged many rounded and angular pebbles of milky and hyaline quartz, fine-grained quartzites, felspathic quartzites, mica schists, serpentine rocks, and compact limestones. These fragments were not larger than 6 or 7 centimetres in diameter. The "Blake," in 1241 fathoms and Lat. 39° 43′ N., dredged similar, but much larger, fragments of the same rocks, some of which were glaciated. In Lat. 41° 14′ N. and in a depth of 1340 fathoms, the "Challenger" again dredged similar rock fragments, and one block of syenite weighing 5 cwt. These deposits being all within the influence of the Labrador Current, these rocks may be regarded as chiefly ice-borne.

The carbonate of lime in these deposits consists of coccoliths and coccospheres, of pelagic and other Foraminifera, and of fragments of Echinoderms, Polyzoa, Ostracodes, and Mollusks. The pelagic Foraminifera shells and coccospheres are more abundant in the deeper deposits far from the land than in those from shallower water near the coast.

The siliceous remains of Diatoms, Radiolarians, and Sponges, together with arenaceous Foraminifera, and glauconitic casts of calcareous Foraminifera make up sometimes 4 or 5 per cent of the deposit.

The following are descriptions of some of the typical deposits:[1] —

Station 305. — Lat. 41° 13′ 53″ N. Long. 65° 57′ 25″ W. Depth, 810 fathoms. Surf. temp. 56¼°. Bot. temp. 39°. Gray mud, brown when wet, earthy, plastic, dries into hard lumps. Mixed with the mud were some few pinnulæ of Crinoids, also a few rock fragments (sandstone, diorite, and diabase) measuring from 10 to 30 millimetres in diameter.

Carbonate of Calcium, 5.08 per cent, consists of coccoliths and coccospheres, fragments of Echinoderms, and the following foraminifera: —

[1] The methods employed in the examination of these deposits are the same as those adopted by Messrs. Murray and Renard for the Challenger deposits. The carbonate of calcium was determined by estimating the carbonic acid, weak and cold hydrochloric acid being used for the purpose. The part insoluble in the acid is designated "residue," which by washing, decantation, and microscopic inspection is separated into three parts: (*a*) *Minerals*, the contraction *m. di.* indicating their mean diameter in millimetres; (*b*) *Siliceous Organisms*, including the glauconitic casts of foraminifera and other calcareous organisms; (*c*) *Fine Washings*, including those particles which, resting in suspension, pass with the first decantation. The numbers in brackets indicate the percentage of the whole deposit.

Globigerina bulloides	Pelagic species.	*Haplophragmium canariensis*	Bottom-living species.
G. inflata		*Textularia* sp.	
G. dutertrei		*Bulimina marginata*	
Pulvinulina menardii		*Uvigerina pygmæa*	
P. micheliniana		*Truncatulina lobatula*	
P. canariensis		*Pulvinulina elegans*	

Residue, 94.92 per cent, dark brown, consists of *Minerals* [75.00], m. di. 0.5 mm., quartz, mica, felspar, hornblende. *Siliceous organisms* [5.00], Diatoms, Radiolarians, and Sponge spicules. *Fine washings* [14.92], argillaceous matter, fine mineral particles, fragments of Diatoms and siliceous spicules.

Station 308. — Lat. 41° 34′ 45″ N. Long. 65° 35′ 30″ W. Depth, 1242 fathoms. Surf. temp. 65°. Bot. temp. 38°. A dark gray mud, plastic, pulverulent, granular, dries into hard lumps.

Carbonate of Calcium, 7.27 per cent, consists of Echinoderm fragments, many coccoliths and coccospheres: the following Foraminifera were observed: —

Orbulina universa, rare.
Globigerina bulloides, common.
G. inflata, common.
G. conglobata, few.
G. dubia, few.
Pulvinulina menardii, few.
P. canariensis, few.
Pullenia obliquiloculata, rare.
Uvigerina pygmæa, few.
U. pygmæa, var. *angulosa*, few.
Bulimina marginata, few.
Lagena fimbriata, rare.
Discorbina sp., few.
Rotalia reparda, few.
Pleurostomella sp., rare.
Cristellaria cultrata, rare.

Residue, 92.73 per cent, dark brown, consists of *Minerals* [75.00], m. di. 0.3 mm., quartz, monoclinic and triclinic felspars, magnetite, mica, hornblende, tourmaline, glauconite, and glassy fragments. *Siliceous organisms* [4.00], Sponge spicules, Radiolarians, and Diatoms. *Fine washings* [13.73], argillaceous matter, and many angular, fine mineral particles.

Station 312. — Lat. 39° 50′ 45″ N. Long. 70° 11′ W. Depth, 466 fathoms. Surf. temp. 71½°. Bot. temp. 40°. A gray mud.

Carbonate of Calcium, 3.46 per cent, consists of a few Echinoderm fragments, coccoliths, and the following Foraminifera: —

Reophax fusiformis, few.
R. scorpiurus, few.
Haplophragmium fontinense? few.
Ammodiscus incertus, few.
A. gordialis, rare.
Clavulina communis, few.
Cyclammina pusella, rare.
Bulimina marginata, rare.
Cristellaria cultrata, rare.
Uvigerina pygmæa, rare.
U. pygmæa, var. *angulosa*, rare.
Globigerina inflata, common.
G. dutertrei, few.
Pulvinulina menardii, var. *tumida*, rare.
Cassidulina crassa, rare.
Polystomella sp., rare.

Residue, 96.54 per cent, gray, consists of *Minerals* [80.00], m. di. 0.4 mm., fragments of milky and hyaline quartz 1 to 2 mm. in diameter, felspar, hornblende, mica, glauconite, augite, fragments of ancient rocks, and fragments of serpentine rocks much decomposed. *Siliceous organisms* [6.00], Sponge spicules, a few Radiolarians and Diatoms. *Fine washings* [10.54], green argillaceous matter with glauconitic particles, fine minerals, and fragments of Sponge spicules and Diatoms.

Station 340. — Lat. 39° 25′ 30″ N. Long. 70° 58′ 40″ W. Depth, 1394 fathoms. Surf. temp. 76½°. Bot. temp. 38°. A gray mud, coherent, plastic, dries into hard lumps.

Carbonate of Calcium, 16.81 per cent, consists of coccoliths and coccospheres, otoliths of fish, fragments of *Dentalium* and Echinoderms, and the following Foraminifera: —

Globigerina bulloides, few.
G. inflata, few.
G. dubia, few.
G. rubra, few.
Pulvinulina menardii (dwarfed), rare.
P. micheliniana, rare.
P. elegans, rare.
Rotalia repanda, rare.
Truncatulina lobatula, few.
Uvigerina pygmæa, few.
Bulimina marginata, rare.
Nonionina umbilicatula, rare.
Biloculina ringens (dwarfed), rare.

Residue, 83.19 per cent, dark brown, consists of *Minerals* [40.00], m. di. 0.3 mm., quartz, felspar, mica, hornblende, magnetite, olivine, glauconite, glassy fragments. *Siliceous organisms* [5.00], Diatoms, Radiolarians, and Sponge spicules. *Fine washings* [38.19], argillaceous matter, fine mineral particles, and fragments of siliceous organisms.

2. *Specimens of deposits procured off the Coast of the United States between Cape Hatteras and Lat.* 31° 48′ *N.*

These deposits are green muds or sands. They are with two exceptions under 1,000 fathoms, and are mostly under the waters of the Gulf Stream, or along its inner margin. The mineral particles are much the same as those in the deposits north of Cape Hatteras, but are all very much smaller, and have evidently not been transported by ice. The mineral particles, with the exception of the concretions formed at the bottom, seldom exceed 0.4 mm. in diameter, and consist of quartz, felspars, augite, hornblende, magnetite, and a few fragments of glassy rocks. Glauconitic grains and casts are frequently very abundant, as are also grains of manganese peroxide.

The carbonate of lime makes up usually over 50 per cent of the whole deposit, and consists chiefly of the dead shells of pelagic Foraminifera, along with shells of pelagic Mollusks, fragments of Echinoderms,

Polyzoa and coccoliths. All the tropical species of pelagic Foraminifera are abundant in these deposits, while they are relatively rare in the deposits along the coast to the north of Cape Hatteras.

The remains of siliceous organisms, such as Diatoms, Radiolarians, Sponge spicules, and glauconitic casts of Foraminifera and other organisms, make up usually 10 or 12 per cent of the deposit.

The finer washings of these deposits are of a greenish color, which seems to be chiefly due to the presence of some organic substance, the nature of which has not yet been determined. A similar greenish matter was met with by the "Challenger" in deposits from the same depths off the coasts of Africa, Australia, Japan, and China.

Phosphate of lime and manganese concretions are present in all the deposits, and one remarkable concretion of these substances is described in detail from Station 317, in a depth of 333 fathoms, immediately under the waters of the Gulf Stream.

Many of these deposits might equally well be called Globigerina oozes.

Station 314. — Lat. 32° 24′ N. Long. 78° 44′ W. Depth, 142 fathoms. Surf. temp. 81°. Bot. temp. 56½°. A greenish gray sand, granular, very slightly coherent.

Carbonate of Calcium, 47.64 per cent, consists of shells of Gasteropods, Lamellibranchs, Pteropods, and Ostracodes, fragments of Echinoderms, coccoliths, and the following pelagic and other Foraminifera: —

	Biloculina ringens, few.	
	Planispirina cælata, few.	
Globigerina bulloides, common.	*Miliolina agglutinans*, rare.	
G. dubia, common.	*M. seminulum*, rare.	
G. inflata, common.	*M. venusta*, common.	
G. rubra, common.	*Vernevilina triquetra ?* rare.	
G. conglobata, few.	*Textularia conica*, few.	
G. sacculifera, few.	*Bulimina marginata*, few.	
G. (*Orbulina*) *universa*, few.	*Nodosaria communis*, rare.	Bottom-living species.
Sphæroidina dehiscens, few.	*Cristellaria cultrata*, common.	
Pulcinulina menardii, common.	*C. rotulata*, rare.	
P. menardii, var. *tumida*, common.	*C. obtusata*, rare.	
	C. calcar, rare.	
P. micheliniana, few.	*C.* sp. few.	
Pullenia obliquiloculata, common.	*Uvigerina pygmæa*, few.	
	Truncatulina lobatula, few.	
	Pulvinulina elegans, rare.	
	Rotalia sp.	
	Nonionina umbilicatula, rare.	

Pelagic species.

Residue, 52.36 per cent, a green sand, consists of *Minerals* [40.00], m. di. 0.3 mm., many glauconitic grains, quartz, mica, felspars, hornblende, magnetite, augite, phosphatic grains. *Siliceous organisms* [8.00], Sponge spicules, Diatoms, Radiolarians, and many fine glauconitic casts of Foraminifera. *Fine washings* [4 36], traces of argillaceous matter, fine mineral particles, fragments of Diatoms, and much green amorphous matter.

Station 317. — Lat. 31° 57′ N. Long. 78° 18′ 35″ W. Depth, 333 fathoms. From this place, where the ground was said to be hard, there was procured a very remarkable concretion that appears to have been formed in the position from which it was dredged.

This was irregular in form, the greatest diameter being about nine inches, and of a mottled black, red, and brown color. The surface was somewhat irregular, and presented many ovoid, smooth projections, the largest of which were about one centimetre in diameter. The whole mass was overgrown with sponges, corals, and annelids. Imbedded in the concretion were two sharks' teeth, resembling *Lamna*, the largest being 2¼ inches in length and one inch across the base. This tooth is similar to many found by the "Challenger" in great numbers in the greater depths of the Central Pacific, frequently forming the centres of manganese nodules. In the specimens from the deep water of the Pacific the interior of the tooth had been in every instance completely removed, only the hard outer dentine remaining. In the tooth imbedded in this concretion, on the contrary, the vaso-dentine of the interior of the tooth is well preserved, in this respect resembling the sharks' teeth of the same kind found in various tertiary deposits, as for instance in South Carolina and in the Island of Malta. The vessels of the tooth are infiltrated with peroxide of iron and manganese and phosphate of lime.

The whole mass has a breccia-like appearance, the several fragments being cemented by deposits of carbonate of lime and manganese peroxide. When thin sections are prepared and examined with the microscope, the preparation has a variegated appearance; all the grains being closely cemented together. There are numerous sections of pelagic and other calcareous Foraminifera, of Pteropods, and fragments of Echinoderms. The interior of the Foraminifera is sometimes completely filled with calcite, and the same crystals are found cementing many of the fragments of which the rock is composed. Small fragments of quartz, of felspars, and of zoïene are also seen in the sections. But the most characteristic element is formed by small rounded grains of a brownish or yellow-green color, having much the aspect of glauconite, which is also present. Chemical reactions show that these grains are phosphatic.

They are similar to the grains found in phosphatic nodules dredged off the Cape of Good Hope and elsewhere by the "Challenger," and identical in their physical and chemical properties to the phosphatic grains in cretaceous rocks.

The manganese is infiltrated through the whole mass of the concretion, appearing in the microscopic sections in the form of dendrites or concretions, sometimes opaque, sometimes black-brown, and slightly transparent. The phosphatic grains are sometimes enclosed in the manganese.

The "Challenger" dredged on several occasions, especially off the Cape of Good Hope, concretionary masses like that above described, but very much smaller. Phosphatic nodules were always found in the deposits in depths less than 1,500 fathoms, near continental shores, but never in the deeper deposits far removed from land.

An analysis of a portion of the above concretion by M. Klement, Brussels, gave as follows: —

Phosphoric acid (P_2O_5)	23.53
Carbonic " (CO_2)	15.56
Sulphuric " (SO_3)	2.29
Fluorine	2.28
Chlorine	0.16
Lime (CaO)	52.15
Magnesia (MgO)	1.01
Insoluble residue	0.52
Loss on ignition	3.15
	100.65
Oxygen corresponding to Fluorine	— 0.96
" corresponding to Chlorine	— 0.04
	99.65

Atomic Ratios.

P_2O_5	997	
CO_2	707	
SO_3	57	1866
Fl	120	
Cl	5	
CaO	1864	1914
MgO	50	

The substance analyzed also contained traces of silica, of iron, of alumina, and of manganese.

Station 323. — Lat. 33° 19′ N. Long. 76° 12′ 30″ W. Depth, 457 fathoms. Surf. temp. 83°. Bot. temp. 40°. Green mud, slightly coherent, granular.

Carbonate of Calcium, 59.43 per cent, chiefly made up of pelagic and other Foraminifera, as in the following list, shells of Pteropods, Gasteropods, and Ostracodes, Echinoderm fragments, and coccoliths.

Pelagic species.

G. (*Orbulina*) *universa*, common.
Globigerina bulloides, common.
G. conglobata, few.
G. bulloides var. *triloba*, common.
G. æquilateralis, few.
G. sacculifera, few.
G. dubia, common.
G. rubra, common.
Candeina nitida, common.
Sphæroidina dehiscens, few.
Pullenia obliquiloculata, common.
Pulvinulina menardii, abundant.
P. menardii, var. *tumida*, common.
P. menardii, var. *fimbriata*, common.
P. micheliniana, few.
P. canariensis, few.

Bottom-living species.

Biloculina ringens, rare.
Miliolina seminulum, few.
Bulimina marginata, rare.
Polymorphina sp., rare.
Uvigerina pygmæa, rare.
Sphæroidina bulloides, common.
Pullenia sphæroides, few.
Truncatulina lobatula, few.
T. sp., rare.
Nonionina umbilicatula, few.
Nodosaria communis, rare.
N. lævigata, rare.

Residue, 40.57 per cent, greenish brown, consists of *Minerals*, [20.00], m. di. 0.1 mm. quartz, hornblende, felspars, glauconite, and glassy fragments. *Siliceous organisms* [5.00], Diatoms, Radiolarians, and Sponge spicules, and casts of many of the organisms mentioned above. *Fine washings* [15.57], argillaceous and green amorphous matter, fragments of Diatoms, siliceous spicules, and fine mineral particles.

3. *Specimens of deposits procured around the Shores of the Greater and Lesser Antilles.*

The specimens are chiefly from depths between 100 and 1,000 fathoms, although a few are in depths less than 100 fathoms and a few are over 2,000 fathoms. They are all in more or less close proximity to the coasts. The mineral particles are chiefly fragments of volcanic rocks or crystals derived from these, such as monoclinic and triclinic felspars, hornblende, augite, olivine, magnetic iron, and pumice ; along with a few fragments from ancient rocks, as quartz, tourmaline, mica, and epidote. Glauconitic grains were rare in these deposits, and phosphatic grains were likewise rare. In the deposits farthest from land the size of the

mineral particles seldom exceeded 0.1 mm. in diameter, but near shore they were very much larger, and fragments of rocks and pebbles were frequently dredged. Altered fragments of plagioclase, basalts, and diabase were rather frequent.

The percentage of carbonate of lime in these deposits was usually very high, being frequently 70 or 80 per cent, and in the case of a chalk rock 90.24 per cent. Where the shores were composed of volcanic or other rocks not calcareous, the débris of these made up the larger part of the deposits, which might be called volcanic muds. But the majority of the deposits should be termed Pteropod or Globigerina oozes, owing to the large number of these organisms present in them. It should be remembered, however, that both in the size of the mineral particles and in the nature of a large number of the calcareous particles, these deposits differ considerably from similar deposits found far away from land in the open ocean and called also Pteropod and Globigerina oozes.

The siliceous organisms never make up more than four or five per cent of the whole deposit, and consist of Radiolaria, Sponge spicules, and a few Diatoms.

Fragment of White Chalk. — From 994 fathoms, off Nuevitas, Cuba, there was obtained a fragment of white chalk coated on the surface with streaks of peroxide of manganese. This chalk contained 90.24 per cent of carbonate of lime. The sections showed the rock to be composed of crystalline grains of carbonate of lime, which however were not the result of precipitation. A few sections of *Globigerina* and *Textularia* were observed, but no other organisms could be recognized. After dissolving away a considerable quantity, small fragments of quartz and hornblende, Sponge spicules and Radiolarians were observed in the residue. It is impossible to be certain that this rock was formed in the position from which it was dredged, though there are reasons for supposing that it was. The ooze which came up from the same place was of a reddish or brownish tinge, and contained an immense number of Pteropods, Heteropods, and pelagic Foraminifera; the percentage of lime was not so high as in the white chalk rock, and the residue was much darker in color.

Concretions. — Off the Barbadoes in 221 fathoms (St. 280) a very hard calcareous concretion was obtained, which showed perfectly how the rock was formed by crystallization of carbonate of lime around the shells of Foraminifera and other centres. A zone is seen around the shells, composed of fibro-radiate calcite; the crystals of calcite, coming from the various centres, abut against each other, and frequently leave

an empty space between. When these spaces are filled by a further deposition of lime, the whole becomes very compact and massive.

The centres of the Foraminifera are frequently filled with a gray or yellowish substance which does not, however, give the reactions of phosphate of lime.

The mineral particles were very few in number, among them fragments of quartz and plagioclase being observed. This concretion was about two inches in diameter and had a rough areolar surface on which Serpulæ and Polyzoa were growing.

A similar and somewhat larger concretion from 200 fathoms (St. 291) was also obtained off the Barbadoes, which was much more overgrown with organisms, and on its upper surface had a large cavity in which a hermit-crab had lived. (Polycheles Agassizii, see Bulletin VIII. No. 1.)

Off the north coast of San Domingo, in 772 fathoms (No. VI.), there were obtained several small manganese Nodules and a few fragments of a *Corallium* coated with manganese, precisely similar to that dredged by the "Challenger" in 1,525 fathoms near the Cape Verdes (see Narrative of the Voyage, page 125). The interior of the nodules were of a light brownish color and were composed in all cases chiefly of a mass of pelagic Foraminifera. The largest of these nodules had a diameter of about two inches. Microscopic sections of the nodules and concretions were easily made and showed with great distinctness the structure of the mass, composed chiefly of pelagic Foraminifera cemented together as above stated.

Station 103. — Old Bahama Channel. Depth, 438 fathoms. Surf. temp. 79° Bot. temp. 49½°. A Pteropod ooze or white coral mud, slightly coherent when dry, chalky.

Carbonate of Calcium, 87.06 per cent, consists of Gasteropod, Lamellibranch, Ostracode, Pteropod and Heteropod shells, calcareous Algæ, Echinoderm fragments, Polyzoa, Alcyonium spicules, coccoliths and rhabdoliths, and the following Foraminifera : —

Globigerina dubia	Pelagic species.	*Cymbalopora bulloides*
G. rubra		*Miliolina seminulum*
G. hirsuta		*M. linnæana*
G. æquilateralis		*M. bicornis*
G. (Orbulina) universa		*M. agglutinans*
Pulvinulina menardii		*Biloculina cornuta*
P. menardii, var. *tumida*		*Pulvinulina* sp.
P. micheliniana		*Cassidulina crassa*
Pullenia obliquiloculata		*Textularia turris*

Discorbina sp.
Truncatulina sp.
Polytrema rubra
Carpenteria sp.
Orbiculina adunca
Orbitolites marginalis
Cristellaria cultrata
Vertebralina striata
Articulina conico-articulata
Bulimina marginata
Nodosaria costulata

Residue, 12.94 per cent, light brown, consists of *Minerals* [3.00], m. di. 0.1 mm., quartz, hornblende, magnetite, mica, olivine, and a few glassy fragments. *Siliceous organisms* [3.00], Sponge spicules, Diatoms, and a few casts. *Fine washings* [6.94], argillaceous matter, fine mineral particles, and fragments of siliceous organisms.

Station 112. — W. of Navassa Bank, 19 Dec., 1878. Depth, 1050 fathoms. Surf. temp. 82°. Bot. temp. 39½°. A light brown Globigerina ooze, slightly coherent, pulverulent, granular; dries into lumps, which break easily between the fingers.

Carbonate of Calcium, 62.38 per cent, consists of Lamellibranch, Pteropod, and Heteropod shells, coccoliths and rhabdoliths, and the following Foraminifera: —

Globigerina bulloides
G. rubra
G. æquilateralis
G. dubia
G. hirsuta
G. sacculifera
G. (Orbulina) universa
Sphæroidina dehiscens
Candeina nitida
Pulcinulina menardii
P. menardii, var. *tumida*
P. menardii, var. *fimbriata*
P. micheliniana
P. canariensis
Pullenia obliquiloculata
Biloculina depressa
B. sphæra
Cassidulina sp.
Webbina clavata
Truncatulina lobatula
Uvigerina sp.

Residue, 37.62 per cent, red, consists of *Minerals* [15.00], m. di. 0.07 mm., (angular) felspars, quartz, hornblende, mica, magnetite, many glassy fragments. *Siliceous organisms* [4.00], Sponge spicules, Radiolarians, and a few casts. *Fine washings* [18.62], argillaceous matter, fine mineral particles, and fragments of siliceous organisms.

Station 117. — Lat. 17° 47′ 20″ N. Long. 67° 3′ 20″ W. Off Porto Rico. Depth, 874 fathoms. Surf. temp. 82½°. Bot. temp. 40°. A coral mud or Pteropod ooze, slight coherent, granular. Also, a small quantity of larger material, which appears to have been washed from the dredge, consisting of Gasteropod, Lamellibranch, Ostracode, Pteropod, and Heteropod shells, Echinoderm fragments, Coral, Polyzoa, and Serpula tubes.

Carbonate of Calcium, 70.66 per cent, consists of Pteropods, Heteropods, frag-

ments of Echinoderms and Gasteropod and Lamellibranch shells, calcareous Algæ, coccoliths, and the following Foraminifera: —

Globigerina rubra	Pelagic species.	*Sphæroidina bulloides*
G. dubia		*Truncatulina lobatula*
G. hirsuta		*T.* sp.
G. sacculifera		*Rupertia* sp.
G. æquilateralis		*Rotalia* sp.
G. conglobata		*Cristellaria cultrata*
G. (Orbulina) universa		*Lagena squamata*
Sphæroidina dehiscens		*Textularia biculeata*
Pullenia obliquiloculata		*Clavulina cylindrica*
Pulvinulina menardii		*Gaudryina rugosa*
P. menardii, var. *tumida*		*Biloculina depressa*
P. menardii, var. *fimbriata*		*B. ringens*
P. micheliniana		*B. sphæra*
P. canariensis		
P. sp.		

Residue, 29.34 per cent, dirty brown, consists of *Minerals* [10.00], m. di. 0.05 mm., (angular) quartz, hornblende, mica, felspar, olivine, scoriæ, small fragments of rocks. *Siliceous organisms* [7.00], Sponge spicules and Radiolarians. *Fine washings* [12.34], argillaceous matter, fine mineral particles, and fragments of siliceous organisms.

Station 138. — Off Santa Cruz, January 7, 1879. Depth, 2,375 fathoms. Surf. temp. 76½°. Bot. temp. 38½°. A light brown Globigerina ooze, slightly coherent, pulverulent.

Carbonate of Calcium, 63.54 per cent, consists of Gasteropod and Lamellibranch shells (larval forms), Ostracode, Pteropod, and Heteropod shells, Alcyonium spicules, Echinoderm fragments, coccoliths and rhabdoliths, and the following Foraminifera: —

Globigerina rubra	*Pulvinulina menardii*
G. dubia	*Pulvinulina micheliniana*
G. conglobata	*P. canariensis*
G. sacculifera	*Planorbulina* sp.
G. bulloides, var. *triloba*	*Miliolina bicornis*
G. (Orbulina) universa	*M. circularis*

Residue, 36.46 per cent, red, consists of *Minerals* [20.00], m. di. 0.2 mm., several fragments of mica schist 3 to 5 mm. in diameter, felspars, quartz, mica, hornblende, magnetite. *Siliceous organisms* [5.00], Sponge spicules. *Fine washings* [11.46], amorphous clayey matter, fine mineral particles, and fragments of siliceous spicules.

Station 182. — Off Dominica. Depth, 1,131 fathoms. Surf. temp. 81°. Bot. temp. 39½°. A light brown volcanic mud (dark when wet), coherent, plastic, earthy, slightly granular.

Carbonate of Calcium, 13.78 per cent, consists of Pteropods, Echinoderm fragments, coccoliths, and the following Foraminifera: —

Globigerina rubra
G. dubia
G. conglobata
G. sacculifera
G. (*Orbulina*) *universa*
Sphæroidina dehiscens
Pullenia obliquiloculata
Pulvinulina menardii
P. menardii, var. *fimbriata*
P. micheliniana
Sphæroidina bulloides
Pullenia quinqueloba
Truncatulina lobatula
Polymorphina sp.
Uvigerina asperula
Vaginulina sp.
Cassidulina crassa
Biloculina, fragments.

Residue, 86.22, brown, consists of *Minerals* [35.00], m. di. 0.3 mm. (angular), quartz, hornblende, magnetite, felspar, olivine, augite, a few glassy fragments, fragments of scoriæ. *Siliceous organisms* [2.00], Sponge spicules. *Fine washings* [49.22], argillaceous matter, fine mineral particles, and fragments of siliceous spicules.

Station 197. — Off Martinique. Depth, 1,224 fathoms. Surf. temp. 80°. Bot. temp. 39°. A light brown volcanic mud, coherent, plastic, earthy, slightly granular.

Carbonate of Calcium, 13.41 per cent, consists of otoliths of fish, Pteropods, Echinoderm fragments, coccoliths, and Foraminifera as follows: —

Globigerina rubra
G. dubia
G. conglobata
G. sacculifera
G. inflata
G. bulloides, var. *triloba*
G. (*Orbulina*) *universa*
Pulvinulina menardii
P. menardii, var. *tumida*
P. micheliniana
Pullenia obliquiloculata
Pulvinulina elegans
Pullenia quinqueloba
Truncatulina lobatula
T. robertsoniana
Lagena sp.
Cassidulina crassa
Haplophragmium globigeriniformis
Trochammina ringens
Reophax nodulosa, fragments.

Residue, 86.59 per cent, brown, consists of *Minerals* [60.00], m. di. 0.5 mm. (angular), felspar, magnetite, olivine, augite, quartz, hornblende, palagonite, and fragments of pumice from 1 to 2 mm. in diameter. *Siliceous organisms* [3.00], Radiolarians, Diatoms, and Sponge spicules. *Fine washings* [23.59], argillaceous matter, fine mineral particles, and fragments of siliceous organisms.

Station 241. — Off Grenadines. Depth, 163 fathoms. Surf. temp. 80°. Bot. temp. 53°. A yellowish brown Pteropod ooze, has a greenish tinge when wet, slightly coherent, pulverulent, granular.

Carbonate of Calcium, 76.20 per cent, consists of otoliths of fish, Serpula tubes, Ostracode, Pteropod, and Heteropod shells, fragments of Polyzoa, Echinoderms, calcareous Algæ, and the following Foraminifera : —

Globigerina bulloides
G. bulloides, var. *triloba*
G. rubra
G. inflata
G. conglobata
G. sacculifera
G. (Orbulina) universa
Pulvinulina menardii
P. menardii, var. *tumida*
P. micheliniana
P. sp.
Sphæroidina bulloides
Polytrema rubra
Planorbulina mediterranensis
Discorbina sp.
Truncatulina lobatula
T. sp.
Polymorphina sp.
Cristellaria sp.
Textularia conica
T. agglutinans
Cassidulina crassa
Clavulina parisiensis
Verneuilina spinulosa
Haplostiche soldanii
Nonionina umbilicatula
Amphistegina mamillata
Orbiculina adunca
Articulina sagra
Planispirina celata
Spiroloculina limbata
Miliolina seminulum
M. macilenta
M. linnæana
M. agglutinans
Biloculina ringens (very small).

Residue, 23.80 per cent, yellowish green, consists of *Minerals* [10.00], m. di. 0.25 mm. (angular), quartz, hornblende, felspar, magnetite, augite, olivine. *Siliceous organisms* [5.00], Diatoms, Radiolarians, Sponge spicules, and a few pale glauconitic casts. *Fine washings* [8.80], argillaceous matter, fine mineral particles, fragments of siliceous organisms, and greenish organic matter.

Station 275. — Off Barbadoes. Depth, 218 fathoms. Surf. temp. 80°. Bot. temp. 52½°. A Pteropod ooze or Foraminiferal sand, somewhat coherent, pulverulent, granular, dries into lumps which are easily broken by the pressure of the fingers.

Carbonate of Calcium, 38.09 per cent, consists of otoliths of fish, Gasteropod, Lamellibranch, Pteropod, Heteropod, and Ostracode shells, fragments of Echinoderms and Polyzoa, Alcyonium spicules, coccoliths, and the following Foraminifera : —

Globigerina rubra
G. dubia
G. inflata
G. conglobata
G. sacculifera
G. æquilateralis
G. bulloides var. *triloba*
G. (Orbulina) universa
Candeina nitida
Sphæroidina dehiscens
Pullenia obliquiloculata
Pulvinulina menardii
P. menardii var. *fimbriata*
P. micheliniana
Biloculina ringens
B. depressa

Miliolina seminulum
Spiroculina impressa
Vertebralina striata
Clavulina communis
C. parisiensis
Textularia conica
T. luculenta
T. agglutinans
Cristellaria cultrata
C. calcar
Sagrina columnella
Uvigerina pygmæa
Truncatulina lobatula
Planorbulina sp.
Nonionina umbilicatula.

Residue, 61.91 per cent, yellowish brown, consists of *Minerals* [25.00], m. di. 0.2 to 0.3 mm. magnetite felspar, quartz, hornblende, and a few glassy fragments. *Siliceous organisms* [25.00], many Sponge spicules, a few Diatoms, one or two Radiolarians, and glauconitic casts of the calcareous organisms. *Fine washings* [11.91], amorphous clayey matter, with fragments of casts, fine minerals, and siliceous particles.

4. *Specimens of deposits procured in the Gulf of Mexico and in the Florida Strait.*

During the years 1875, 1876, 1877, and 1878, very extensive series of soundings were obtained at all depths, and in all parts of the above areas.

There is a very great variety in the shallow water deposits under 100 fathoms. Near the coasts of the North American continent, where rivers enter, and where there are few coral reefs, the deposits are either sands or fine clayey muds, formed of detrital matter brought down from the land. Where the shores are lined by coral reefs, the deposits are chiefly made up of coral débris, the shells of pelagic Foraminifera and Mollusks and other calcareous organisms.

The character of the deposits in depths greater than 100 fathoms is likewise largely determined by the greater or less proximity to the embouchure of rivers or to coral reefs.

In all the deeper deposits in the Gulf of Mexico and Strait of Florida, the crystalline mineral particles are very small, rarely exceeding one-tenth of a millimetre in diameter. They consist principally of small rounded grains of quartz, with fragments of felspars, mica, hornblende, augite, magnetite, and rarely tourmaline. In a few places there were fragments of pumice, and glauconitic particles were occasionally noticed. The mineral particles and fine clayey matter appear to be almost wholly derived from North American rivers.

The carbonate of lime in the deposits of these regions is mostly made up of the shells of pelagic Foraminifera and Mollusks. In depths greater

than 2,000 fathoms the Pteropod and Heteropod shells appear to be nearly, if not quite, absent, — the carbonate of lime then consisting of the shells of pelagic Foraminifera; in less depths the Pteropod and Heteropod shells are present, and in depths varying from 200 to 500 fathoms they make up the bulk of the deposits in many places. In several of the deposits, where the percentage of carbonate of lime is very high, the whole has a very chalk-like appearance; it appears, indeed, as if it were in the process of transformation to true chalk.

The siliceous organisms consist of Radiolarians and Sponge spicules, with a few Diatoms, but these seldom make up more than three or four per cent of the whole deposit.

Phosphatic Concretions. — The phosphatic concretions in the dredgings in Florida Strait are very interesting. In a great many deep-sea deposits there is usually a small percentage of phosphate of lime, but near the shore, in some instances, the quantity is very considerable. Sharples, who analysed the ooze of the Gulf Stream, found —

Carbonate of Lime	85.62
" of Magnesium	4.26
Silica	1.32
Alumina	
Oxide of iron	0.31
Phosphate of Lime	0.18
Loss on ignition	8.15
	100.04

In certain concretions found by the "Blake" in the Florida Strait, and by the "Challenger" in various parts of the world near land, the quantity of phosphate of lime is very much greater than in the deposits. These concretions appear always to be associated in an intimate way with organisms.

In 125 fathoms S. W. of Land Key, Florida, a fragment of bone was obtained several centimetres in diameter. It was of a dirty brown color, of great hardness, and had a conchoidal fracture. A microscopic examination of thin sections showed that the bone structure was perfectly preserved.

The following is the result of an analysis of this specimen by M. Klement: —

Phosphoric acid (P_2O_5)	33.42
Carbonic " (CO_2)	5.80

Sulphuric acid (S O_3)	2.74
Fluorine	1.21
Lime (Ca O)	51.90
Magnesia (Mg O)	0.70
Iron and Alumina	1.56
Insoluble residue	0.21
Loss on ignition	2.16
	99.70
Oxygen corresponding to Fluorine	— 0.51
	99.19

There were also traces of Silica and Chlorine.

Atomic Ratios.

P_2O_5	1417	1814.
CO_2	264	
S O_3	69	
Fl	64	
Ca O	1853	1888
Mg O	35	

At the same place and depth there was a concretion of a brown color consisting of an aggregation of calcareous organisms cemented by a brownish yellow matter, often showing concentric rings after the manner of agate. This yellowish brown matter is isotropic, between crossed nicols only the calcite and the shells of the Foraminifera brighten up; the calcite lies crystallized in the interior of the Foraminifera. In treating the brown or yellow parts under the microscope with molybdate of ammonium and nitric acid, there is an abundant yellow precipitate characteristic of phosphoric acid.

At other stations small phosphatic concretions were also obtained by the "Blake," all more or less resembling those described above. There are difficulties in understanding how phosphate of lime and carbonate of lime are deposited at the bottom of the sea, yet there is no doubt that such a deposition does take place under some special circumstances. Their solution is, however, an almost universal phenomenon in the ocean.

Specimen 60, *Line P'.* — Lat. 24° 50′ N. Long. 84° 50′ 45″ W. 15 May, 1875. Depth, 2008 fathoms. A reddish brown Globigerina ooze dries into slightly coherent lumps.

Carbonate of Calcium, 47.87 per cent, consists of coccoliths, rhabdoliths, and the following Foraminifera: —

Globigerina conglobata
G. bulloides
G. bulloides, var. *triloba*
G. sacculifera
G. æquilateralis
G. rubra
G. dubia
G. (*Orbulina*) *universa*
Candeina nitida
Pullenia obliquiloculata
Pulvinulina menardii
P. menardii, var. *tumida*
P. canariensis
P. elegans
Truncatulina lobatula
Nonionina umbilicatula

Residue, 52.13 per cent, reddish brown, consists of *Minerals* [20.00], m. di. 0.05 mm., quartz, mica, felspar, hornblende, magnetite, palagonite, glauconite. *Siliceous organisms* [5.00], Sponge spicules, glauconitic or other casts. *Fine washings* [27.13], amorphous clayey matter, with fine mineral particles and fragments of siliceous spicules.

Specimen 4, *Line P.* — Lat. 26° 40′ N. Long. 96° 01′ W. 29 January, 1877. Depth, 489 fathoms. A brown mud, coherent, plastic. This deposit resembles very much a fine river clay, mixed with a very few pelagic Foraminifera; it would seem, judging from its position, to be derived from the fine detrital matter carried down by the rivers.

Carbonate of Calcium, 2.76 per cent, consists of one or two coccoliths along with the following Foraminifera: —

Globigerina bulloides	Pelagic species.	*Biloculina ringens*	Bottom-living species.
G. dubia		*Ammodiscus charoides*	
G. rubra		*Bolivina ænariensis*	
G conglobata		*Bulimina rostrata*	
Pullenia obliquiloculata		*B. oculata*	
Pulvinulina menardii		*Nodosaria raphanus*	
P. menardii, var. *tumida*		*Uvigerina asperula*	
P. micheliniana		*U. asperula*, var. *auberiana*	
		Sphæroidina bulloides	
		Truncatulina lobatula	
		Pulvinulina elegans	

Residue, 97.24 per cent, of a light slaty-brown color, consists of *Minerals* [25.00], m. di. 0.01 mm., quartz, magnetite, mica, felspars, augite, hornblende, and several small red particles. *Siliceous organisms* [1.00], siliceous spicules and fragments of Radiolarians. *Fine washings* [71.24], amorphous clayey matter.

Specimen 21, *Line E E.* — Lat. 20° 59′ N. Long. 96° 39′ W. 25 May, 1877. Depth, 511 fathoms. Volcanic mud, very coherent, clayey.

Carbonate of Calcium, 15.14 per cent, consists of Echinoderm fragments, fish teeth, and Foraminifera as follows: —

Globigerina rubra	Pelagic species.	*Planispirina celata*	Bottom-living species.
G. dubia		*Bolivina ænariensis*	
G. inflata		*Nonionina umbilicatula*	
G. conglobata		*Lagena squamosa*	
G. bulloides		*Ammodiscus charoides*	
G. bulloides, var. *triloba*		*Uvigerina asperula*	
G. (*Orbulina*) *universa*		*Cassidulina crassa*	
Pullenia obliquiloculata		*Bulimina marginata*	
Pulvinulina menardii		*Truncatulina lobatula*	
P. micheliniana		*Pulvinulina elegans*	

Residue, 84.86 per cent, chocolate color, consists of *Minerals* [50.00], m. di. 0.1 mm., quartz, pumice fragments, magnetite, hornblende, tourmaline, glauconite, mica, many glassy fragments. *Siliceous organisms* [3 00], Radiolarians and Sponge spicules. *Fine washings* [31.86], argillaceous matter, fine mineral particles, and a few fragments of siliceous spicules.

Specimen 28, *Line D D.* — Lat. 22° 06′ N. Long. 92° 13′ W. 22 May, 1877. Depth, 353 fathoms. A light greenish gray fine calcareous mud, coherent.

Carbonate of Calcium, 67.81 per cent, consists of Echinoderm fragments, Pteropod, Ostracode, Gasteropod, and Lamellibranch shells, and the following Foraminifera: —

Globigerina rubra
G. dubia
G. conglobata
G. inflata
G. bulloides, var. *triloba*
Pullenia obliquiloculata
Pulvinulina menardii
P. canariensis
Miliolina seminulum
M. sp.
Bulimina marginata
B. aculeata
Bolivina nobilis
B. ænariensis
Truncatulina lobatula
Uvigerina pygmæa
Nodosaria hispida
Textularia conica
T. sp.

Residue, 32.19 per cent, consists of *Minerals* [3.00], m. di. 0.05 mm., quartz, felspar, hornblende, magnetite, glauconite, glassy fragments, and a few red particles. *Siliceous organisms* [10.00], *Geodia* and other Sponge spicules, Diatoms and Radiolarians. *Fine washings* [19.19], argillaceous matter, fine mineral particles, and fragments of siliceous organisms.

Specimen 51, *Line P′.* — Lat. 25° 08′ 15″ N. Long. 87° 12′ 50″ W. 14 May, 1875. Depth, 2119 fathoms. A brown Globigerina ooze, slightly coherent.

Carbonate of Calcium, 41.86 per cent, consists of a few coccoliths and rhabdoliths, Ostracode valves, Echinoderm fragments, and the following Foraminifera: —

Globigerina inflata
G. rubra
G. dubia
G. æquilateralis
G. sacculifera
G. conglobata
G. bulloides, var. *triloba*
G. (Orbulina) universa
Candeina nitida
Pullenia obliquiloculata
Sphæroidina dehiscens
Pulvinulina menardii
P. menardii, var. *tumida*
P. menardii, var. *fimbriata*
P. micheliniana
P. canariensis
Truncatulina lobatula
Pulvinulina elegans
Biloculina depressa
Haplophragmium globigeriniformis
Hyperammina vagans
Ammodiscus charoides
Nonionina umbilicatula
N. pompilioides
Uvigerina asperula
Clavulina communis
Reophax (fragments).

Residue, 58.14 per cent, light brown, consists of *Minerals* [30.00], m. di. 0.1 mm. (mostly rounded), quartz, felspar, mica, hornblende, glauconite, magnetite, tourmaline. *Siliceous organisms* [3.00], Sponge spicules and Radiolarians. *Fine washings* [25.14], argillaceous matter, fine mineral particles, and fragments of siliceous organisms.

Specimen 15, *Line F'*. — Lat. 27° 55′ N. Long. 89° 53′ W. 17 March, 1875. Depth, 407 fathoms. A gray mud, clayey, coherent, plastic.

Carbonate of Calcium, 10.27 per cent, consists of otoliths of fish, Pteropod fragments, and the following Foraminifera: —

Pelagic species.

Globigerina rubra
G. dubia
G. bulloides
G. æquilateralis
G. sacculifera
G. (Orbulina) universa
Pulvinulina menardii
P. menardii, var. *tumida*
P. micheliniana
Pullenia obliquiloculata
Biloculina ringens
Planispirina celata
Pullenia sphæroides
Sphæroidina bulloides
Pulvinulina pauperata
P. elegans
Haplophragmium globigeriniformis
Chilostomella ovoidea
Bolivina ænariensis
Bulimina marginata
Sagrina columnella
Virgulina subsquamosa
Truncatulina lobatula
Uvigerina pygmæa
U. asperula
Lagena orbignyana
L. sp.

Residue, 89.73 per cent, light brown, consists of *Minerals* [10.00], m. di. 0.05 mm., quartz, augite, magnetite, felspars, hornblende, and a few small red particles. *Siliceous organisms* [3.00], casts of Foraminifera, Sponge spicules, and Radiolarians. *Fine washings* [76.73], amorphous clayey matter, and fragments of siliceous organisms.

Specimen 40, *Line P'.* — Lat. 25° 31′ 45″ N. Long. 90° 28′ W. 13 May, 1875. Depth, 1,922 fathoms. A dark brown Globigerina ooze, coherent, plastic.

Carbonate of Calcium, 36.54 per cent, consists of Echini spines, Ostracode valves, coccoliths, and the following Foraminifera: —

Bottom-living species.

Biloculina depressa
Miliolina sp.
Truncatulina lobatula
Nonionina pompilioides
Globigerina rubra
G. dubia
G. conglobata
G. sacculifera
G. bulloides, var. *triloba*
Pullenia obliquiloculata
Sphæroidina dehiscens
Candeina nitida
Pulvinulina menardii
P. menardii, var. *tumida*
P. menardii, var. *fimbriata*
P. micheliniana
P. canariensis

Residue, 63.46 per cent, reddish, consists of *Minerals* [30.00], m. di. 0.07 mm., quartz, mica, felspar, augite, plagioclase, glauconite, and red palagonite-like particles. *Siliceous organisms* [5.00], Radiolarians, Sponge spicules, and brown flexible casts of Foraminifera. *Fine washings* [28.46], amorphous clayey matter, with fine minerals and fragments of siliceous spicules.

Specimen 30, *Line C C.* — Lat. 23° 23′ N. Long. 94° 39′ W. May 17, 1877. Depth, 2,057 fathoms. A reddish Globigerina ooze, coherent, clayey, with lustrous streak.

Carbonate of Calcium, 32.12 per cent, consists of a very few coccoliths and rhabdoliths, and the following Foraminifera: —

Globigerina dubia
G. rubra
G. sacculifera
G. conglobata
G. helicina
G. bulloides, var. *triloba*
G. several irregularly growing forms.
G. (*Orbulina*) *universa*
Pullenia obliquiloculata
Sphæroidina dehiscens
Pulvinulina menardii
P. menardii, var. *tumida*
P. micheliniana
P. canariensis
Truncatulina lobatula
Nonionina umbilicatula
N. pompilioides
Pulvinulina elegans
Bolivina textilarioides
Miliolina cultrata

Bottom-living species.

Residue, 67.88 per cent, red, consists of *Minerals* [15.00], m. di. 0.05 mm., quartz, felspars, magnetite, augite, hornblende, a few red particles, glassy fragments, and fragments of scoriæ. *Siliceous organisms* [3.00], Sponge spicules, and fragments of Radiolarians. *Fine washings* [49.88], argillaceous matter, fine mineral particles, and a few fragments of siliceous spicules.

Specimen 21, *Line C C.* — Lat. 23° 18′ N Long. 92° 03′ W. Depth 2,080 fathoms. A light brown Globigerina ooze, reddish when wet, coherent, clayey.

Carbonate of Calcium, 35.52 per cent, chiefly made up of pelagic Foraminifera,

along with Ostracode shells, fragments of Echinoderms, coccoliths, and rhabdoliths. The following is a list of the Foraminifera: —

Globigerina bulloides, few, small.
G. bulloides, var. *triloba*, common.
G. dubia, common, large.
G. æquilateralis, few.
G. rubra, abundant.
G. conglobata, common.
G. sacculifera, common.
G. (Orbulina) universa, abundant.
Candeina nitida, few.
Pullenia obliquiloculata, abundant.
Sphæroidina dehiscens, few.
Pulvinulina menardii, abundant.
P. menardii, var. *tumida*, abundant.
P. menardii, var. *fimbriata*, few.
P. micheliniana, abundant.
P. canariensis, few.
Truncatulina lobatula, few.
Nonionina pompilioides, few.
Rotalia soldanii, rare.
Bolivina sp., rare.
Biloculina ringens, rare.
Miliolina sp., rare.
} Bottom-living species.

Residue, 64.48 per cent, reddish, consists of *Minerals* [3.00], m. di. 0.05 mm., felspars, quartz, magnetite, augite, hornblende, glassy fragments. *Siliceous organisms* [3.00], Sponge spicules, Diatoms, Radiolarians, casts of Foraminifera. *Fine washings* [58.48], amorphous clayey matter, fine mineral particles, and fragments of siliceous organisms.

Station 4. — Off Morro Light. Depth, 936 fathoms. Surf. temp. 77½°. Bot. temp. 39½°. A Pteropod ooze, of a grayish white color, chiefly composed of Pteropods, with many pelagic Foraminifera, slightly coherent.

Carbonate of Calcium, 68.84 per cent, consists of otoliths of fish, Gasteropod, Lamellibranch, Ostracode, Pteropod, and Heteropod shells, Echinoderm fragments, coccoliths and rhabdoliths, and Foraminifera as follows: —

Globigerina bulloides
G. rubra
G. dubia
G. æquilateralis
G. sacculifera
G. conglobata
G. (Orbulina) universa
Candeina nitida
Sphæroidina dehiscens
Pullenia obliquiloculata
Pulvinulina menardii
} Pelagic species.

Biloculina sphæra
B. depressa
Miliolina sp.
Planispirina celata
Hyperammina ramosa
H. vagans
H. subnodosa
Ammodiscus incertus
Gaudryina pupoides
G. rugosa
Cassidulina crassa
Truncatulina lobatula
Sphæroidina bulloides
} Bottom-living species.

Residue, 31.16 per cent, grayish brown, consists of *Minerals* [10.00], m. di. 0.07 mm., quartz, hornblende, felspars, plagioclase, orthoclase, mica. *Siliceous organisms* [15.00], Radiolarians, Diatoms, and Sponge spicules. *Fine washings* [6.16], argillaceous matter, fine minerals, fragments of siliceous organisms, and greenish organic matter.

Note. — Fragments of an areolar tufaceous rock were obtained in the dredging.

Station 27. — Lat. 24° 30′ N. Long. 83° 49′ W. Depth, 392 fathoms. Surf. temp. 73°. Bot. temp. 44½°. A grayish green coral mud, pulverulent and granular.

Carbonate of Calcium, 82.06 per cent, consists of otoliths of fish, Gasteropod, Lamellibranch, Ostracode, Pteropod, and Heteropod shells, Echinoderm fragments, coccoliths and rhabdoliths, and Foraminifera as follows: —

Globigerina rubra
G. dubia
G. conglobata
G. bulloides
G. (Orbulina) universa
Pullenia obliquiloculata
Pulvinulina menardii
P. micheliniana
Sphæroidina bulloides
Miliolina venusta
M. seminulum
Cassidulina crassa
Bolivina dilatata
Bigenerina sp.
Textularia sp.
Bulimina aculeata
Nodosaria hispida
Uvigerina asperula
Cristellaria variabilis
Discorbina obtusa
D. allomorphinoides
Truncatulina lobatula
T. ungeriana
T. rosea
Rotalia soldanii
Polystomella crispa
P. striatopunctata
Nonionina umbilicatula.

All the Foraminifera in this deposit appear very small (dwarfed).

Residue, 17.94 per cent, dark green, consists of *Minerals* [5.00], m. di. 0.1 mm., quartz, felspars, hornblende, magnetite, plagioclase, mica, many glassy fragments. *Siliceous organisms* [10 00], Sponge spicules, Radiolarians, Diatoms, and a few casts of Foraminifera. *Fine washings* [2.94], argillaceous and green flocculent matter, fine mineral particles, and fragments of siliceous organisms.

Station 33. — Lat. 24° 1′ N. Long. 88° 58′ W. Depth 1,568 fathoms. Surf. temp. 72½°. Bot. temp. 40½°. A light brown Globigerina ooze, with a rosy tinge, dark brown when wet, coherent, pulverulent, granular.

Carbonate of Calcium, 72.21 per cent, consists of otoliths of fish, Pteropod and Ostracode shells, Echinoderm fragments, coccoliths and rhabdoliths, and the following Foraminifera: —

Pelagic species.
Globigerina rubra
G. dubia
G. conglobata
G. sacculifera
G. (Orbulina) universa
Pullenia obliquiloculata
Sphæroidina dehiscens
Pulvinulina menardii
P. menardii, var. *fimbriata*
P micheliniana

Bottom-living species.
Miliolina seminulum
Biloculina depressa
B. tubulosa
Cassidulina crassa
Lagena hispida
Uvigerina asperula
Pulvinulina elegans
Truncatulina lobatula
T. ungeriana

Residue, 27.79 per cent, reddish brown, consists of *Minerals* [6.00], m. di. 0.15 mm., quartz, hornblende, magnetite, felspar, glassy fragments. *Siliceous organisms* [10.00], Sponge spicules, Radiolarians, Diatoms. *Fine washings* [11.79], argillaceous and flocculent matter, fine mineral particles, and fragments of siliceous organisms.

Station 41. — Lat. 23° 42′ N. Long. 83° 13′ W. Depth, 860 fathoms. Surf. temp. 73°. Bot. temp. 39¼°. A white chalky Pteropod ooze, granular; with several hard chalky concretions, which are perforated by worms, and in parts showing deposits of manganese.

Carbonate of Calcium, 83.67 per cent, consists of otoliths of fish, Pteropod and Heteropod shells, coccoliths, rhabdoliths, and Foraminifera as follows: —

Globigerina rubra	*Biloculina depressa*	
G. inflata	*Miliolina seminulum*	
G. sacculifera	*M. circularis*	
G. conglobata	*Planispirina celata*	
G. dubia	*Rhabdammina discreta*	
G. bulloides, var. *triloba*	*Hyperamina ramosa*	Bottom-living species.
G. (*Orbulina*) *universa*	*Bulimina marginata*	
Sphæroidina dehiscens	*Uvigerina oculata*	
Candeina nitida	*Sphæroidina bulloides*	
Pulvinulina menardii	*Truncatulina rosea*	
P. menardii var. *tumida*	*T. lobatula*	
P. menardii var. *fimbriata*	*Pulvinulina pauperata*	
P. micheliniana		
Pelagic species.		

Residue, 16.33 per cent, light brown, consists of *Minerals* [4.00], m. di. 0.08 mm., quartz, magnetite, felspar, hornblende, and a few glassy fragments. *Siliceous organisms* [7.00], many Radiolarians, Sponge spicules, and Diatoms. *Fine washings* [5.33], light brown flocculent and argillaceous matter, with fine mineral particles and fragments of siliceous organisms.

Station 48. — Lat. 28° 47′ 30″ N. Long. 88° 41′ 30″ W. Depth, 533 fathoms. Surf. temp. 66°. Bot. temp. 41¾°. Mud (river), of a light brown color, dark with a greenish tinge when wet, showing Gasteropod shells imbedded, very coherent, clayey streak, dries into very hard lumps.

Carbonate of Calcium, 6.43 per cent, consists of a few Gasteropod shells, coccoliths, and the following Foraminifera: —

Globigerina inflata	*Pullenia obliquiloculata*
G. conglobata	*Pulvinulina menardii*
G. bulloides	*P. menardii*, var. *tumida*
G. dubia	*P. micheliniana*
G. rubra	*Miliolina seminulum*
G. (*Orbulina*) *universa*, fragments.	*Bulimina marginata*

Lagena gracillima
Cristellaria gibba
Uvigerina pygmæa
Pulvinulina elegans
Sphæroidina bulloides

Residue, 93.57 per cent, brown, consists of *Minerals* [25.00], m. di. 0.05 mm., quartz, feldspars, hornblende, fragments of coal. *Siliceous organisms* [3.00], fragments of Radiolarians. *Fine washings* [65.57], argillaceous matter and fine mineral particles, with a few fine siliceous fragments.

In the examination and description of these deposits I was assisted by the abbé Renard, who determined many of the mineral particles. I have also to acknowledge the services rendered by my assistants, Mr. James Chumley and Mr. Frederick Pearcey.

John Murray.