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DISTRIBUTION OF MERCURY IN LAKE ST. CLAIR AND THE ST. CLAIR RIVER SEDIMENTS

A. Mudroch and K. Hill

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Lakes Research Branch
National Water Research Institute
Canada Centre for Inland Waters
Burlington, Ontario, Canada L7R 4A6

. Environment Canada

EXECUTIVE SUMMARY

The increase of mercury concentrations in surface sediments from Lake Huron to Lake St. Clair and Western Basin of Lake Erie was attributed to industrial mercury inputs in 1970's. This study was carried out to investigate the present distribution pattern of mercury in Lake St. Clair sediments, and the concentration and association of mercury in the sediments from the St. Clair River. The results of the study showed a decrease of mercury concentrations in the surficial sediment of Lake St. Clair from 1974, despite continuous input of mercury into the lake. The concentration of mercury was greater in the nearshore sediments of the St. Clair River at Sarnia than that in the Lake St. Clair sediments. The results indicated a different association of mercury in the sediments of the St. Clair River and Great Lakes depositional basins. This investigation was carried out under study no. ECD-236.

MANAGEMENT PERSPECTIVE

This report provides information on the distribution of mercury in Lake St. Clair and the St. Clair River bottom sediments. The information can be used for assessment of the transport of mercury into Lake Erie via the St. Clair/Detroit River system. The information on association of mercury with sediment particles should be considered in RAP for the St. Clair River.

DISTRIBUTION DU MERCURE DANS LES SÉDIMENTS DU LAC SAINTE-CLAIRE ET DE LA RIVIÈRE SAINTE-CLAIRE

A. Mudroch et K. Hill

RÉSUMÉ À L'INTENTION DE LA DIRECTION

L'augmentation des concentrations de mercure dans les sédiments superficiels prélevés entre le lac Huron et le lac Sainte-Claire et le bassin occidental du lac Érié a été attribuée aux apports industriels de mercure dans les années soixante-dix. La présente étude a été menée afin d'analyser la modèle actuel de distribution du mercure dans les sédiments du lac Sainte-Claire ainsi que la concentration et l'association du mercure dans les sédiments de la rivière Sainte-Claire. Les résultats de l'étude ont indiqué une baisse de la concentration de mercure dans les sédiments superficiels du lac Sainte-Claire depuis 1974, malgré l'apport ininterrompu de mercure dans le lac. La concentration de mercure était plus forte dans les sédiments prélevés près de la rive de la rivière Sainte-Claire à Sarnia que dans les sédiments du lac Sainte-Claire. Les résultats ont mis en évidence une association différente du mercure dans les sédiments des bassins de sédimentation de la rivière Sainte-Claire et des Grands Lacs. Cette étude porte le numéro ECD-236.

PERSPECTIVE DE GESTION

Le présent rapport donne des renseignements sur la distribution du mercure dans les sédiments de fond du lac Sainte-Claire et de la rivière Sainte-Claire. Ces données peuvent servir à évaluer le transport du mercure dans le lac Érié par le système hydrographique des rivières Sainte-Claire et Detroit. Les données sur l'association du mercure avec les particules sédimentaires devraient être prises en considération dans les RAP pour la rivière Sainte-Claire.

ABSTRACT

Sediment cores were collected in Lake St. Clair in 1985 and in the St. Clair River in 1986 to investigate the horizontal and vertical distribution and association of Hg in the sediments. A layer of recent sediment up to about 35 cm thick was differentiated by the geochemical composition and visual appearance from the underlying glacial-lacustrine deposits. The concentration of Hg in the surficial sediments in Lake St. Clair was lower in 1985 (<0.025-1.200 μg/g) than that found in 1974 (<0.20->3.00 μg/g). Up to 8.30 μg/g of Hg were found in the sediments collected from the nearshore area at Sarnia, Ontario, in the St. Clair River in 1986. The concentrations of Hg ranged from 5.05 to 16.00 μg/g in different sand-size fractions (0.063-0.350 mm) of the sediment. The concentration of Hg was 17.80 μg/g in the silt-clay size fraction (<0.063 mm). No relationship was found between the concentration of organic matter and Hg, and the concentration of silica and Hg in the St. Clair River sediments. The results indicated a relationship of Hg with particles of different mineralological composition. Up to 3.72 μg/g Hg was found in the surface sediment in Chenal Ecarte. The greatest concentration of Hg (13.15 μg/g) existed in the 0.350 mm particle size fraction, which consisted mainly of small pieces of decaying wood. A good relationship was found between the concentrations of Hg and organic matter in the sediment at this area.

DISTRIBUTION DU MERCURE DANS LES SÉDIMENTS DU LAC SAINTE-CLAIRE ET LA RIVIÈRE SAINTE-CLAIRE

A. Mudroch et K. Hill

RÉSUMÉ

Des carottes de sédiments ont été prélevées dans le lac Sainte-Claire en 1985 et dans la rivière Sainte-Claire en 1986 pour étudier la répartition horizontale et verticale et l'association du mercure (Hg)dans les sédiments. D'après la composition géochimique et l'examen visuel, on a différencié une couche de sédiments récents d'une épaisseur d'environ 35 cm maximum des dépôts sous-jacents d'origine glacio-lacustre. La concentration de mercure dans les sédiments superficiels prélevés dans le lac Sainte-Claire était plus faible en 1985 (<0,025-1,200 µg/g) que celle observée en 1974 (<0,20->3,00 µg/g). On a trouvé jusqu'à 8,30 ug/g de mercure dans les sédiments prélevés près de la rive à Sarnia, en Ontario, dans la rivière Sainte-Claire en 1986. Les concentrations de mercure variaient de 5,05 à 16,00 µg/g dans diverses fractions de classe granulométrique des sables (0,063-0,350 mm) des sédiments. La concentration de mercure était de 17,80 µg/g dans la fraction limono-argileuse (<0,063 mm). On n'a trouvé aucune relation entre la concentration de matière organique et de mercure et la concentration de silice et de mercure dans les sédiments de la rivière Sainte-Claire. Les résultats révèlent l'existence d'un rapport entre le mercure et les particules de composition minéralogique diverse. Les sédiments superficiels prélevés dans le chenal Ecarte contenaient jusqu'à 3,72 µg/g de mercure. La plus forte concentration de mercure (13,15 µg/g) a été observée dans la fraction granulométrique de 0,350 mm, composée principalement de petits morceaux de bois en décomposition. Une bonne relation a été établie entre les concentrations de mercure et de matière organique dans le carotte prélevée à cet endroit.

INTRODUCTION

The reported contamination of fish by mercury in Lake St. Clair in 1969 was followed by commercial fish ban in March 1970. An immediate response by U.S. and Canadian Federal and Provincial agencies resulted in a number of studies of mercury concentration in fish, water and sediments in the Great Lakes.

In a study by Walters et al. (1974) the concentration of mercury in the sediment increased at two sampling stations in the Western Basin of Lake Erie from about 0.01 µg/g (estimated sediment age 1930) up to 3.00 µg/g in 1970. Thomas and Jaquet (1976) found the range of mercury concentration from 0.008 µg/g to 2.90 µg/g in surface sediments collected from 259 stations in Lake Erie.

The mercury concentration in the 3 cm surface sediment from Lake Huron ranged from 0.054 µg/g to 0.805 µg/g with a mean of 0.222 µg/g (Thomas, 1973).

A study of distribution of metals in Lake St. Clair sediment during 1970 and 1974 by Thomas et al. (1975) showed a significant decrease of mercury concentration from 1970 to 1974. The mean concentration of mercury in the 2 cm surface sediment was 1.549 µg/g in 1970 as compared to 0.568 µg/g in 1974.

The increase of mercury concentration in surface sediments from Lake Huron to Lake St. Clair and Western Basin of Lake Erie was attributed to industrial mercury inputs. Mercury enriched sediment from the St. Clair/Detroit River system is believed to be transported ultimately to Lake Erie depositional basins.

It has been demonstrated by many authors that mercury is associated with fine-grained sediment (for example, Cranston and Buckley, 1972; Thomas, 1973). The greatest concentration of mercury occurs in fine-grained sediment deposited in the offshore areas in the Great Lakes.

The high flow rate of the St. Clair River restricts the accumulation of fine-grained sediments on its bottom. Therefore, most of the St. Clair River sediments consist of medium to coarse sand and gravel. Only firm, hard, glacial lacustrine clay exists at some areas. Fine sand and silt may occur at small embayments or inshore areas with restricted flow speed (Sly and Lewis, 1972; Rukavina, 1986).

Under normal conditions, mercury would become associated with suspended fine particles in the St. Clair River and transported downstream to Lake St. Clair. However, few preliminary analysis of coarse-grained sediments from some areas in St. Clair River showed elevated concentrations of mercury.

The objective of the present study was to investigate the distribution pattern of mercury in Lake St. Clair sediments and the concentration and association of mercury in sediments from the St. Clair River.

MATERIALS AND METHODS

Sediment Sampling and Sample Preparation

Sediment cores were obtained from Lake St. Clair on a sampling grid shown in Figure 1 by divers using plastic tubing (ϕ 10 cm) during June - August 1985. Water depth and thickness of recent sediments were recorded at each sampling station. The cores were subsampled into 1 cm sections on the day of the recovery, and the sediment texture was recorded.

Sediment cores were obtained from the St. Clair River and Chenal Ecarte by a Benthos gravity corer at sampling stations shown in Figure 1 in June 1986. The cores were shipped to the National Water Research Institute, Burlington, Ontario, where they were subsampled into 2 cm sections and the sediment texture recorded during the subsampling.

All sediment subsamples were freeze dried. One portion of each sample was ground to a 100 µm size and used for the determination of the geochemical composition and the concentration of Hg. The second portion of the samples was stored, and selected samples were used later for the separation of sediment into different size fractions. The separation was carried out by sieving the dry sediment through a set of sieves of following size: 4.0 mm, 2.83 mm, 2.0 mm, 1.41 mm, 1.0 mm, 0.71 mm, 0.5 mm, 0.35 mm, 0.25 mm, 0.177 mm, 0.125 mm, 0.088 mm, and 0.063 mm. The weight of each size fraction was recorded.

Selected sediment size fractions were used for the determination of the geochemical composition and the concentration of Hg.

Analytical Methods

The concentrations of major elements (Si, Al, Fe, Ca, Mg, K, Na, Mn, Ti and P) were determined by the X-ray fluorescence spectrometry. The precision of the analyses was determined by analyzing five pellets made from a homogenized sediment sample. Relative deviations and accuracy were identical to those described by Mudroch and Duncan, 1986. The concentration of Hg was determined by the cold vapor atomic absorption spectrometry, using the procedure of Water Quality Branch (1979), and by the gold film mercury analyzer using the method described by Mudroch and Kokotich (1987). Standards obtained from the Quality Assurance Section, National Water Research Institute, Burlington, Ontario, were used to test the accuracy of the Hg determination. One to four standards were analyzed with each set of 20 samples. The concentration of Hg determined in the standards was always within the range given by the Quality Assurance Section. All concentrations of Hg given in this report are in µg/g dry weight of sediment. The concentration of organic matter was determined as loss on ignition (LOI) at 450°C. The mineralogical composition was investigated by the powder X-ray diffraction using a Cu-target with a Ni-filter. Specific gravity of selected samples was determined by the method described by Duncan and St. Jacques (1979).

RESULTS AND DISCUSSION

Lake St. Clair

Water depth and thickness of the recent sediment recorded during the sampling period in 1985 are shown in Figures 2 and 3, respectively. The greatest water depth and thickness of the recent sediment were found in the middle of the lake and at a small area in the southeastern part of the lake. The pattern of thickness of the recent sediment accumulated over the underlying glacial deposits conforms closely to the lake bathymetry. The pattern of the recent sediment distribution is in good agreement with observations by Thomas et al. (1975). Lake St. Clair is considered a non-depositional region for fine-grained recent sediments. These observations indicated that the fine-grained sediment, transported from the St. Clair River and from the shore and bottom deposits erosion in the lake, is transitional and is subsequently carried via the Detroit River into Lake Erie. The glacial-lacustrine sediment underlying the recent sediment is well recognized from the latter by its appearance and geochemical composition (Table 1). The differences in the geochemical composition of recent and glacial-lacustrine sediments in cores from stations 64 and 72 are shown in Figures 4 and 5. An increase of concentrations of Al, Fe, Mg and K corresponds to the change from the recent to the glacial-lacustrine sediment below 6 cm and 30 cm depth in cores from stations 72 and 64, respectively. These changes are due

to the difference in the mineralogical composition of both types of sediments. The glacial-lacustrine sediment contains greater concentrations of well crystallized clay minerals represented mainly by Al, Fe, Mg and K. This type of sediment is also easily recognized visually by its much finer grain size, light grey colour, firm and sticky consistency and a low water content.

The distribution of Hg in the 0-1 cm surface sediments in Lake St. Clair is shown in Figure 6. The greatest concentration (0.90 - 1.20 µg/g dry weight) was found in the deepest part in the middle of the lake. The concentration of Hg in the surface sediments decreased significantly from the survey carried out in 1970 and 1974 by Thomas et al. (1975) (Figures 7 and 8). However, the distribution pattern of the concentration of Hg was similar to that found in 1983 by the Ontario Ministry of the Environment (Figure 9). The concentration profiles of Hg in cores from stations 64, 24 and 18 are shown in Figures 10-12, respectively. In all three cores the concentration of mercury increased from the sediment surface to about 5-6 cm sediment depth, followed by a decrease down to about 12 cm sediment depth where it reached the background level. The 12 cm depth in cores from stations 18 and 24 is close to the glacial-lacustrine sediment layer; however, this layer is at about 30 cm depth in core from station 64. Consequently, about 18 cm of recent sediments accumulated over the glacial-lacustrine clay contained a background concentration of Hg at this station (Figure 10). The dating of the sediment from Lake St. Clair by Cs-137 indicated stratigraphic inhomogeneity and mixing of

the recent sediments. The sediment was found to be 8% efficient in retaining the tracer (as of 1985), implying a residence time of about five years (Robbins and Mudroch, 1987). The lower concentration of Hg at the surface of the cores suggested the deposition of a more recent, less contaminated material. However, this more recent sediment contained greater Hg levels than the background concentration found in recent sediment in core 64 (below 12 cm depth) suggesting a continuous supply of Hg to the lake.

St. Clair River

The sediments collected at all sampling stations in the river consisted mainly of coarse material (gravel and sand) mixed with some silty clay. The concentration of Hg which ranged from 0.025 to 0.070 µg/g in sediments collected at stations 1, 3, 4 and 9 (Figure 1) was considered the background. The concentration of Hg was up to 0.705 µg/g in sediment cores from stations 5, 6, 7, 12, 14, 16 and 17, and up to 8.5 µg/g in sediment cores from stations 8, 10, 13, 15 and 18 (Figure 1). The concentration profiles of Hg in the cores with elevated concentrations are shown in Figure 13. The greatest concentration was found between 8 and 18 cm sediment depth in a core collected 25 cm offshore at station 15, and at 2-4 cm sediment depth in a core collected 25 m offshore at station 18. The concentration of Hg was 28.00-43.00 µg/g at 0-11 cm sediment depth in a core collected at station 13, and 35.00 µg/g at 18-24 cm sediment depth in a core collected at station 16 during the survey in 1985. Dating of a core

obtained in 1985 from station 16 indicated that about 18 cm of sediment is at most about 30 years old, and that about 13 cm of the sediment were deposited less than ten years ago in this area of the river (S.R. Joshi, National Water Research Institute, Burlington, Ontario, unpublished data). According to these data, the input of Hg to the river between stations 13 and 18 existed in the past ten years and contaminated sediments have been transported downstream from the source.

In the past studies, the greatest concentrations of Hg and organic matter were found in the fine-grained sediments of the Great Lakes (Thomas, 1972; Thomas and Jacquet, 1976). The sediment in cores collected from the St. Clair River consisted of about 75-95% sand. The particle size distribution of selected subsamples from a core collected 25 m offshore at stations 10, 13, 15 and 18 is shown in Table 2. Two of the subsamples from station 15 (6-8 cm and 12-14 cm) separated into different size fractions were used for the determination of the concentration of Hg in individual fractions. Concentrations of Hg up to 16 µg/g were found in the sand-size fraction (>0.063 mm) (Table 3). Up to 87% of sediment particles were in this size fraction. The specific gravity of the particles was 2.53-2.54.

The concentration of Hg was 17.8 µg/g in the silt-size fraction (<0.063 mm), which consisted of 60% of coarse silt (0.032-0.063 mm) and 17% clay-size particles (<0.004 mm). The rest of the particles were fine- and medium-size silt. The specific gravity of sediment in this size fraction was 2.30.

The concentrations of major elements, organic matter and Hg in different sediment size fractions from 12-14 cm depth at station 15 are shown in Table 4. Generally, the concentrations of Ca, present mainly as calcite, were greater than those found in the Lake St. Clair sediments. The smallest size fraction (<0.063 mm) contained some clay minerals (chlorite, kaolinite and illite). Silica, dolomite and feldspar were abundant in all size fractions. There was no relationship between the concentration of organic matter and Hg, and between Hg and SiO_2 in individual size fractions (linear correlation coefficient r^2 0.52 and -0.69, respectively). A relationship between Hg and K, Ca, Mg, Fe, Ti and Al (linear correlation coefficient r^2 0.92, 0.80, 0.71, 0.70, 0.68 and 0.62, respectively) suggested that Hg was associated with grains of different mineralogical composition.

Chenal Ecarte

The concentration of Hg in sediment core collected from station 3 in Chenal Ecarte (Figure 1) was <0.30 µg/g. However, the concentrations of Hg in the sediment cores from sampling stations 1, 2 and 4 were up to 3.715 µg/g in the surface 4 cm and decreased towards the bottom of the cores (Figure 14). The water depth at station 3 was about twofold (10 m) of that at stations 1, 2 and 4. The sediment in all four cores consisted mainly of sand-size particles (Table 5). The greatest concentration of Hg was found in the 0.350 mm particle size fraction (Table 3). This size fraction consisted of many small pieces

of decaying wood and contained the greates concentration of organic matter. A good relationship existed between the concentrations of Hg and organic matter in the sediment from Chenal Ecarte (Table 6).

The concentration profile of Hg at the mouth of a branch of Chenal Ecarte, Johnson Bay, had a similar pattern to that in Lake St. Clair sediments, i.e. a small increase below the sediment surface followed by a decrease to about 13 cm sediment depth where it reached the background level of about 0.060 µg/g Hg (Figure 15).

SUMMARY

1. Sediment cores were collected in Lake St. Clair in 1985 and in the St. Clair River in 1986 to investigate the horizontal and vertical distribution of Hg in the sediments. The geochemistry and mineralogy of the sediments were determined to assess the association of Hg with sediment components.
2. The pattern of thickness of recent sediment accumulated over the underlying glacial-lacustrine deposits conformed closely to the bathymetry of Lake St. Clair. The greatest accumulation of recent sediment (about 35 cm) was found in the deepest part of the lake. Geochemical composition and texture differentiated the recent from the glacial-lacustrine sediments.
3. The distribution of Hg in surficial sediment in Lake St. Clair was similar to that found in 1983. The concentration of Hg decreased from that determined during the survey in 1974.

However, the concentration of Hg was greater (up to 1.20 µg/g) in the surface than in the deeper layers of the recent sediment. The concentration profiles of Hg suggest a continuous anthropogenic input to the lake.

4. Sediments collected from the nearshore area near Sarnia in the St. Clair River in 1986 consisted mainly of sand and gravel and contained up to 8.30 µg/g Hg. The concentration of Hg was determined in different particle size fractions of the sediment from selected stations. Up to 16.00 µg/g Hg was found in the fraction containing 0.350 mm large particles (i.e. sand). No relationship was found between the concentration of Hg and organic matter or SiO_2 in the river sediment. A good relationship between the concentration of Hg and some major elements (K, Ca, Mg, Ti, Fe and Al) indicated an association of Hg with particles of different mineralogical composition.

5. The concentration of Hg was up to 3.72 µg/g in the surface sediment in Chenal Ecarte, consisting mainly of sand-size particles. The greatest concentration of Hg was found in the 0.350 mm size particles. A good relationship was found between the concentration of Hg and organic matter in sediment from this area.

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TABLE 1 Range of concentrations of major elements in the surface and glacial-lacustrine sediments in Lake St. Clair.

	Surface %	Glacial Lacustrine %
SiO_2	62.1 - 77.2	64.0 - 67.4
Al_2O_3	7.1 - 12.0	13.3 - 14.7
Fe_2O_3	2.68 - 5.23	5.70 - 6.40
MgO	1.70 - 6.29	3.61 - 4.64
CaO	6.48 - 12.86	3.79 - 3.94
Na_2O	0.52 - 1.35	0.80 - 0.84
K_2O	2.27 - 3.48	4.21 - 4.28
TiO_2	0.31 - 0.65	0.80 - 0.83
MnO	0.05 - 0.09	0.07 - 0.09
P_2O_5	0.17 - 0.28	0.17 - 0.18

TABLE 2 **Particle size distribution in sediment cores from the St. Clair River.**

		Grain Size % Station 15 25 m[1]				
mm	PHI	6-8 cm	8-10 cm	10-12 cm	12-14 cm	14-16 cm
1.000	0	0.19	0.16	0.18	0.10	0.11
0.710	0.5	0.14	0.14	0.10	0.29	0.24
0.500	1	0.60	1.46	0.28	1.91	1.42
0.350	1.5	1.59	2.07	0.96	2.36	2.13
0.250	2	2.43	3.15	2.33	3.24	3.07
0.177	2.5	9.80	8.31	6.38	7.96	7.64
0.125	3	26.17	24.72	20.92	20.00	23.50
0.088	3.5	30.68	27.38	28.97	24.01	27.80
0.063	4	15.39	12.97	15.20	14.47	16.50
<0.063	<4	12.98	19.63	25.17	25.64	17.59

		Grain Size % Station 10		Station 13 25 m[1]		Station 18 25 m[1]
		25m[1]	50m[2]			
mm	PHI	4-6 cm	4-6 cm	2-4 cm	6-8 cm	2-4 cm
4.000	-2	40.78	37.87	72.54	35.37	12.56
2.830	-1.5	7.45	8.68	6.39	15.47	3.15
2.000	-1	4.14	5.86	3.31	9.71	2.39
1.410	-0.5	2.44	3.93	2.08	9.48	2.50
1.000	0	1.48	2.12	1.06	5.00	1.47
0.710	0.5	1.59	1.57	1.26	3.42	1.04
0.500	1	1.70	2.51	1.63	4.00	1.86
0.350	1.5	2.12	3.39	2.07	4.03	3.07
0.250	2	4.51	4.87	2.79	4.73	7.08
0.177	2.5	8.16	15.36	2.41	3.95	17.70
0.125	3	16.27	6.98	1.89	2.63	27.55
0.088	3.5	6.59	2.02	1.00	0.37	11.85
0.063	4	1.94	1.57	0.58	0.88	4.24
<0.063	>4	0.83	3.27	0.99	0.97	3.54

[1]25 m = sediment core collected 25 m offshore.
[2]50 m = sediment core collected 50 m offshore.

TABLE 3 Concentrations of Hg in different particle size fractions in sediments from St. Clair River, station 15 (25 m offshore), and Chenal Ecarte, station 1. (µg/g dry weight)

Particle Size mm	Particle Size PHI	Station 15 (6-8 cm depth)	Station 15 (12-14 cm depth)	Chenal Ecarte Station 1 (2-4 cm depth)
0.350	1.5	11.81	16.00	13.15
0.250	2.0	10.25	8.05	n.s.
0.177	2.5	5.91	5.52	4.35
0.125	3.0	5.05	8.00	1.50
0.088	3.5	5.92	7.40	1.10
0.063	4.0	7.01	8.03	0.86
<0.063	>4.0	17.80	17.80	5.30

n.s. = no sample for analyses.

TABLE 4 Concentrations of major elements, organic matter and Hg in different sediment size fractions from the St. Clair River, station 15 (25 m offshore): 12-14 cm depth.

Parameter	Size Fraction mm (PHI)[1]						
	0.350 (1.5)	0.250 (2.0)	0.177 (2.5)	0.125 (3.0)	0.088 (3.5)	0.063 (4.0)	<0.063 (>4.0)
SiO_2 (%)[2]	61.4		83.2	78.7	77.6	66.7	52.1
Al_2O_3	5.5		6.1	6.3	6.4	6.4	6.8
Fe_2O_3	8.9		5.6	4.4	5.1	7.4	9.9
MgO	3.3		2.4	2.8	3.4	4.6	4.7
CaO	13.2		8.6	11.3	12.0	14.5	16.6
Na_2O	0.91		1.36	1.53	1.53	1.29	0.93
K_2O	1.65		1.34	1.54	1.51	1.47	1.90
TiO_2	0.50		0.30	0.23	0.30	0.46	0.57
MnO	0.06		0.05	0.06	0.05	0.05	0.06
P_2O_5	0.06		0.04	0.04	0.04	0.05	0.08
Org. matter	5.05	5.33	2.65	1.85	1.75	1.95	3.77
Hg (µg/g)	16.00	8.05	5.52	8.00	7.40	8.03	17.80

[1]There was not sufficient quantity of material for analysis in size fractions >0.350 mm (<1.5 PHI).
[2]Because a small sample size first two size fractions were combined for the determination of major elements.

TABLE 5 Particle size distribution in sediment core from the Chenal Ecarte, Station 1.

		Grain Size %			
	Station:	1	2	2	4
mm	PHI	2-4 cm	2-4 cm	14-16 cm	6-8 cm
1.000	0	0.00	0.05	0.02	0.06
0.710	0.5	0.00	0.12	0.05	0.19
0.500	1	1.06	0.52	0.14	0.75
0.350	1.5	1.48	0.84	0.45	1.86
0.250	2	2.30	1.75	0.55	4.59
0.177	2.5	14.77	13.98	5.77	46.68
0.125	3	37.87	38.82	51.10	9.63
0.088	3.5	29.45	29.43	33.63	28.61
0.063	4	8.21	7.99	6.07	3.67
<0.063	>4	4.85	6.51	2.23	3.95

TABLE 6 Concentrations of Hg and organic matter in sediment from Chenal Ecarte, Station 1 (2-4 cm depth).

Particle Size		Hg	Organic Matter
mm	PHI	(µg/g dry weight)	(% dry weight)
0.350	1.5	13.15	43.67
0.250	2.0	n.s.	n.s.
0.177	2.5	4.35	3.71
0.125	3.0	1.50	1.27
0.088	3.5	1.10	1.08
0.063	4.0	0.86	1.22
<0.063	>4.0	5.30	4.22

Linear correlation coefficient r^2 (Hg/organic matter) = 0.95
n.s. = no sample for analyses.

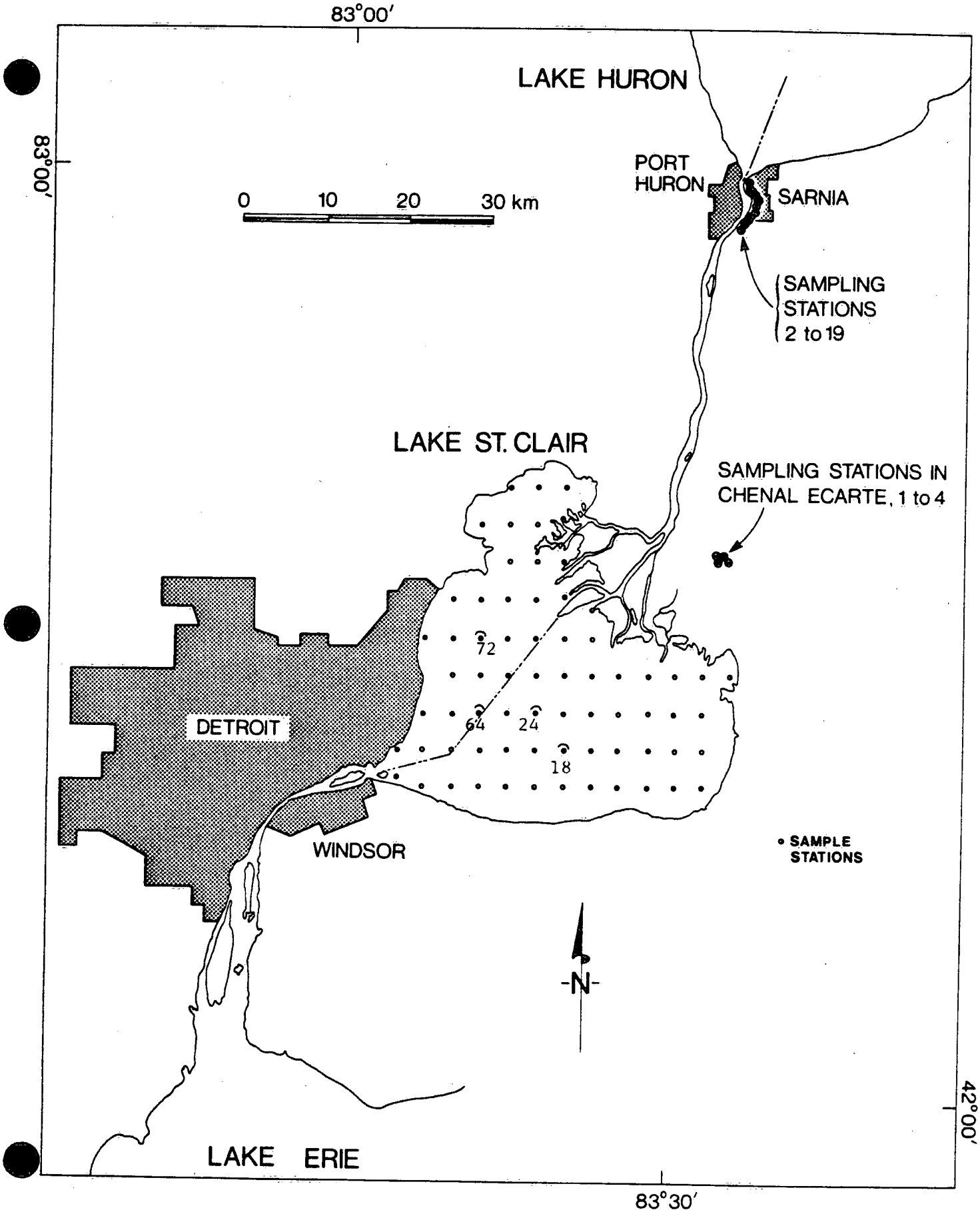

FIGURE 1. Sediment sampling stations.

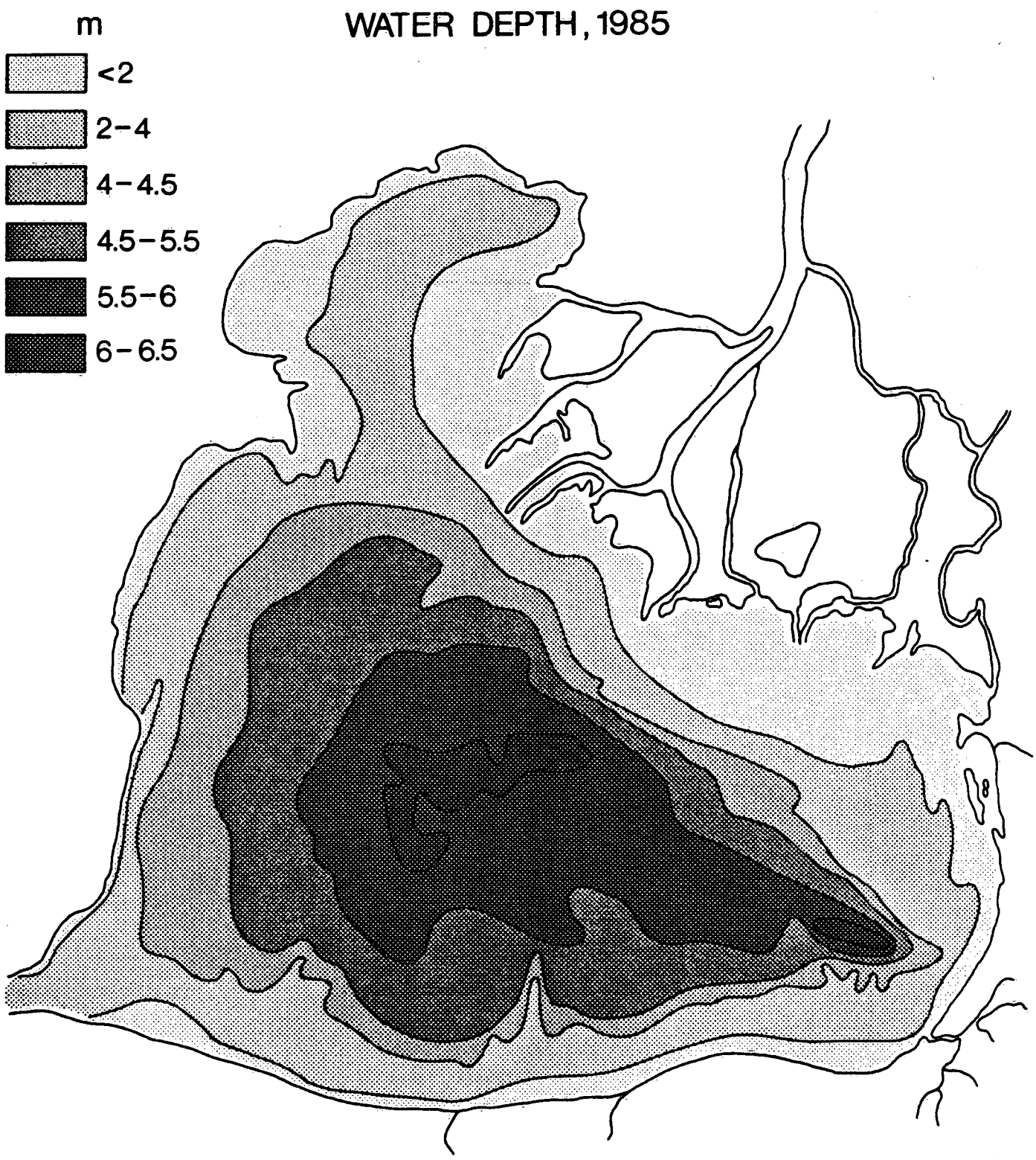

FIGURE 2. Water depth, Lake St.Clair, June-August 1985.

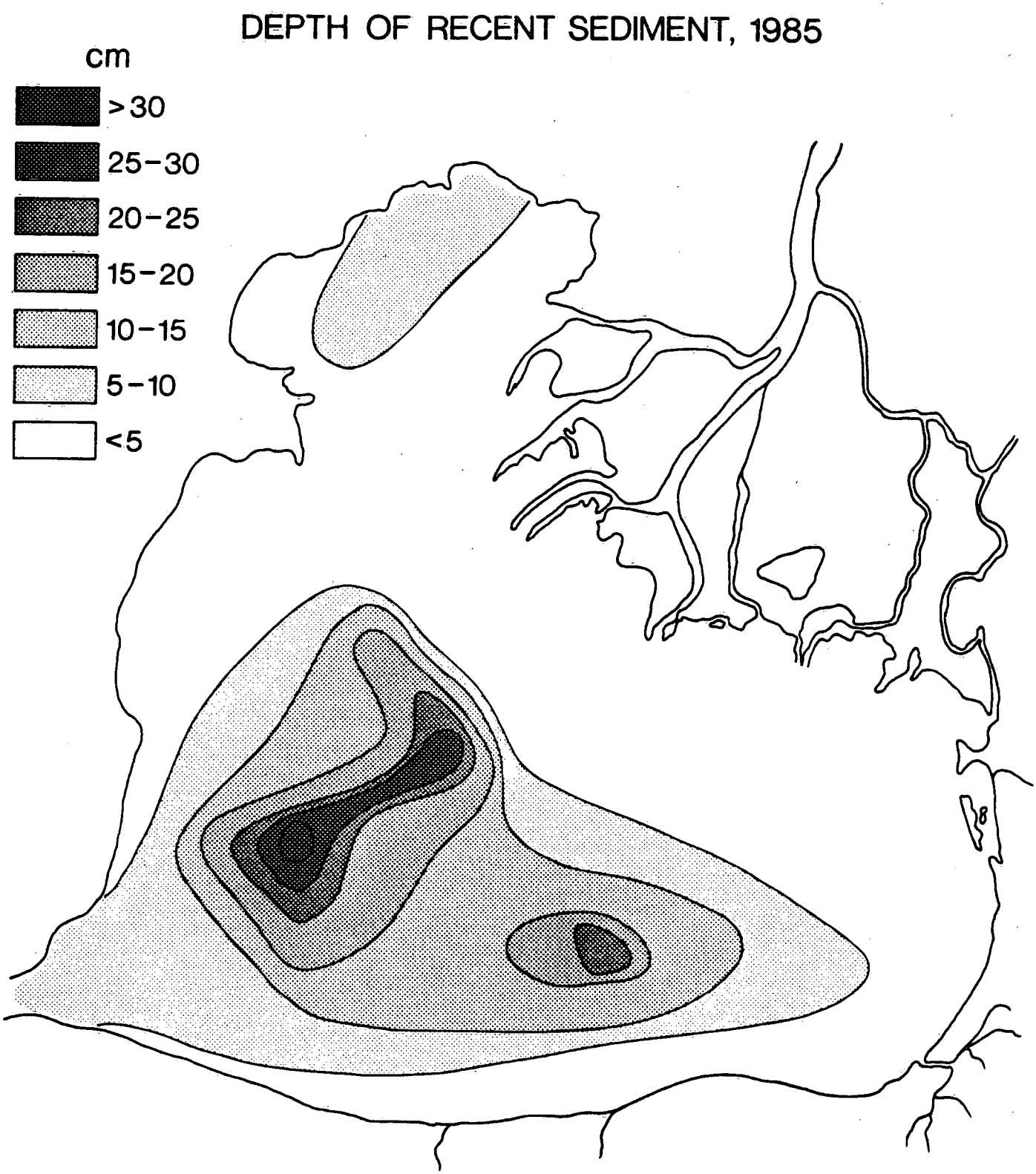

FIGURE 3. Recent sediment thickness, Lake St.Clair, June-August 1985.

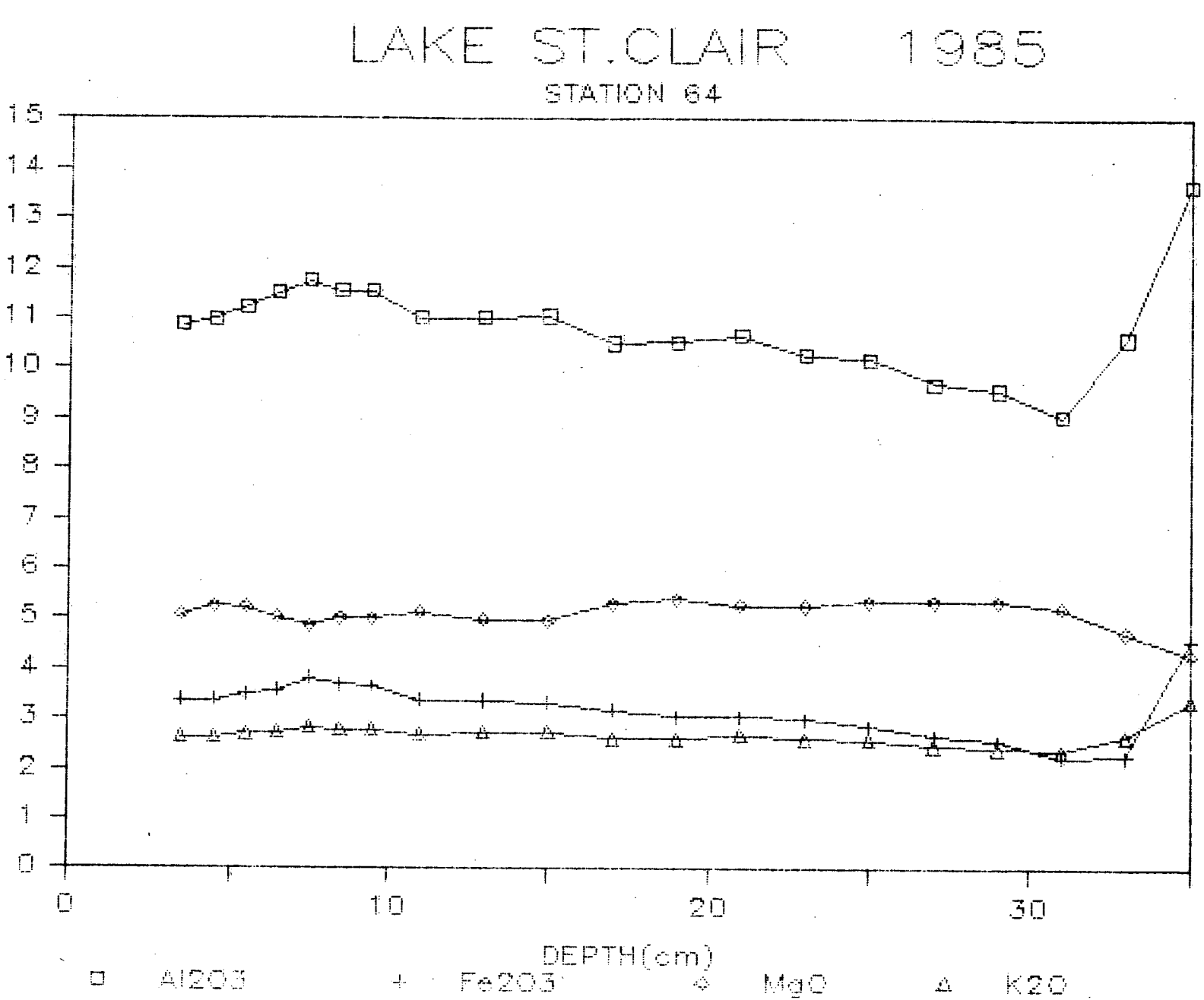

FIGURE 4. Concentration profiles of Al, Fe, Mg and K in sediment at station 64, Lake St.Clair.

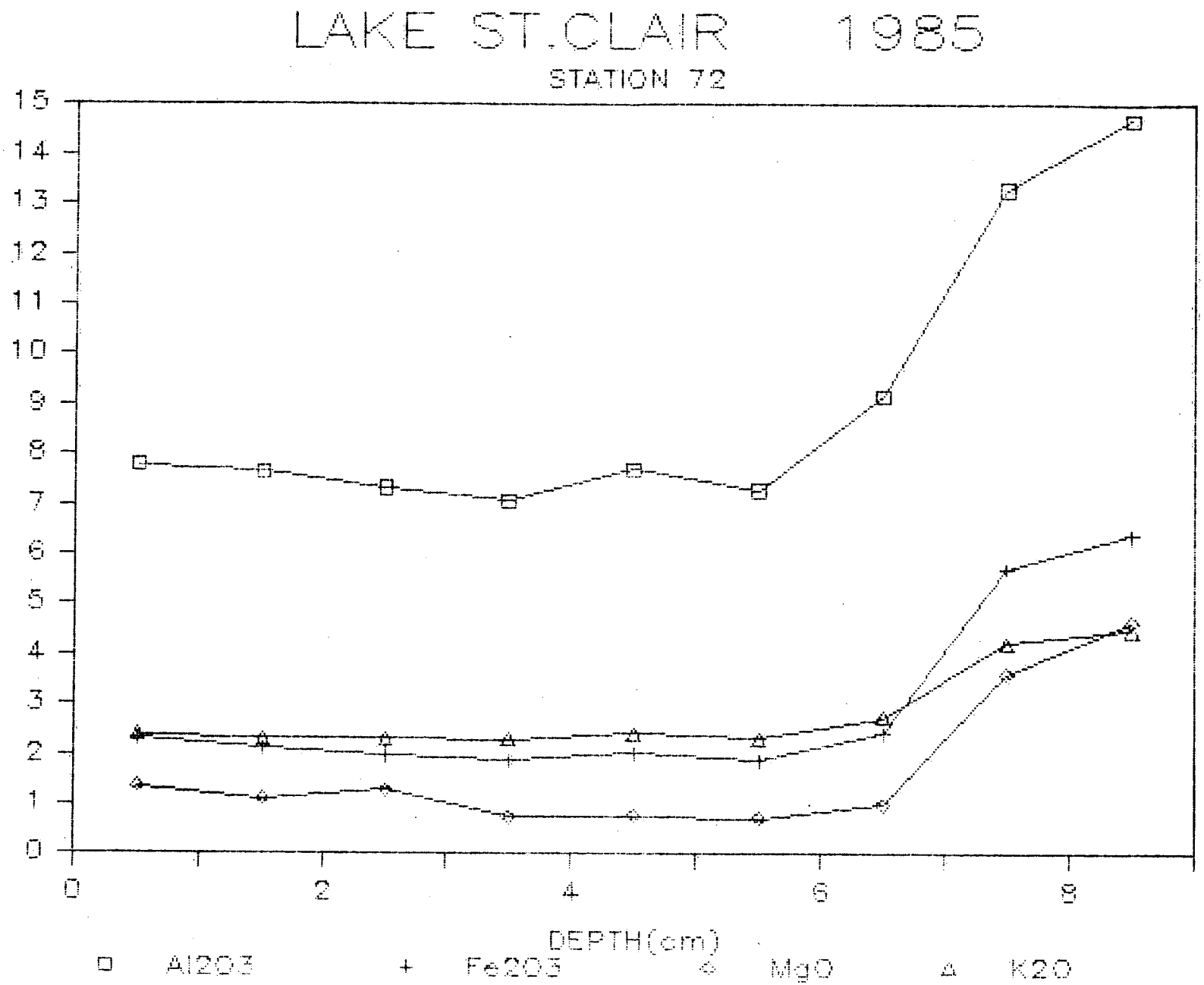

FIGURE 5. Concentration profiles of Al, Fe, Mg and K in sediment at station 72, Lake St.Clair.

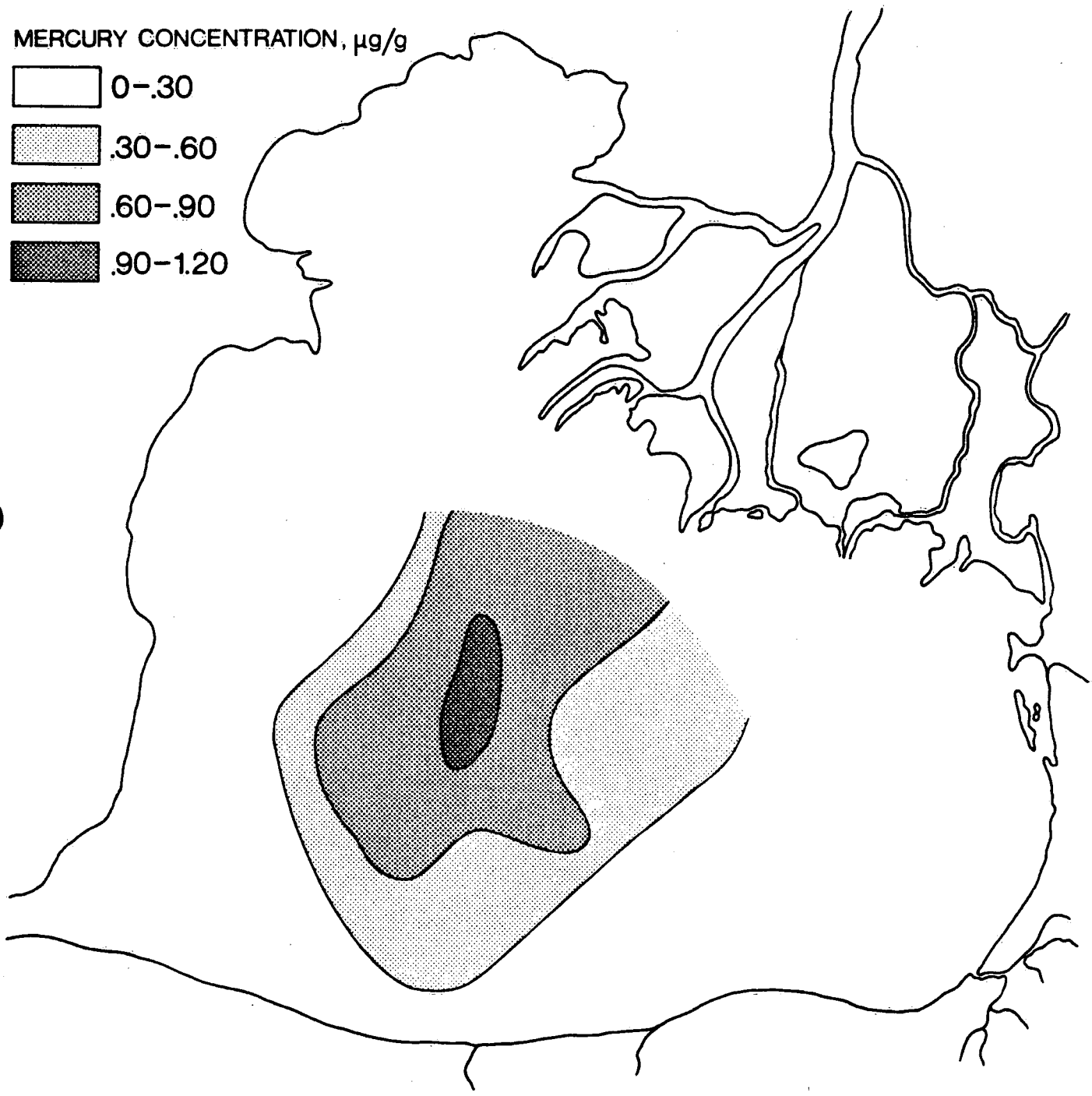

FIGURE 6. Distribution of Hg in the surface sediment of Lake St.Clair, 1985.

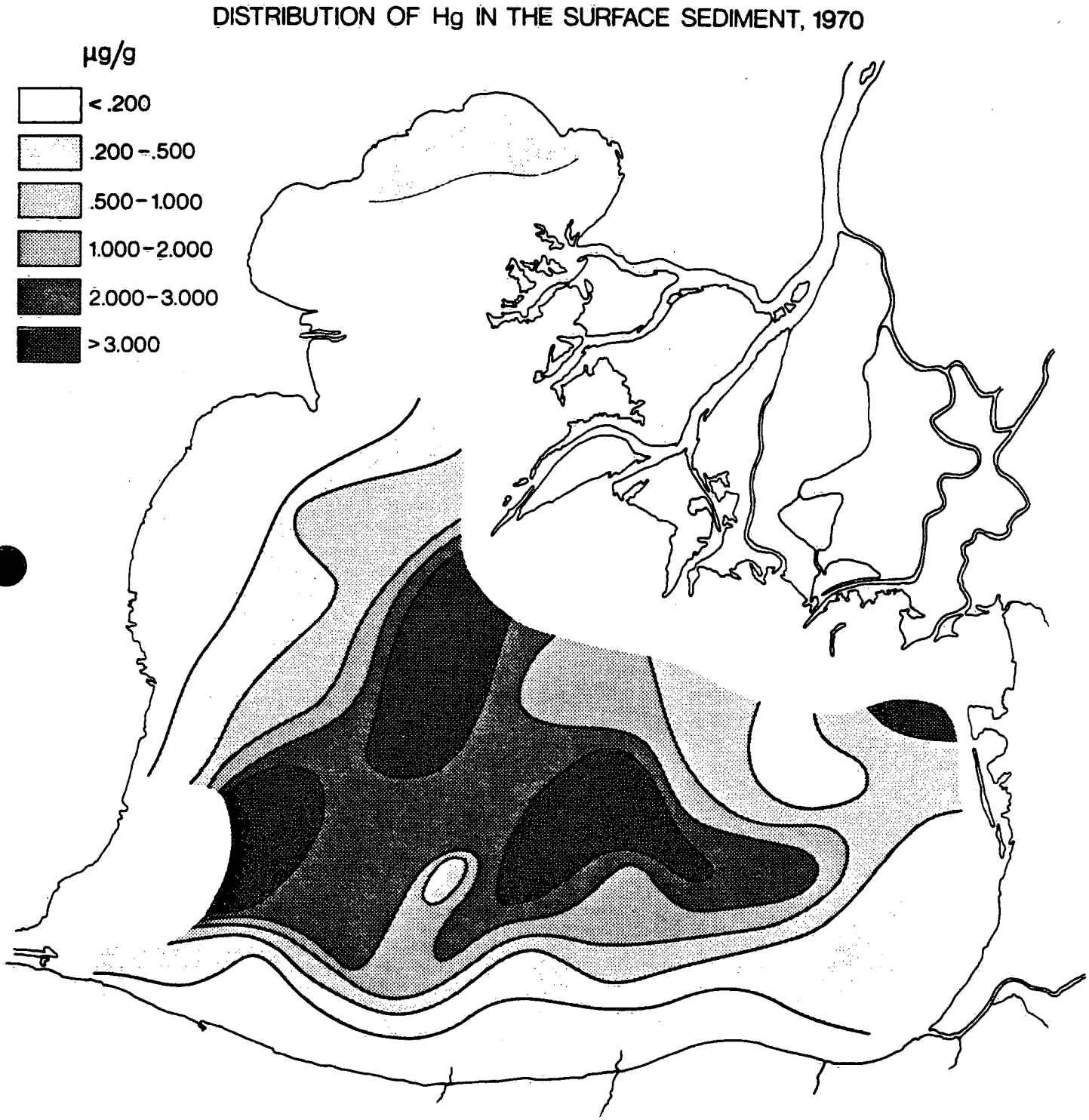

FIGURE 7. Distribution of Hg in the surface sediment of Lake St.Clair, 1970. (After Thomas et. al., 1975)

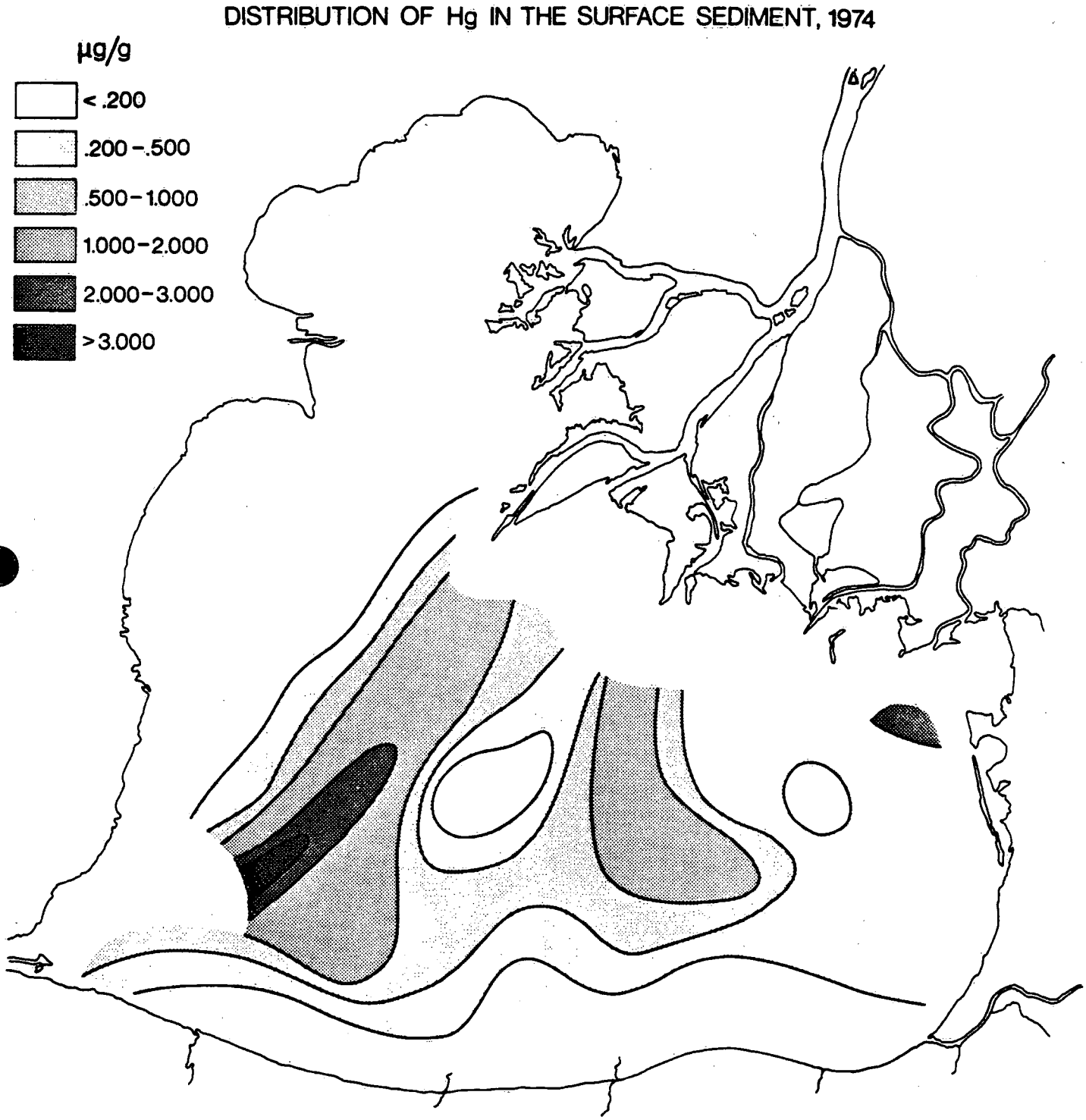

FIGURE 8. Distribution of Hg in the surface sediment of Lake St.Clair, 1974. (After Thomas et. al., 1975)

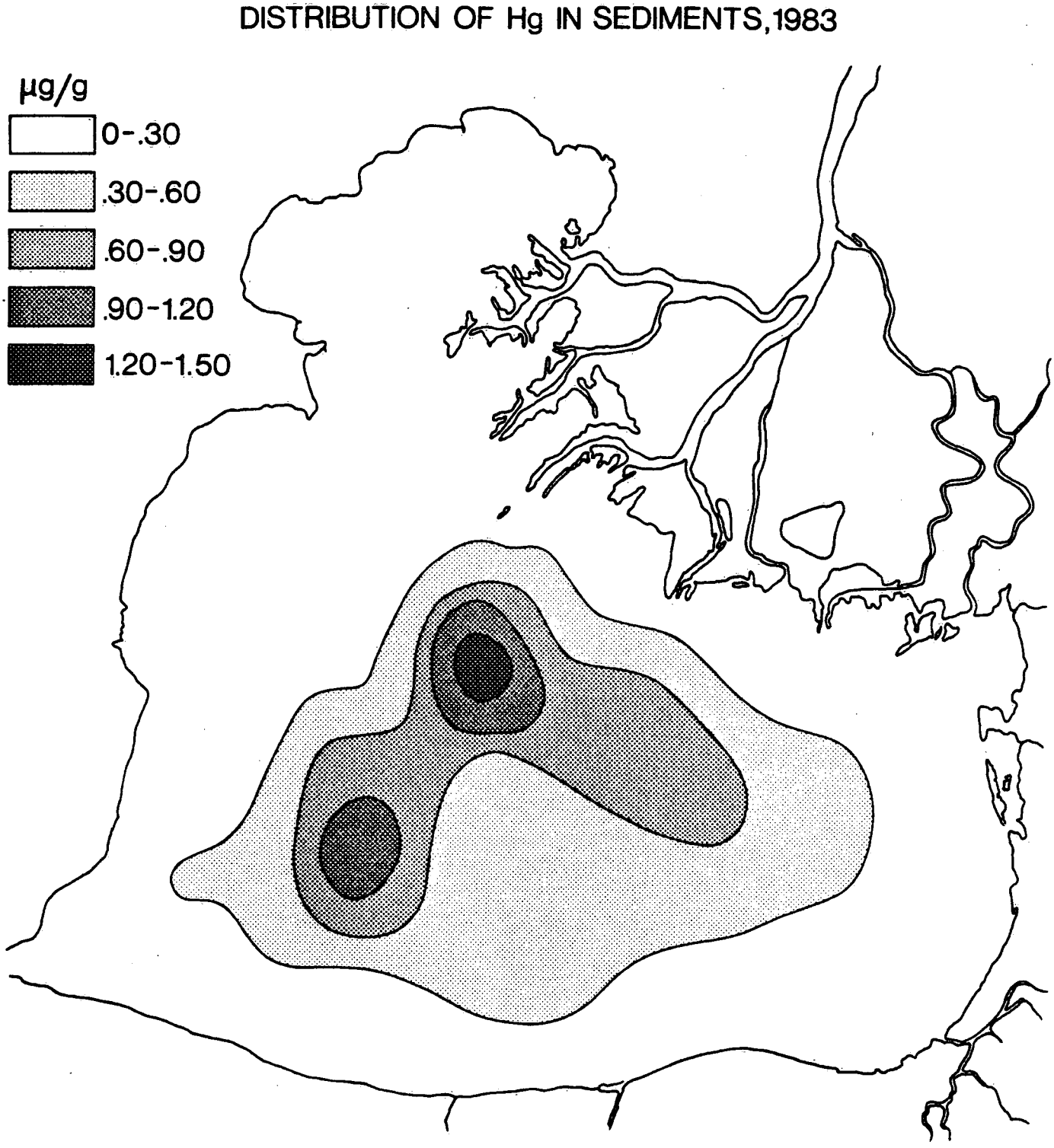

FIGURE 9. Distribution of Hg in the surface sediment of Lake St.Clair, 1983. (The Ontario Ministry of the Environment)

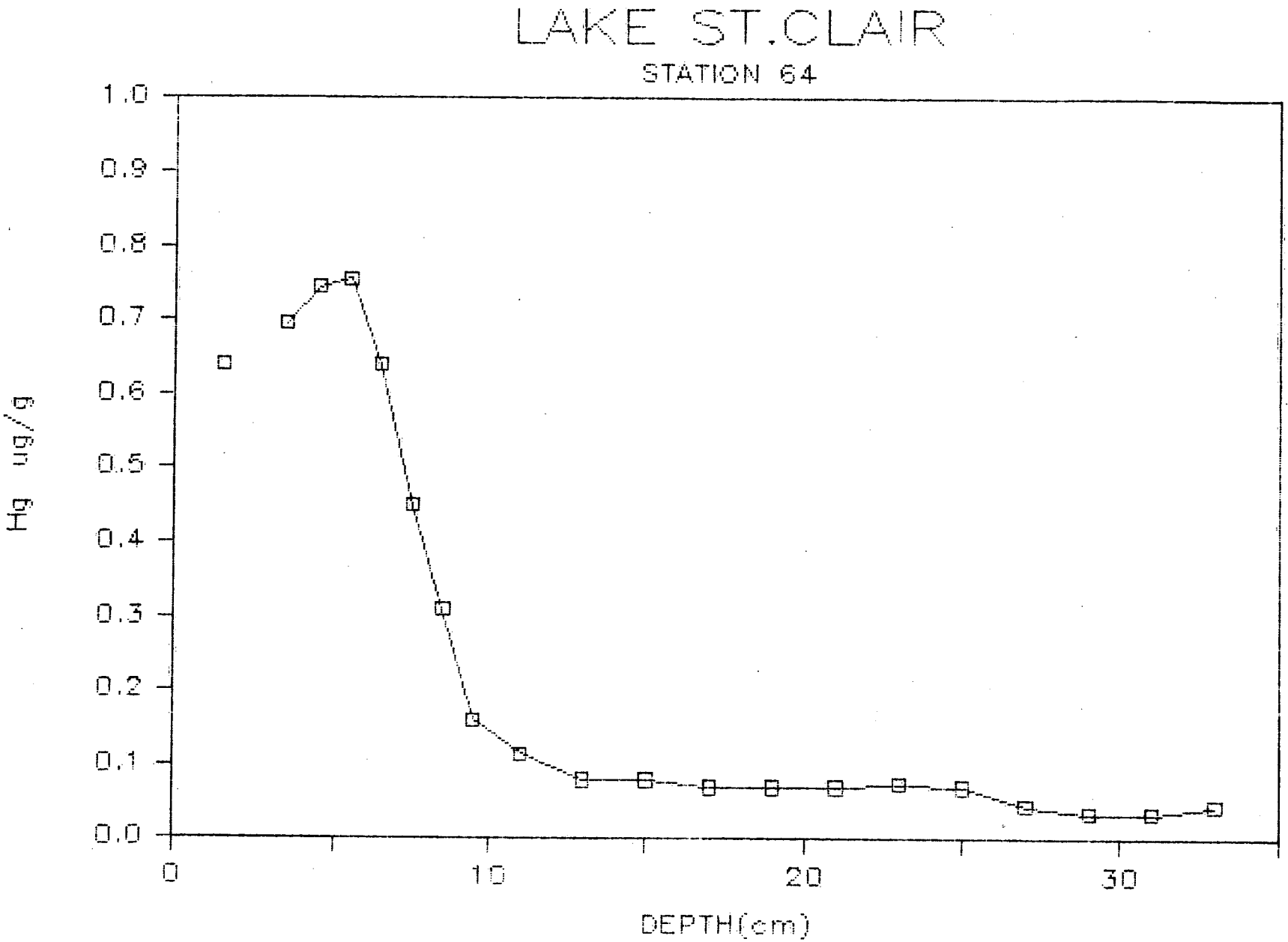

FIGURE 10. Concentration profile of Hg in sediment at station 64, Lake St.Clair, 1985.

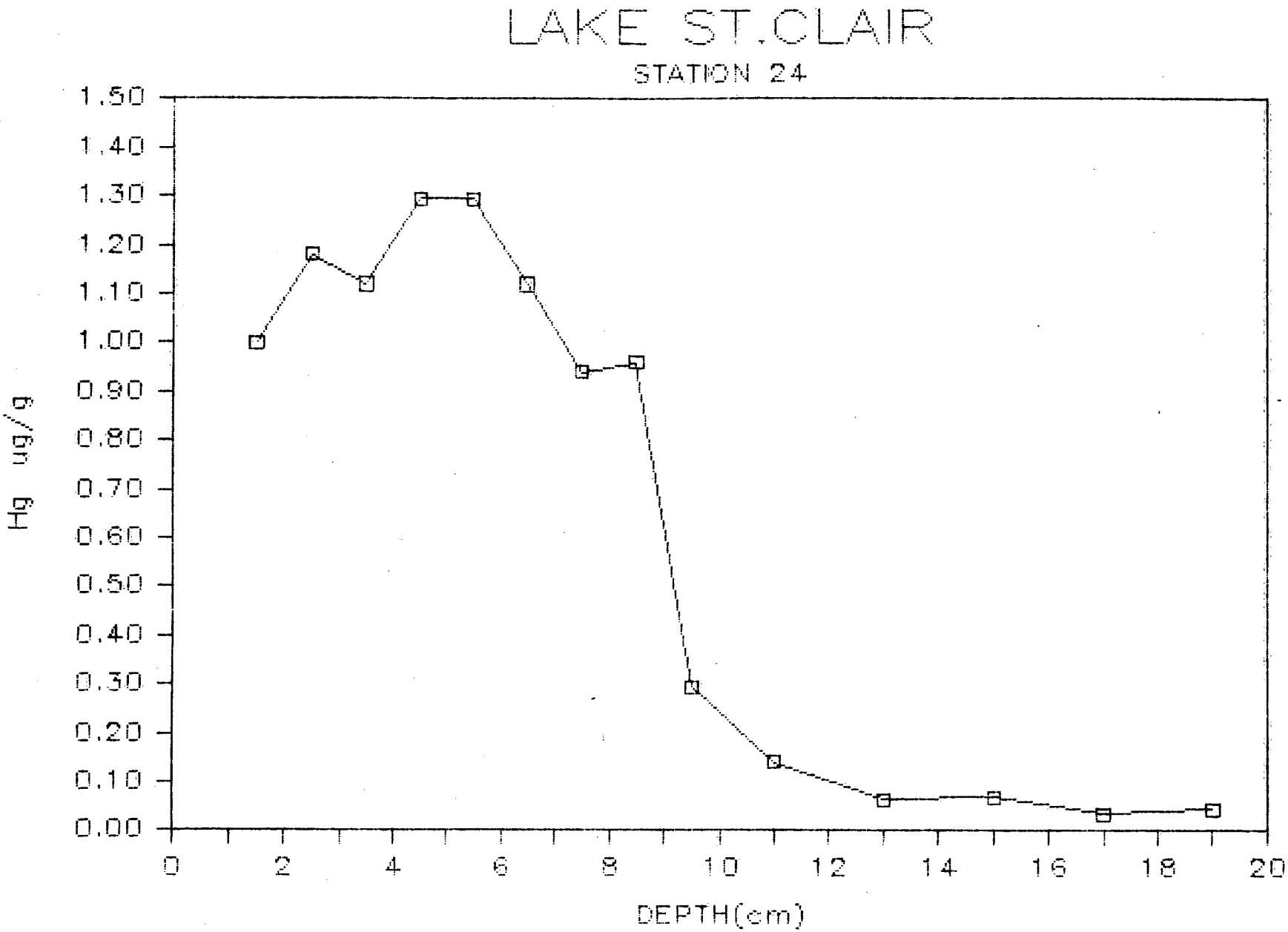

FIGURE 11. Concentration profile of Hg in sediment at station 24, Lake St.Clair, 1985.

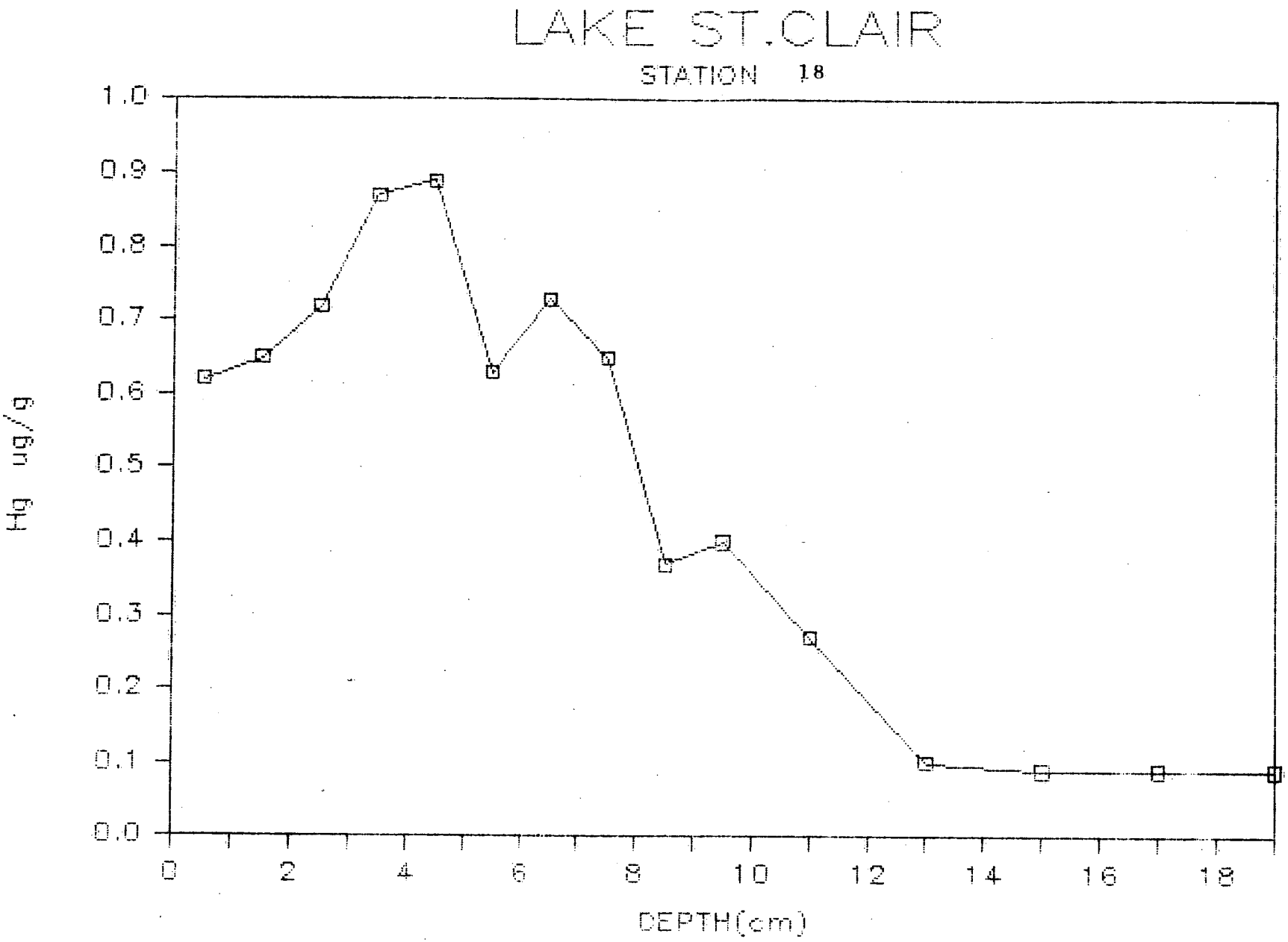

FIGURE 12. Concentration profile of Hg in sediment at station 18, Lake St.Clair, 1985.

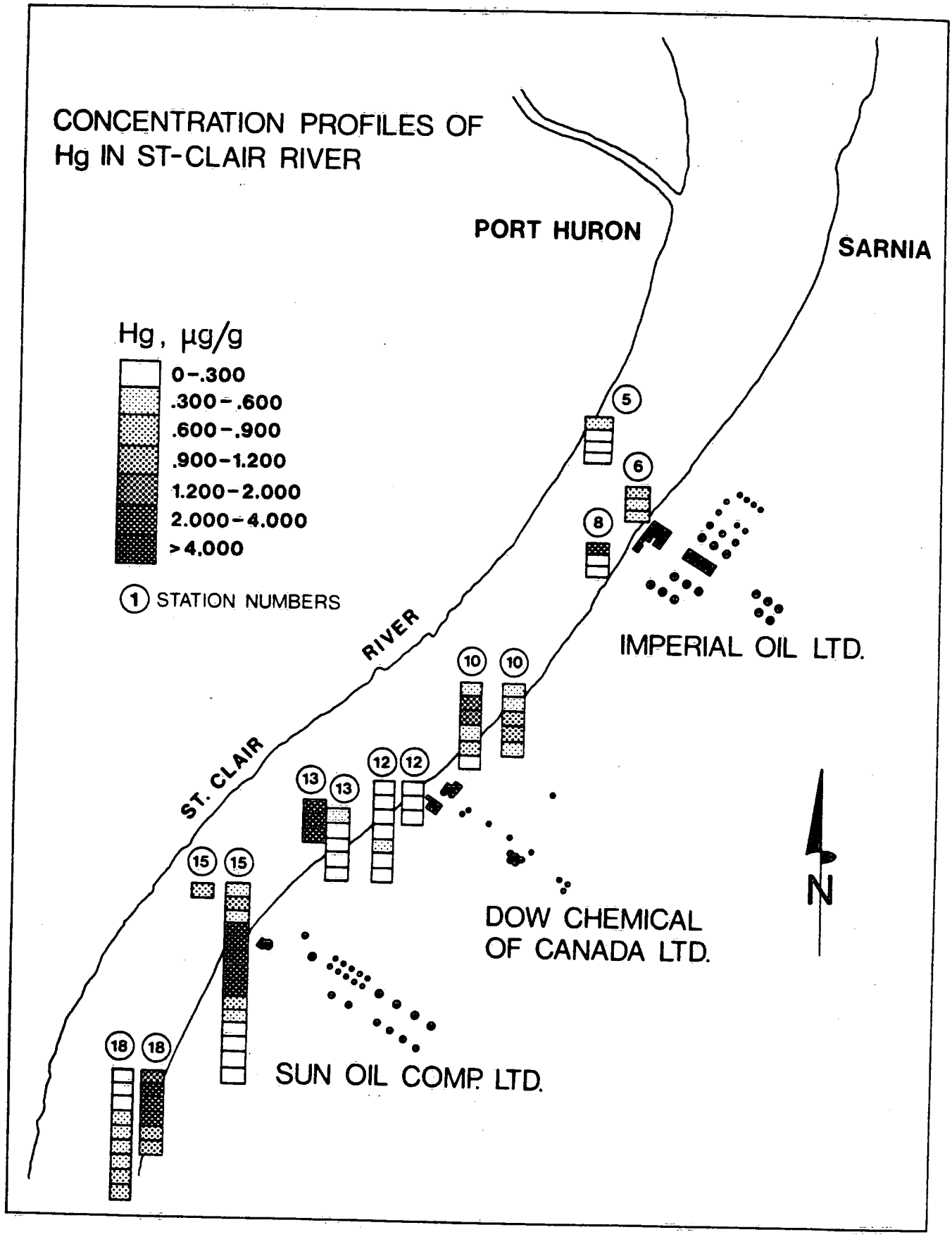

FIGURE 13. Concentration profiles of Hg in sediments from St.Clair River, 1986.

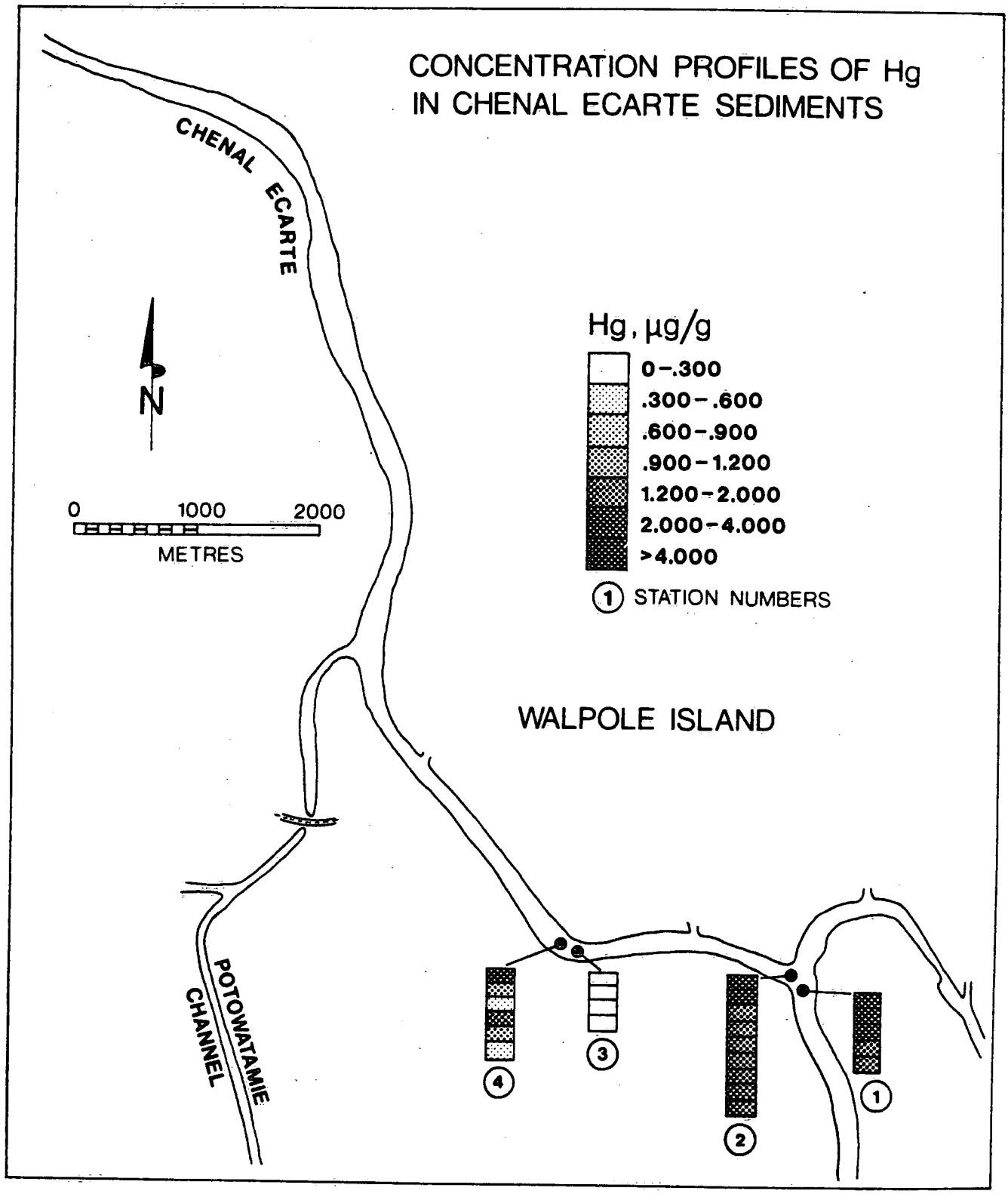

FIGURE 14. Concentration profiles of Hg in sediments from Chenal Ecarte, 1986.

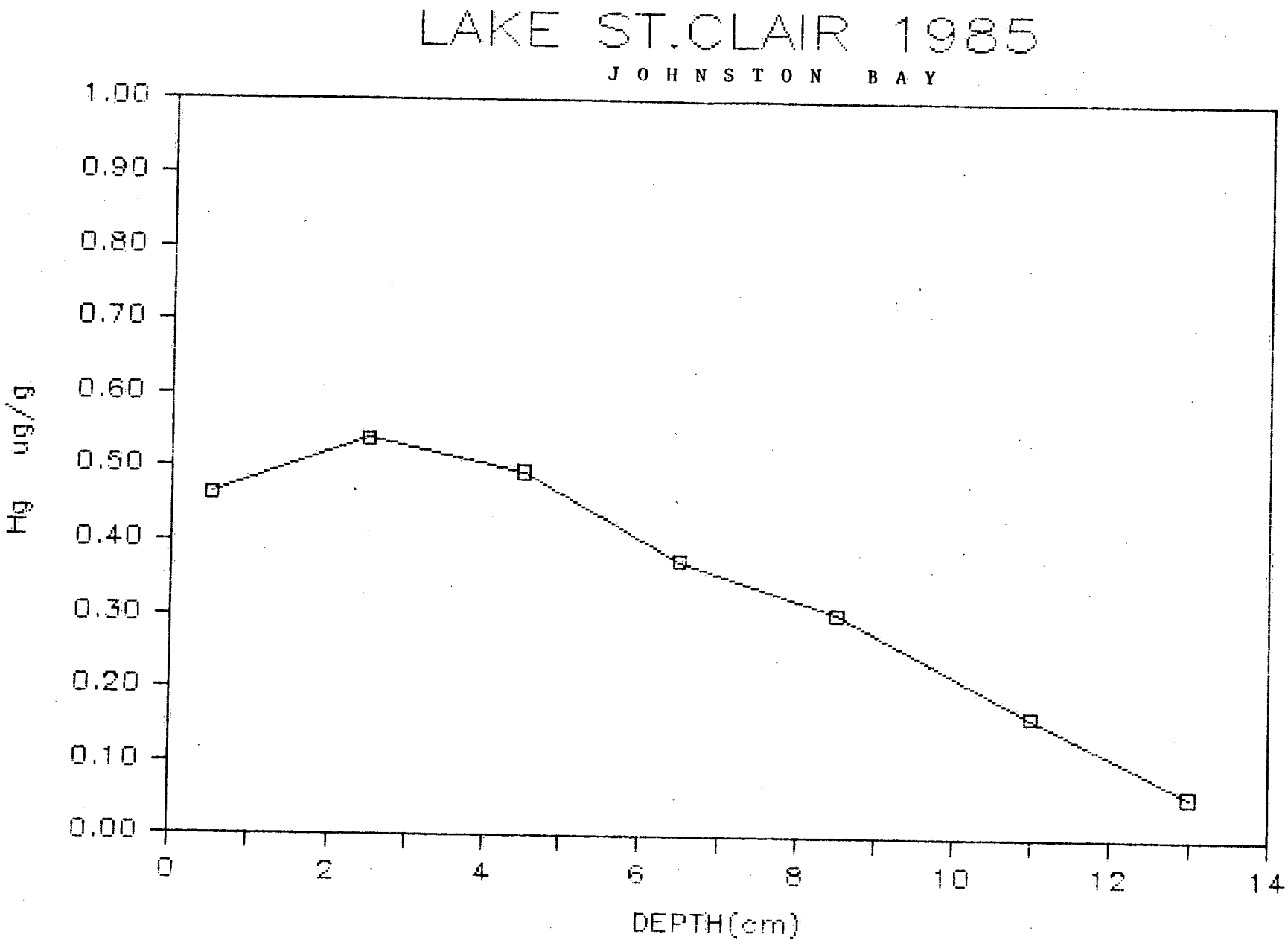

FIGURE 15. Concentration profile of Hg in sediment from Johnston Bay.