WOODS HOLE OCEANOGRAPHIC INSTITUTION

Woods Hole, Massachusetts

In citing this report in a bibliography, the reference should be followed by the phrase UNPUBLISHED MANUSCRIPT, which is in accordance with accepted bibliographic practice

Reference No. 57-19

Supplement to Reference No. 57-5

THE IRON CONTENT OF SEDIMENT SAMPLES IN NEW YORK BIGHT OBTAINED DURING R/V CARYN CRUISE 108 October 19 - 24, 1956

by

N. Corwin and B. H. Ketchum

Submitted to the
National Lead Company

APPROVED FOR DISTRIBUTION C. O'D. Iselin

C. O'D. Iselin, Director

During R/V CARYN Cruise No. 108 to the New York Bight, samples of the bottom were obtained with an orange peel dredge at 23 stations and additional bottom samples were obtained by aqualung divers. These samples have been returned to the Woods Hole Oceanographic Institution where they have been analyzed for their iron content. No analyses were made on the samples obtained at Stations 25 and 26 since these consisted of coarse gravel and rocks and a representative sample of the sediment could not be obtained.

The method used has been to weigh a dried sample of approximately one gram and to extract this sample with successive volumes of 6 N hydrochloric acid. The extractions were repeated until all of the soluble iron was removed from the sediment sample. At the same time a duplicate sample was weighed and ignited at 550°C. for a period of three hours prior to the extractions. The first sample provides the soluble iron in the sediment. The ignited sample provides the total iron including the soluble iron and that which might have been combined with organic material or otherwise made insoluble. After neutralization with 6 N NaOH, the combined extracts were rediluted to a known volume, an aliquot was removed and the iron content determined by the dipyridyl method as described by Cooper (1935).

The distribution of iron in sediment may be expected to be variable. The physical processes which permit an accumulation of the finely divided iron hydroxide would also permit accumulation of fine silt particles and of organic matter. For this reason, the loss on ignition can be used as one criterion for the sedimentary processes which have contributed to the formation of the bottom, and high organic content can be expected to be associated with high iron concentrations. The interpretation of variable results is thus facilitated.

Although the location of the present sediment samples do not duplicate those previously studied, it may be well to review the previous observations which were summarized by Redfield and Walford (1951)*. A variety of bottom samples obtained either with the orange peel dredge or with the coring tube in the original disposal area or in the mud hole were analyzed and gave iron contents ranging from 2.9 to 9.5 milligrams per gram. The average value was about 6.5 milligrams per gram. In the core samples there was no significant difference in iron content between the upper and lower parts of the cores, which ranged in length from 10.5 to 20 cm.

---

* Disposal of Chemical Wastes at Sea, p. 26. Nat. Res. Council of the Nat. Acad. Sci., Publ. 201, 1-49 pp.

Results

A general description of the character of the bottom and of the sediment samples obtained will be found in the original report. The results of the analyses are presented in Table 1, which shows the loss on ignition for each sample and the content of soluble and of total iron in the sample of sediment. Both of these are expressed as milligrams of iron per gram of sediment. Generally 80 - 90% of the iron is present in soluble iron, and the variation seems to be unrelated to the amount of organic matter present.

Of the 32 analyses conducted, 26 showed iron contents of less than 10 milligrams per gram of sediment. These are all well within the range of the previous analyses and indicate that there has been no cumulative change within the past eight years of the disposal operations. Within the present disposal area 19 samples were taken. One of these, obtained by a diver at Station 19, will be discussed below. The remaining 18 samples show an average iron content of 3.4 milligrams per gram of sediment for soluble iron and 3.8 milligrams per gram of sediment for total iron. These values are significantly lower than those obtained previously, but as mentioned above the location of the previous samples was not in this same area, and a reference to the chart will show that the present dumping area has a sandy bottom rather than the muddy bottom of the previous dumping area. Since the physical processes which tend toward the accumulation of fine silts on a muddy bottom would also tend toward the accumulation of the fine iron hydroxide precipitate in the same location, it is not surprising that the sandy bottom has a lower iron content than the muddy bottom.

Six of the samples had an unusually high iron content ranging from 15.2 to 29.0 milligrams of soluble iron per gram of sediment. Of these six samples only one was obtained in the present dumping area, and this one is the diver's sample obtained at Station 19 mentioned above. Reference to the original report will show that at Station 19 the divers found a rippled, sandy bottom with a black ooze exposed as irregular areas in the troughs of the ripples. A sample of this black ooze was collected and it was found to contain 29 milligrams of soluble iron and 31.3 milligrams of total iron per gram of sediment. Two other divers' samples of adjacent sediments showed 3.08 and 3.74 milligrams of iron per gram. It is also noteworthy that the sample of the ooze had about ten times the organic matter contained in the other three samples obtained at Station 19.

Five of the high iron concentrations were observed outside of the present dumping area, three being to the north between the dumping area and the shore of Long Island and two being to the eastward. One of the latter was obtained in the original

dumping area assigned to The National Lead Company which has not been used for the past eight years. With only one exception, these high iron samples also contained in excess of 1% organic matter in the sediment and thus reflect sedimentation processes which accumulate simultaneously these fine sediments. The one sample with low organic matter and high iron (Station 5) was obtained well north of the area. One sample within the dumping area (Station 21) contained relatively low iron (8.35 mg/gram) even though the sedimentation processes had produced a high organic matter content (11.9%).

Conclusions

The iron content of the sediments shows no evidence of any accumulation of unusual amounts of iron on the bottom which could be attributed to the disposal operations of The National Lead Company. Five of the six samples which showed unusually high iron content were outside the present disposal area. Only one of nineteen samples collected within the disposal area showed a high iron content, and this sample was obtained by a diver of a part of the bottom which consisted of black ooze. All but one of the samples which contained high iron concentrations also contained larger than usual amounts of organic matter, indicating that the distribution of iron on the bottom is controlled by the same processes which lead to an accumulation of other fine sediments.

Table 1

Iron Content of Sediment Samples Collected on CARYN Cruise #108

Station No.	Loss on Ignition %	Soluble Fe mg/g	Total Fe mg/g
1	0.79	5.55	6.37
1	0.77	6.15	6.75
2	6.20	16.9	19.6
3	1.84	19.3	26.4
4	1.89	5.38	5.83
5	0.53	13.2	13.7
7	0.34	4.35	4.52
8	0.52	4.26	4.78
9	0.72	2.84	2.99
10	0.25	3.50	4.00
11	0.57	3.10	3.46
12	0.54	2.68	2.74
13	0.72	3.85	4.43
14	0.51	3.61	3.80
15	0.53	2.92	3.40
16	0.67	2.82	3.05
17	0.44	2.56	2.61
18	1.14	25.7	37.9
19	0.89	3.08	3.52
19	8.87	29.0	31.3
19	0.94	3.74	3.83
19?	0.58	4.31	4.44

Table 1 (cont'd.)

Station No.	Loss on Ignition %	Soluble Fe mg/g	Total Fe mg/g
19A	0.79	2.85	4.25
20	0.69	3.10	3.70
21	11.90	8.35	10.20
21A	0.44	2.56	2.61
21B	0.34	1.90	2.10
22	1.04	3.49	3.61
22A	0.64	2.24	2.91
23	0.79	2.58	3.51
24	5.42	20.3	21.5
24	2.74		8.2