Examination of some deep soundings from the Atlantic Ocean ; On some new localities of fossil Diatomaceae in California and Oregon / by J.W. Bailey.

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EXAMINATION

OF SOME

DEEP SOUNDINGS FROM THE ATLANTIC OCEAN.

By Prof. J. W. BAILEY, West Point, N. Y.

In an account of a microscopical examination of soundings made by the U. S. Coast Survey near the Atlantic coast of the United States* I made known that the soundings along the coast, from the depth of 51 fathoms S. E. of Montauk Point, to 90 fathoms S. E. of Cape Henlopen were chiefly made up of vast amounts of Foraminiferous shells, rivalling in abundance the deposits of analogous fossil species which I had proved to compose immense beds under the city of Charleston, S. C.

The facts were also mentioned that none of the species found in the soundings belong to the littoral genera of the group *Agathistegues* of D'Orbigny (*Plicatilia*, Ehr.) and that they also differed from those found in the tertiary deposits of Maryland and Virginia. These facts were confirmed and extended by the observations of F. de Pourtales in his Report to Prof. A. D. Bache, on the distribution of Foraminiferæ on the coast of New Jersey as shown by the off-shore soundings of the U. S. Coast Survey.†

In this paper Mr. Pourtales states that "the greatest depth from which specimens had been examined is two hundred and sixty-seven fathoms, and there the Globigerina are still living in immense numbers." He adds that the region of Globigerina extends to a depth not known.

I am indebted to that zealous cultivator of science, Lt. Maury of the National Observatory, for an opportunity to examine the deep sea soundings made by means of Brookes's lead on board the U. S. Dolphin by Lt. Berryman. These soundings proved to be of great interest and furnished results which have an important bearing upon Geology and Physical Geography.

* See Smithsonian Contributions to Knowledge, vol. ii, Art. 3.

† See Proceedings of American Association for the Advancement of Science, 1850, p. 84.

The soundings examined were as follows:

1080	fathoms,	Latitude	42°	04′	North,	Longitude	29°	00′	West,	July 25,	1853.
1360	"	"	44°	41′	"	"	24°	35′	"	" 18,	"
1580	"	"	49°	56′	30″	"	13°	13′	45″ "	Aug. 22,	"
1800	"	"	47°	38′	"	"	09°	08′	"	No date.	
2000	"	"	54°	17′	"	"	22°	33′	"	" "	

As these soundings are believed to be the deepest ever submitted to microscopic examination, and were obtained at localities far remote from those previously noticed, they were studied very carefully, and the following are the facts ascertained:

1. None of these soundings contain a particle of gravel, sand, or other recognizable unorganized mineral matter.

2. They all agree in being almost entirely made up of the calcareous shells of minute, or microscopic Foraminiferæ (*Polythalamia*, Ehr.), among which the species of *Globigerina* greatly predominate in all the specimens, while *Orbulina universa*, D'Orb., is in immense numbers in some of the soundings, and particularly abundant in that from 1800 fathoms.

3. They all contain a few species of non-parasitic or pelagic Diatoms, among which *Coscinodiscus lineatus*, *C. excentricus*, and *C. radiatus* of Ehrenberg, are much the most abundant.

4. They all contain a few siliceous skeletons of Polycistineæ, among which are several species of *Haliomma*, *Lithocampe*, &c.

5. They all contain spicules of sponges, and a few specimens of *Dictyocha fibula*, Ehr.

6. The above mentioned organic bodies constitute almost the entire mass of the soundings, being mingled only with a fine calcareous mud derived from the disintegration of the shells.

7. These soundings contain no species of Foraminifera belonging to the group of *Agathistegues* (*Plicatilia*, Ehr.), a group which appears to be confined to shallow waters, and which in the fossil state first appears in the tertiary, where it abounds.

8. These soundings agree with the deep soundings off the coast of the United States, in the presence and predominance of species of the genus *Globigerina*, and in the presence of the cosmopolite species *Orbulina universa*, D'Orb., but they contain no traces of the *Marginulina Bacheii*, B., *Textilaria Atlantica*, B., and other species characteristic of the soundings of the western Atlantic.

9. Examined by chromatic polarized light, the foraminiferous shells in these soundings showed beautiful colored crosses in their cells, and the mud accompanying them also became colored, showing that it is not an amorphous chemical precipitate. It in fact can be traced through fragments of various sizes, to the perfect shells of the Foraminiferæ.

10. In the vast amount of pelagic Foraminiferæ, and in the entire absence of sand, these soundings strikingly resemble the

chalk of England, as well as the calcareous marls of the Upper Missouri, and this would seem to indicate that these also were deep sea deposits. The cretaceous deposits of New Jersey present no resemblance to these soundings, and are doubtless littoral, as stated by Prof. H. D. Rogers (Proc. Bost. Soc. Nat. Hist. 1853, p. 297).*

11. The examination of a sounding 175 fathoms in depth, made in latitude 42° 53′ 30″ N., longitude 50° 05′ 45″ W. (near Bank of Newfoundland) by Lt. Berryman gave results singularly different from those above stated. It proved to be made up of quartzose sand, with a few particles of hornblende, and not a trace of any organic form could be detected in it. This exceptional result is important, as it proves that the distribution of the organic forms depends on something beside the depth of the water.

12. Connecting the results above mentioned with those furnished by the soundings made in the western portions of the Atlantic it appears that with the one exception above mentioned, the bottom of the North Atlantic Ocean, as far as examined, from the depth of about 60 fathoms, to that of more than two miles (2000 fathoms) is literally nothing but a mass of microscopic shells.

13. The examination of a large number of specimens of ocean water taken at different depths by Lt. Berryman at situations in close proximity to the places where the soundings were made, shows that even in the summer months when animal life is most abundant, neither the surface water, nor that of any depth collected, contained a trace of any *hard* shelled animalcules. The animals present, some of which are even now alive in the bottles, are all of a soft, perishable nature, leaving on their decay only a light flocculent matter, while the Foraminiferæ and Diatoms would have left their hard shells if they had been present.

As the species whose shells now compose the bottom of the Atlantic Ocean have not been found living in the surface waters, nor in shallow water along the shore, the question arises, Do they live on the bottom at the immense depths where they are found, or are they borne by submarine currents from their real habitat? Has the Gulf Stream any connection by means of its temperature or its current with their distribution? The determination of these and other important questions connected with this subject requires many additional observations to be made. It is hoped that the results already obtained will induce scientific commanders and travellers to spare no pains in collecting deep sea soundings. If such materials are sent either to Lt. Maury, U. S. Observatory, or to myself at West Point, N. Y., they will be thankfully received and carefully studied.

* See also this Journal, vol. xvii, p. 131.

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ON SOME NEW LOCALITIES

OF

FOSSIL DIATOMACEÆ IN CALIFORNIA AND OREGON.

By Prof. J. W. BAILEY, West Point, N. Y.

Some interesting specimens of fossil Diatomaceæ from California and Oregon having come into my possession, I am induced to publish the following brief notices of them, in hopes to direct the attention of travellers in those regions to those remarkable deposits, and thus acquire more information concerning their position and extent.

1. The first specimen of fossil Diatomaceæ from California, I found among specimens of minerals collected two or three years ago in California by Washington Chilton, Esq., of New York. It was from *Suisun Bay*, 25 to 30 miles above St. Francisco, where Mr. Chilton says a large bed of similar material exists. It consists of a light white claylike substance made up entirely of fossil *marine* Diatoms, many species of which are identical with species occurring fossil in the tertiary diatomaceous deposits of Virginia and Maryland, while a number of the species found in these latter deposits do not occur in the California beds.

2. In a box of minerals collected in Oregon and California by Lt. Robt. Williamson, of the U. S. Topographical Engineers, I found four specimens of fossil diatomaceous earth, evidently from different localities, although unfortunately the precise locality is mentioned for but two of the specimens. I will designate them as specimens A, B, C, and D.

Specimen A.—This is a very light white substance, made up of the siliceous shells of *fluviatile* Diatoms. The predominant species are a small Gallionella, and a Discoplea mingled with a few species of Epithemia, Cocconema, Gomphonema and Spongiolites. This specimen was without a label, but is believed to be the specimen referred to in the following extract from a letter received from Lt. Williamson: "You will find some of the light white clay from *Pit River*, which I spoke of to you." This is, I believe, the same substance which has given rise to the news-

paper accounts of cliffs in California composed of carbonate of magnesia.

Specimen B.—This is a light white chalky mass, whose locality is not given. It consists of fluviatile species, among which various species of *Biblarium* are quite abundant. The species of this genus have been found living in Siberia, and fossil in Oregon. Lt. Williamson's specimen resembles the Oregon mass found by the U. S. Exploring Expedition under Capt. Wilkes, but presents a different group of forms and therefore must be from a different locality.

Specimen C.—This is also a chalklike mass, whose precise locality is not marked. It is composed chiefly of a minute species of Gallionella, mingled with sieve-like discs which at first would be referred to the marine genus Coscinodiscus, but the entire absence of all other marine forms and the presence of several decidedly fluviatile species, makes me believe that the deposit is a fresh water one, and careful examination of these discs show that they are more nearly allied to the fresh water genus Stephanodiscus than to the marine Coscinodiscus.

Specimen D.—Is an ash-colored earth, marked as from near the Boiling Spring, Pit River. It is chiefly remarkable for containing a great number of Phytolitharia, or remains of the siliceous portions of plants, mingled however with numerous minute fluviatile Diatoms.

It is hoped that travellers in California and Oregon will keep a look out for specimens of light white clay like substances, and *carefully marking the locality at the time of collection*, send them to me for microscopic examination. Even a minute portion sent by mail will be very acceptable.