SEDIMENT SAMPLING NEAR MOUND LABORATORY - JULY 1974

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ABSTRACT

Eight large diameter sediment cores and 16 water samples were taken from local water bodies in the vicinity of Mound Laboratory. These samples will be analyzed for plutonium and other chemical and physical properties.

INTRODUCTION

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This report summarizes the field sampling program carried out in Miamisburg, Ohio, July 15 through 19, 1974. The primary objective was to obtain undisturbed, large area sediment cores from three water bodies to the west of Mound Laboratory: the North and South Ponds and the Miami-Erie Canal. Secondary objectives included obtaining a similar sediment core from the Great Miami River and water samples from each of these bodies as well as of local tap water. All of the objectives were successfully met.

The ultimate purpose of this program is to obtain information about the geochemical behavior of plutonium (and perhaps americium) in a fresh water system. The water - sediment relationship, the distribution in the sediment column and the ratios of various

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isotopes may provide useful guidance for subsequent studies in and around nuclear facilities involved with transuranic elements. The water bodies near Mound Laboratory provide a unique "natural laboratory" for carrying out these studies.

The field team consisted of two from HASL (H. Volchok and J. Dowdall and three from Woods Hole Oceanographic Institution (WHOI) (J. Burke, D. Mann and T. Lewis).

We acknowledge the very excellent cooperation provided by the Mound personnel, in particular by Mr. William Westendorf and his colleagues; and we also thank the Miami Conservancy District for the use of their boat.

The sediment samples obtained will be distributed to a number of laboratories, including HASL, WHOI, Oak Ridge National Laboratory and Mound Laboratory for radiochemical and other chemical-physical measurements.

SAMPLING PROCEDURE

The sediment cores were obtained with a 21 cm diameter device equipped with a sphincter core retainer. This instrument has been described (1) and successfully employed in a variety of programs (e.g., 2) although never before in such shallow water (the deepest core came from the river in about 2 meters of water, the others

were from less than 0.5 meters). Where possible, the water above the sediment in the core barrel was removed and retained. A piston was then placed on top of the sediment column, in the barrel, the entire barrel was inverted and the core extruded bottom side first by lowering the barrel.

The sediment was divided into increments of between 1 and 4 cm thickness, depending upon the type of material, the depth in the core and convenience. In every case, material found in the nose cone, and at least one cm of the material first extruded, was discarded, as well as the outer edge of the entire extruded core, to a thickness of about one cm.

Each sediment slice was split, approximately in half, during extrusion, and in some cases, one of the halves was split again. This procedure was designed to provide aliquots for a number of planned analysis programs, yet avoiding the necessity for splitting the samples back in the laboratory as a contamination precaution.

In three of the cores substantial sediment was found in the extrusion piston, evidently having flowed from the top of the core around the edges of the piston, which fits the barrels rather loosely. This material was recovered and bottled as separate samples.

All of the water samples from the ponds, canal and river were obtained from the shore with a hand powered bilge pump.

STATION LOCATIONS AND DESIGNATIONS

In all, 8 cores and 16 water samples were obtained. The locations of the sampling stations in the ponds and canal are shown in Figure 1. These are accurate to about ± 5 meters. Power line poles, also shown in Figure 1, were used as fixed reference points. The only sampling station not shown is number 4, that in the Great Miami River; this core was obtained at a point about 250 m north of the Chataqua Dam, and some 10 m from the east shore.

CORE NOTES

Table 1 lists the cores and summarizes the thickness of the various depth increments sampled. Water from the tops of the cores was not obtainable in every case, this will be discussed subsequently. Following are specific notes about each of the stations:

Station 1 South Pond. Core was black and varied from smooth to lumpy with recognizable, partially decayed vegetation. Top few cm was light grey and this color also showed in streaks at the bottom and edges. Top water drained through core.

Station 2 North Pond. Similar in appearance to core 1 except little or no grey at top, some seen at bottom. About 20 liters of top water was pumped off and retained.

Figure 1. Sampling stations in the water bodies near Mound Laboratory.

Station 3 North Pond. Meant to be a duplicate of 2, sampled about 1 meter east of 2. Very similar in appearance and the same total amount of sediment was obtained. The top water was lost from this core.

TABLE 1
SEDIMENT CORE SAMPLES OBTAINED

<u>Map Station</u>	<u>Core Length (cm)</u>	<u>Depth Increments Sampled</u>				<u>Top Water Col. (1)</u>
		<u>4 cm</u>	<u>3 cm</u>	<u>2 cm</u>	<u>1 cm</u>	
1	22	-	-	0-2	2-22	lost
2	26	-	-	0-26	-	~20
3	26	-	-	0-26	-	lost
4	12	-	-	0-12	-	lost
5	31	-	0-3*	3-31	-	~20
6	54	18-54	-	0-18	-	~2
7	35	19-35	0-3*	3-19	-	~12
8	47	19-47	0-3*	3-19	-	lost

*Additional "top" sediment found in piston - separately bottled.

Station 4, Great Miami River. It was difficult to find sediment in the middle, deeper parts of the river. Probing mainly indicated a stoney, gravelly bottom. Closer to shore, sediment was

found by probing; the sediment depth was variable. The sediment obtained was very homogeneous, brown to grey, lumpy, rather unconsolidated like large curd cottage cheese. A few cms of bottom mud was taken from the top of the core catcher, untrimmed. Top water was lost.

Station 5, near dam at north end of Canal. Sediment almost completely black, containing much partially decayed vegetation. A good column of top water was retained.

Station 6, in the Canal. Material was very similar to that at station 5. Some top water was retained.

Station 7, further south in the Canal. Material again very similar to 6 and a good deal of top water was retained.

Station 8. We attempted, here, to get as close to the south end of the canal (and Mound's station D) as possible. We were limited by the water depth, which gets shallower to the south. The boat was grounded about 50 meters from the south end dam, probably about 25 meters north of "D". The material from the core was similar to that from the other canal cores except for a distinct layer of brown (about 5 mm thick) at the top. Some of this color had been noticed at the bottom. All of the top water was lost.

WATER NOTES

The pond and canal sampling locations are shown on Figure 1. The river sample was taken about 50 meters north of the coring site. A sample of town tap water was obtained from a private home across the road, just west of station 8. Table 2 summarizes the water samples.

TABLE 2

WATER SAMPLES FROM NEAR MOUND LAB.

<u>Location</u>	<u>Sample No.</u>	<u>Volume (l)</u>
South Pond	1A	55
"	1B	"
"	1C	"
North Pond	2A	55
"	2B	"
"	3	"
Miami-Erie Canal	5A	55
"	5B	10
"	6A	"
"	6B	"
"	7	"
"	8A	"
"	8B	"
Great Miami River	4A	55
"	4B	"
Drinking Water	DW	55

DISCUSSION

Although, as mentioned, the objectives of this field exercise were, by and large met, a few areas of difficulty or discrepancy are pointed out. These are not intended as criticism but are mentioned to hopefully stimulate discussion and improvement, if possible.

Top Water

It is clear that if everything worked at optimum, the water in the barrel above the sediment would be retained, and recoverable. In 4 of our 8 cores the top water was lost, apparently finding a pathway through the sediment and leaking out between the barrel and nose cone. In such cases, fine particles, will undoubtedly be carried along with the water and be either lost or vertically displaced in the sediment column. The latter is probably not too serious in that, the pathway of the water is apparently along the sediment-barrel interface, hence the normal practice of discarding the outer 1 cm of sediment eliminates contamination of this nature. There can be little doubt, however, that loss of top water results in loss of an unknown amount of suspended surface material.

Sediment Depth

It was observed, that all seven of our pond and canal cores were substantially shorter than expected from reports by Mound Lab. personnel. Prior to each coring, we probed the area with a long,

thin aluminum rod to anticipate the probable sediment depth. In every case, the length of core obtained was in substantial agreement with the estimate from probing.

We do not understand this discrepancy, at this time. Either our corer (and probe) were not weighted enough to penetrate a sub-surface interface into much harder sediment, or the Mound cores, which are driven in with substantial force, penetrated into a clay sub-sediment layer. It seems likely that this problem will be resolved when the radiochemical analyses of both sets of cores are completed. It seems doubtful that much migration of plutonium would have occurred into the sub-sediment clay. Hence if the integrated amount of plutonium, per unit area, is similar, between Mound's and our cores, it would suggest that our system indeed sampled all of the sediment.

Sediment Extrusion

The extrusion and sampling of mud, varying in viscosity from core to core, is a difficult engineering problem, and while the present system is rather crude, experience indicates that it is probably as accurate as necessary. A fair amount of study has gone into quantitatively standardizing the area sampled and as yet no practical system has been developed. One modification that we feel is of major importance is to extrude in the same position as sampled, top side first. This will help a great deal in

preserving the very top of the column, and allow more precise sampling of that very important section of the core.

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