Regional Geochemistry of Metals in Organic-Rich Sediments, Sawgrass and Surface Water, from Taylor Slough, Florida

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SUMMARY

We report progress on the task "Processes in Organic-Rich Sediments of South Florida—Mercury and Metals", part of the USGS-cooperative "Aquatic Cycling of Mercury in the Everglades" (ACME) project. Objectives of the task include: (1) definition of mercury and other element spatial concentration patterns and baselines, (2) definition of historical Hg and other element concentration trends in organic-rich sediments, and (3) development of an understanding of element uptake in sawgrass as it relates to element bioavailability in organic-rich sediments. The report focuses on work in Taylor Slough, Everglades National Park, because it is both the terminus of surface water flow for the eastern side of the Everglades and the main source of fresh water to the hyposaline eastern Florida Bay.

Surface water, sawgrass leaf and root material, and cores of organic-rich sediments were collected in 1996 at eight sites within Taylor Slough along a predominantly north/south trend. The upper-most site was near the canal water discharge gate to the Slough and the lower two sites were within several km of Florida Bay. All samples were collected, preserved, transported and analyzed for mercury and other elements using accepted USGS QA/QC procedures and protocols.

We present element concentration data for over thirty elements in the water, plant, and sediment samples collected. In addition to the cores used for element analysis, additional cores were collected at each site and used for nutrient and sulfur species studies, peat diagenesis studies, and geochronology (dating) determinations using ^{210}Pb. The core dates and dry bulk density data were used to calculate sediment accumulation rates which were in turn used, in conjunction with the element concentration data, to calculate element accumulation rates (EAR).

Very little variation in element concentration among cores was noted for the major elements. Several cores had higher Ca concentrations near the sediment surface which is attributed to localized biogenic marl accumulations. In addition, concentrations of Al and Fe in some cores increased with depth. In contrast, the concentration of minor (trace) elements did present much greater regional and down-core variability. Our data, however, do not show strong near-surface trace element enrichment. This is in contrast to trends reported in the literature further north in the Water Conservation Areas (WCA). Only Pb and Zn show some enrichment in the top 10-15 cm for cores TS2, TS7E, TS9, and TS15. However, these elements, as well as Cu and Ni, often show an increase in concentration below about 30 cm. Our data, for the concentration of environmentally important trace elements in organic-rich sediments, when compared with more mineral-rich soils from throughout Florida, show levels that are about two- to eight-times greater.

Except for core TS15 (and possibly TS2) no strong pattern of higher total Hg concentration near the sediment surface was noted (~0.1-0.2 ppm). This tendency for Taylor Slough is contrary to trends reported for sediments in WCA further north where values as high as 0.41 ppm have been reported in the top 10 cm of similar sediments. The total Hg concentrations for all core sediments that we report (0.03-0.26 ppm) are , in general, two-to-three times less than those reported in WCA. For the five cores examined, our calculated Hg EAR's showed an increase between about 8 and 12 cm in depth. Depending on the core, the depths corresponded to sediment ages from about 20 years to about 60-180 years. In contrast, the sediments in WCA have shown a general decrease in EAR with depth. Our highest EAR values (>200 μg m^{-2} yr^{-1}) were found in the core from site 1 (TS1), the site furthest north in the Slough, and were fairly uniform with depth. These values directly reflect high sediment accumulation rates and not high total Hg concentrations. These EAR values (~200 to ~320 μg g m^{-2} yr^{-1}) are several-

times greater than those found in post-1985 core material from WCA (23-141 $\mu g\ g\ m^{-2}\ yr^{-1}$). Progressing south in the Slough the EAR values for the cores decrease and the range of values for TS15 (furthest south) are ~2.2-10.

Sulfur concentrations and speciation were determined in sediments and pore water and are only peripherally discussed in this report. Sulfur is found to possibly influence the metal distributions in sediments. The environment of Taylor Slough ranges from a freshwater, low sulfate environment in the north, to a brackish water, high sulfate environment in the south. Metals showed generally poor correlations with total sulfur content in the freshwater areas whereas several metals (Ni, Cr, Fe, and Cu) showed reasonably strong correlations ($R^2 = 0.8$ or higher) in the brackish water zone. Correlation is not a proof of a mechanism, but does provide an indication that sulfur may play a role on metal distributions in sediments, especially in the southern part of the slough.

The uptake of elements from sediment by sawgrass (element bioavailability) was evaluated using enrichment factors (EF) normalized to Al. Except for Fe, the EF values in root tissue were lower than in leaf tissue. This difference reflects the greater concentration of most elements in root tissue relative to leaf tissue. The high EF values in general indicate that sawgrass tissue has a tendency to accumulate elements relative to the substrate within which it is growing. Because the sediment material is primarily decomposed sawgrass, the metals are being remobilized from dead tissue to living tissue. Further, the high EF values may indicate a physiological compensation mechanism that allows for element uptake and accumulation by sawgrass in the low nutrient sediments that are characteristic of the Everglades peat lands. Many elements (Hg, Mg, Na, and Zn) show strong decreasing north/south EF trends.

All total Hg analyses in surface water were below the 0.2 $\mu g\ L^{-1}$ detection limit for the analytical method used. This detection limit is two orders of magnitude above the values commonly reported for surface water in the canals that feed WCA. The data for other major and trace elements in water are regionally uniform and do not show pronounced areal trends.

INTRODUCTION

This study was funded by the Integrated Natural Resources Science Program of the U.S. Geological Survey (USGS) to address the general issue of south Florida wetland ("Everglades"[1]) restoration. In 1995, as part of this effort, the USGS initiated the Aquatic Cycling of Mercury in the Everglades (ACME) project to evaluate Hg cycling processes (Krabbenhoft, 1996). A major goal of ACME is to determine fluxes, rates, and factors that affect Hg transport, cycling, and bioaccumulation. Work is conducted in close coordination with land management agencies such as the South Florida Water Management District (SFWMD), National Park Service (NPS), and U.S. Fish and Wildlife Service (FWS). Concern for the loss of wetland ecosystem (Everglades) integrity is the result of both elevated Hg levels (primarily methylmercury) in biota (especially high trophic level fish, alligators, and the endangered Florida panther) and changes in the major floristic composition of the region attributed to variations in nutrient levels in water (Loftus and Bass, 1992; Spalding and others, 1994; Sepulveda and others, 1995; DeBusk and others, 1994; Vaithiyanathan and Richardson, 1999).

Our task (Geochemical Processes in Organic-Rich Sediments of South Florida—Mercury and Metals) within the ACME project seeks to define the sources, distribution, and processes involved in the biogeochemical cycling of major and trace elements, including Hg. The task has three sub-elements: (1) studies of the distribution of inorganic major and trace elements (with an attempt to define generalized baseline levels), (2) definition of the historical variation of elements in cores, and (3) assessment of the relation of element bioavailability and cycling to sediment diagenesis (Gough and Kotra, 1996). An understanding of the relation between organic-rich sediments and the concentration and speciation of elements of environmental importance is essential for water quality planners in developing long-term remediation and management strategies for the South Florida wetlands (Orem, 1997;

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[1] Everglades, as used in this report, follows the general definition of Gleason and Stone (1994, p. 151), "the freshwater wetland occupying the contiguous basin aside but mostly south of Lake Okeechobee".

Hurley and others, 1998). For example, such information is critical for making informed decisions regarding the regulation of water levels and in the evaluation of the effectiveness of constructed wetlands for remediation of contaminated waters. This project's studies of the Taylor Slough portion of the Everglades system will provide a historical perspective of ecosystem conditions and variability.

This report focuses on studies conducted in the spring of 1996 in the Taylor Slough region of Everglades National Park (ENP, fig. 1). Taylor Slough, a natural watershed, extends north/south for about 27 km on the east side of ENP (Orem, 1997). A portion of the water that historically would flow in the Slough has been diverted into a major canal system (C-111, fig. 1). Nevertheless, the Slough is the primary source of freshwater to the shallow, and ecologically sensitive, eastern Florida Bay (McPherson and Halley, 1996). Users of these data are encouraged to contact the authors. Additional reports by the authors of these and other data are currently being prepared.

GENERAL REGIONAL INFORMATION

South Florida is an environmentally sensitive region of rapid population and economic growth with multiple, complex, and often competing land-use options (Davis and Odgen, 1994; McPherson and Halley, 1996). The sub-tropical Everglades aquatic ecosystem, that includes the South Florida Water Conservation Areas (WCA) 1, 2, and 3, Everglades National Park, and parts of Big Cypress National Preserve, depends on surface water "sheet flow" that originates in the Lake Okeechobee watershed which includes the Everglades Agricultural Area (EAA, fig. 1). Changes in the nutrient levels (especially phosphorus) of water moving south from the watershed have been traced, at least in part, to input from EAA (Izuno and others, 1991; Zielinski and others, 2000). These altered nutrient levels are hypothesized to be responsible for changes in both the macrophyte and microalgae (periphyton) communities of the Everglades wetlands (Jensen and others, 1995; Browder and others, 1994). Therefore, of particular concern in the management of this region has been (1) the dramatic decrease in the quantity and quality of surface water that leaves EAA, (2) the impact of decreased water quantity on the historically shallow hyposaline waters of eastern Florida Bay (just off the southern coast), and (3) the alteration (shortening) of the historical surface water hydroperiod (affecting bird breeding success) (Delfino and others, 1993).

South Florida has a sub-tropical climate with a summer wet-season and a winter dry-season. The ambient temperature rarely drops below 0°C (Duever and others, 1994). The Everglades wetland ecosystem is one of the largest fresh water marshes in the world (Douglas, 1947) and is dependent on periodic fires, both natural and human caused, for its stability and biodiversity. The dissemination of invasive and unwanted exotic plant species such as *Melaleuca quinquenervia* (cajeput) and *Schinus terebinthifolius* (Brazilian pepper) are of particular concern (Bodle and others, 1994). Occasional major cyclonic storms, such as Hurricane Andrew which tracked east to west across south Florida at latitude 25° 35' N on August 24, 1992, do little actual damage to the interior wetlands but do extensive damage to coastal mangrove forests, interior hardwood "islands" (hammocks), and the remaining pockets of slash pine (*Pinus elliottii* var. *densa*) forests.

MAJOR AND TRACE ELEMENT INVESTIGATIONS AND MERCURY CONCERNS

In addition to total Hg, this study focuses on the biogeochemistry of selected major nutrient (essential) elements (Ca, Fe, K, Mg, and P) as well as environmentally important trace elements (Cr, Cu, Ni, Pb, and Zn). Data for other elements of possible environmental importance are given but not discussed. We present chemical analysis data for organic-rich sediments from selected cores, selected plant materials, and surface waters.

Everglades Peat Lands

The Everglades peat lands have been described as ombrotrophic and are thus nutrient poor (Koch and Reddy, 1992). Historically, the peat lands developed from organic matter accumulation in standing water derived predominantly from atmospheric precipitation. The waters are near neutral in pH because of extensive calcareous bedrock (Gleason and Stone, 1994; Orem and others, 1997). The peat that forms in this system is ideal for our type of study (the monitoring of historical changes in metal cycling) because it serves as a receptor surface that is discrete from ground water influences (Jones and Hao, 1993). Recent new research by the ACME project does show, however, that ground water influence on nutrient and perhaps metal cycling can occur and should not be discounted (Hurley and others, 1998; Orem and others, 1997).

Taylor Slough

Taylor Slough is a critical part of the overall south Florida Everglades system because (1) it is a terminus for surface water sheet flow from the WCA and ultimately EAA, and is thus the "end of the pipe" for solutes being transported into Everglades National Park (ENP), (2) it discharges over a broad "delta" region into eastern Florida Bay thus directly affecting water quality of the Bay, and (3) it is a major breeding area for both terrestrial and aquatic biota within ENP. In addition, it may be a sink for elements being transported by the sheet flow. Figure 2 shows Taylor Slough and the location of the 1996 study sites. Figure 3 gives the monthly precipitation for three areas that surround Taylor Slough and thus have similar water regimes. The data are grouped by month over a seven-year period from 1990-97. Our sampling occurred in May of 1996 during and right after an unusually wet spring. Loxahatchee National Wildlife Refuge is adjacent to EAA in the north, Royal Palm Ranger Station is in the Slough on its northwestern edge, and Flamingo Ranger Station is immediately west of the southern Slough terminus (fig. 1). Modern Everglades rehabilitation efforts seek to reestablish more of the surface water sheet flow that was characteristic of the area in the past. Concern exists, however, that such an effort will exacerbate current undesirable north/south trends (i.e., nutrient flow, cattail expansion, and mercury bioaccumulation). Our work in Taylor Slough extends the examination of these north/south trends south of WCA (fig. 1).

Mercury

A brief discussion of the Hg concerns in the Everglades is presented. In general, Hg in the environment comes from a number of geogenic and anthropogenic sources. In south Florida these include peat deposits (organic matter oxidation), atmospheric deposition (fossil fuel-fired electrical generating facilities, garbage incinerators, medical laboratories, paint, pulp and paper production), and agricultural operations (herbicide and pesticide application) (Stober and others, 1995). Very recent studies suggest that the atmospheric deposition of Hg in south Florida is generally driven by large-scale regional or hemispheric processes as opposed to local emission/deposition processes (Pollman and others, 1995). These authors also show that deposition is seasonally variable with fluxes 4- to 6-fold higher during April-September (wet season) compared with October-March (dry season). Mason and others (1994) found that deposition on land was the dominant sink for atmospheric Hg and that the atmospheric and ocean surface components are in rapid equilibrium; i.e., the evasion of Hg^o from oceans is balanced by the total oceanic deposition of Hg(II) from the atmosphere. Rood and others (1995), however, note from the literature that gaseous elemental Hg can have an atmospheric residence time of 0.7 to 2.0 years.

As is characteristic of the biogeochemical cycling of Hg in warm-water wetlands, the Hg(II) form is typically methylated in eutrophic, sulfate-reducing sediments and is bioaccumulated in secondary consumers, particularly fish (Zillioux and others, 1993; Zhang and Planas, 1994). Recent work has shown a gradient in methylmercury (MeHg) production in sediment and bioaccumulation in biota in the Water Conservation Areas north of Taylor Slough (fig. 1; Gilmour and others, 1998; Cleckner and others, 1998; Hurley and others, 1998). In general, lower MeHg concentrations occurred in the more eutrophic north and higher concentrations in the more pristine south (south of WCA). This is not to imply, however, that eutrophic conditions "retard" Hg methylation. Typically, Hg appears to be associated with the organic fraction of both soils and sediments (suspended and bottom) (Gill and Bruland, 1990). Humic substances in organic sediments can serve as strong reducing and complexing agents and can influence the processes that control mobilization of many toxic metals including Hg.

METHODS

Sampling Sites

Fieldwork was conducted from May 17-24, 1996 (table 1). May is the end of the dry period and usually allows for ready access to sediment sampling sites because of generally low water levels; however, during May 1996 relatively deep standing water was encountered. Proper collection permits were obtained from managers of all public lands visited.

Field Collections

Water--Surface water samples, to be analyzed for major and trace elements (except Hg), were collected as detailed in Gough and others (1996). Water samples were collected in field-rinsed 1 L polyethylene bottles, and transferred, via filtration in the field (by passing through pre-rinsed cellulose acetate 0.45 μ membranes), to acid-washed and field-rinsed 250 ml polyethylene bottles. Element stability was assured by the addition of 10 drops of concentrated, ultra-pure nitric acid. Samples collected for Hg analyses were taken from the same 1 L bottle. The samples were filtered as above and 30 ml was added to glass, oven-baked bottles with teflon-coated lids. Mercury stability was assured by the addition of 1.5 ml of sodium dichromate/nitric acid.

Vegetation--The vegetation component of the biogeochemical cycling of trace elements is being investigated using sawgrass (*Cladium jamaicensis* Crantz), the dominant species in the Everglades marsh. In addition, bromeliads (*Tillandsia* spp., also known as air plants) were collected when available because of their ability to concentrate airborne metals and therefore act as air quality biomonitors. Data for the air plant samples are reported elsewhere (Gough and others, 1996).

Sawgrass is a coarse, rhizomatous perennial sedge that can dominate both the wet (inundated for months at a time) and dry (seldom inundated) prairies across the Everglades peat lands (McPherson, 1973). This is particularly true east of Big Cypress National Preserve in the Water Conservation Areas and in Everglades National Park. Although locally dominant in marly or rocky areas with shallow sediments, it can be found growing in peaty material that is several meters deep (Duever and others, 1986). Sawgrass leaves (about 200 g, dry weight) were clipped using stainless steel shears at about 10 cm above the high water level. Flowering structures, if present, were removed. Samples consisted of a composite of four individual plants collected within three meters of the site where core material was taken. The material was double sealed in plastic bags and chilled using "wet ice". Sawgrass roots consisted of the material below the sediment level for each sawgrass clump. This usually consisted of the basal portion below the meristem that contains the major rhizomes (but without the fibrous "feeder" roots). The material was field rinsed, doubled sealed in plastic bags, and chilled using "wet ice".

Organic-rich sediments--Sediment cores were obtained by pushing a piston-sealed, 10.2 cm diameter, acrylic butyrate core liner into the sediment using the method of Orem and others (1997). Usually greater than 60 cm of sediment were collected in the core liner at the sites. The cores were maintained in an upright position until they were extruded and sectioned, usually within 8 hours of collection. All sediment samples were placed in plastic bags, chilled, and shipped to the laboratory where they were frozen.

SAMPLE PREPARATION, ANALYSIS, AND QUALITY ASSURANCE/QUALITY CONTROL

Methods of sample preparation and analysis are only briefly presented below. Detailed discussions for water, plant, and sediment samples can be found in Arbogast , 1996; Gough and Crock, 1997; Holmes, 1998; Lichte and others, 1986; and Orem and others, 1999.

In the laboratory, sawgrass was removed from the sample bags, placed in Teflon[2] beakers, submerged and rinsed in deionized water, and drained. This process was repeated at least three times. Plant material was then placed in plastic colanders, rinsed briefly with deionized water, and allowed to drip drain. Colanders were then placed directly into ovens and the material was dried for 24 hr. at about 40°C. This temperature is near the maximum summer ambient field temperature and should not result in any important loss of Hg through volatilization. Samples were then ground in a Wiley mill to pass a 2-mm (10-mesh) sieve. Splits of the ground plant material were ashed at 450-500°C over an 18 hr. period and ash yield was determined.

In order to insure adequate material and sample type for the various analyses conducted, replicate cores were commonly extracted from each study site. The cores used for the geochronology studies (^{210}Pb analyses) and pore water chemistry, were sectioned (extracted) at 2 cm intervals whereas the cores used in the trace metal geochemical studies were sectioned at 5 cm intervals. Because most core material below about 40 cm was several hundred years old, the interval for sectioning commonly increased to 5 or 10 cm for all cores. This was performed in order to economize on the total number of samples being analyzed.

For element analyses, subsets of the sediment core sections were dried, ground, and ashed in a manner similar to the plant samples (Arbogast, 1990; Balistrieri and others, 1995). For details on the ^{210}Pb sediment dating method see Holmes (1996; 1998).

One hundred milligrams of plant and sediment sample ash was digested with mixed acids. After complete digestion of the ash, 40 major and trace elements were determined by inductively coupled plasma-atomic emission spectroscopy (ICP-AES) (Lichte and others, 1987). Mercury was determined directly on a subset of the dried, ground, unashed plant and sediment material by cold vapor atomic absorption spectrometry (AAS)(Kennedy and Crock, 1987). Total sulfur was determined in plant samples only on 250 mg of the ground material by combustion at 1370°C in an oxygen atmosphere with infrared detection of evolved SO_2 (Jackson and other, 1985). Water samples were analyzed by inductively coupled plasma-mass spectrometry (ICP-MS) (Meier and others, 1994; Arbogast, 1996).

Table 2 lists the approximate lower limit of detection (LLD) for the concentration of elements in samples of water, plants, and sediments. In table 2 the LLD is defined as the lowest concentration level of the analyte that can be determined to be statistically different from the analytical blank—this approximately corresponds to a confidence level of 90 percent or 3 sigma above the measured average blank (Arbogast, 1996). The element analyses (except for Hg) for the sediment material were all performed in a non-government contract laboratory. Analyses for plant material and water were performed by the Denver Laboratories of the USGS.

Blind standard reference materials were submitted to the laboratories as part of each suite of samples. This included material from the National Institute of Standards and Technology (NIST), the National Bureau of Standards (NBS), and from internal USGS prepared materials. In addition, some of the material was sampled twice in the field (identified by a "Y"), and split in the laboratory for duplicate analysis (identified by an "X"). Results are presented for the duplicate samples and duplicate analyses in the data tables that follow. Quality assurance (QA) and control (QC) practices, for most of the analytical methods used, are provided in more detail in Arbogast (1996).

The QC evaluation for the samples submitted was as follows:

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[2] The use of brand or trade names in this report is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.

- Blind NIST (NBS) and/or USGS internal reference materials (labeled as SRM or SAR-M, respectively) were submitted for every forty (or fewer) samples.
- Reported laboratory values are considered accurate if their reported value is ±20% of the "target" value of the blind reference material.
- The reported laboratory percent RSD is also examined; however, this value can vary greatly between "jobs" because of matrix effects, the number of analyses near the LLD, and the quantity of sample material available.

The results of all analyses of the SRM's are summarized in tables 3, 4, and 5. Results are compared to SRM certified and/or non-certified concentration values. In addition to the laboratory QA/QC procedures, the field study quality control included submission of procedural blanks for the water samples and periodic splits of sediment and plant samples. All samples, blanks, and splits were analyzed in a randomized sequence relative to their duplicate, their geographic location, and their order of field collection.

The concentrations of elements in the procedural blanks for water samples are generally below detection limits. The laboratory analysis of duplicated splits of sediment and plant samples indicate very good reproducibility (precision). In general, there is also good agreement between our laboratory analysis values and the certified values reported for NIST, NBS, and USGS SRM's. The NIST SRM's list non-certified values for many elements; some of these values are reported in the data tables.

For the element analyses in sediment material, all analyses fell within the ±20% criterion except for As (+36%), Cd (+21%), and Cr (-24%). The poor QC for As and Cd is attributed to a majority of values at or near the 10 and 2 ppm LLD, respectively. The poor QC for Cr appears to be a laboratory bias that may be attributed to the analytical matrix.

RESULTS AND DISCUSSION

Tables 6, 7, 8, and 9 list the analytical results for the determination of element concentrations in sediment, sawgrass leaf, sawgrass root, and water samples discussed in this report. Due to convention, many of the analyses for sediment and vegetation have been converted from a measured ash-weight basis to a dry-weight basis.

Sedimentation, Core Dating and Element Accumulation Rates

Parameters used in the calculation of depth-related sediment ages, sediment deposition rates, and element accumulation rates are given in Table 10. The sedimentation rate, as measured in the core material, for most sites ranged from 0.03 – 0.16 cm yr^{-1} (table 10). The sedimentation rate for core TS1, at the upper-most end of Taylor Slough where canal water was continuously being directed by gates into the Slough, was about 1.5 cm yr^{-1}. Because of the unconsolidated and flocculent nature of the sediment/water interface, it was difficult to accurately sample or preserve intact the 0-2 cm portion of core. Although dating was successful in some instances above 2 cm, dating usually began below this level. With a sedimentation rate of 0.1 cm yr^{-1}, the removal of the top 2 cm of material means a potential loss of about 20 years of sediment record.

As mentioned above, the table 10 data were obtained from a core ("geochronology core") collected adjacent to the core used for geochemical analysis. Because our geochemical samples were collected at 5-cm intervals, and not at the 2-cm interval used for the geochronology cores, the geochemistry dates presented in subsequent discussions are calculated for the 5-cm depth intervals using simple linear regression:

$$Y = a + b(X);$$

where Y (age at a specific depth) = (intercept, a) + (slope, b) x (depth in cm, X). For example, using the data below for core 1, the calculation of core age at 12 cm takes the form Y = 1997 + (-1.26(12)), or 1982.

Core	Regression estimates		n	R^2
	Intercept	Slope	(count)	
TS1	1997	-1.26	12	0.99
TS7	2038	–20.9	8	1.00
TS9	1996	–19.5	10	1.00
TS7E	1995	–6.88	9	1.00
TS15	2012	–5.28	9	0.95
TS2	2011	–7.42	9	1.00

The mass of sediment that accumulates per year (gm cm^{-2} yr^{-1}) is the product of the bulk density of the core sample material (gm cm^{-3}) and the sedimentation rate (cm yr^{-1}). The determination of element mass accumulation rates (EAR, µg $m^{-2}yr^{-1}$ or g $m^{-2}yr^{-1}$) is then a simple calculation of element concentration (µg g^{-1}) times the sediment mass accumulation rate (g m^{-2} yr^{-1}). Tables 11 and 12 give the EAR down-core trends for selected major and minor elements, respectively, for cores TS1, TS7, TS7E, TS9, and TS15.

Sediment Geochemistry

The concentration of selected major and trace elements in the sediment core material from six cores taken from Taylor Slough is plotted in figures 4 and 5. These are the same data as those presented in table 6. Table 6 also presents the arithmetic mean and standard deviation for the concentration of elements in core material. These summary statistics were calculated by combining all sampling intervals for those elements without censored values (all values reported as above the LLD). These data can be compared in a general way to regional data from the literature. For example, a very recent study by Chen and others (1999) compare element concentrations in Florida soils to those in various soils world wide. Comparing our data, for organic-rich sediments, to their data from more mineralized soils from throughout Florida, shows that our Hg concentrations are two-to three-times greater. In addition, most of the other environmentally important metals (Cr, Cu, Ni, Pb, and Zn) that we report are two- to eight-times greater.

Based on similar data from cores we collected in WCA (L.P. Gough, unpublished data) there appears to be very little variation in element concentration among cores for the major elements (fig. 4). There is, however, considerable variation in the down-core concentration trends. For example, Ca in core sites TS7, TS9, and TS7E shows a pronounced increase in concentration near the surface. This reflects variations in the biogenically derived marl content of the core material. Except for Al and Fe in core TS9, most of the major elements do not show a pronounced increase in concentration with depth. Even core TS15, the southern-most site located only a few kilometers from the saline waters of Florida Bay and collected well within the red mangrove ecotone, does not show an increase in Na. Core chemistry uniformity with depth is important because it means that, for the major elements, very little difference should be expected in sediment chemistry north-to-south within the Slough.

The concentration of selected trace elements in sediment core material (table 6), plotted in figure 5, show much greater regional and down-core variability than the major element patterns. Concentrations of Cu, Pb, and Zn are commonly enriched in ombrotrophic surface peat layers because of significant anthropogenic atmospheric inputs (Shotyk and others, 1992). Our data, in general, do not show strong near-surface trace element enrichment. Lead and Zn do show enrichment in the top 10-15 cm for cores TS2, TS7E, TS9, and TS15; however, toward the bottom of the core their concentrations also occasionally increase. All five elements show increases with depth in one or more of the cores--especially in the lower half (>30 cm). For example, the pattern for Cr does show large concentration differences especially in the deeper part of the cores (e.g., TS9 and TS15). However, the quality control (precision) for Cr analyses in sediment was poor (see Methods section) and caution is needed in the interpretation of these data. These two southern-most cores show a general pattern down-core of high-low-high for the concentration of most trace elements.

Sulfur plays an important role in the sequestration of metals in sedimentary systems. Under anoxic conditions, microbial sulfate reduction reduces sulfate to sulfide. Sulfide is a highly reactive chemical species, especially with metal ions, and will quickly form highly insoluble metal sulfides (Boulegue and others, 1982; DeLaune and Smith, 1985; Huerta-Diaz and Morse, 1992). Metal sulfide species once formed are generally stable under the anoxic and circumneutral conditions found in most wetland sediments. Freshwater, peat-forming wetlands like the Everglades, however, typically have low levels of sulfate, limiting sulfate reduction and the formation of metal sulfides. Under these conditions, other processes such as complexation of metal ions by the organic matrix or the admixing of mineral phases with the peat may be more important in influencing the distribution of metals in sediments.

The environment of Taylor Slough ranges from a freshwater, low sulfate environment in the north, to brackish water, high sulfate conditions in the south. Sulfur concentrations and speciation were determined in the sediment and pore water and are reported elsewhere (Orem and others, 1999; W.H. Orem, unpublished data). This was done in order to examine the possible influence of sulfur on metal distributions. Total sulfur contents of sediments ranged from < 0.5% (dry wt.) in the freshwater areas to 8% in the brackish water areas. Most of the sulfur is present as organic sulfur in the freshwater areas, although disulfides can also be important. Disulfides appear to become somewhat more important in the brackish water zone. Vertical profiles of total sulfur were nonsystematic in the freshwater zone, but were observed to generally increase with depth in the brackish water areas. Metals showed generally poor correlations with total sulfur content in the freshwater areas, with the best fits for Pb, Mn, and Zn (correlation coefficients of only 0.4 to 0.6). This suggests that in the freshwater areas sulfur is not a major control on metal distributions in the sediments. A better case can be made for sulfur control of metal distributions in the brackish water areas. Several metals from the brackish water zone show reasonably strong correlations with sulfur in the sediments: Ni, Cr, Fe, and Cu, all with correlation coefficients of 0.8 or higher. The strength of these correlations is primarily driven by increases in both metal and sulfur concentrations in the lower half of the cores. In this area, the brackish water from Florida Bay comes up along the base of the peat, with a fresher layer of water, due to runoff, at the surface. Thus, the major sulfate source at these sites is from the base of the peat. Correlation, of course, is not proof of a mechanism, but does provide an indication that sulfur may play a control on metal distributions in sediments from the brackish water zone in Taylor Slough.

Figure 6 presents the spatial trends for the concentration of total Hg in five of the Taylor Slough cores. The plots also contain the bulk density and geochronology measurements for the same samples as well as the simple correlation coefficient (R^2) for the relation between bulk density and Hg concentration. Except for core TS15, there is no strong pattern of higher Hg concentrations near the sediment surface. This generalization is in contrast with other studies that have shown greater Hg concentrations in the past 90+ years as compared to sediment material deposited before about 1900 (Delfino and others, 1993; Rood and others, 1995). Except for core TS1 (furthest north, at the head of the Slough), the concentration of total Hg in sediment samples is an order of magnitude below the highest values reported by Delfino and others (1993). There appears to be no consistent spatial pattern for the concentration of Hg among sites (north/south within the Slough) or down-core. Also, the relation between bulk density and Hg concentrations is always positive but weak.

Figure 7 presents a ternary plot of Hg concentrations related to bulk density and organic carbon concentrations in the four cores (TS7, TS9, TS7E, and TS15) for which we have complete data for all three parameters. Core segregation is evident with TS7 and TS15 showing the strongest association with organic carbon. There does not appear to be a north/south trend. Like figure 6, figure 7 also demonstrates the positive but weak association of Hg concentrations with bulk density as well as organic carbon. The dramatic segregation of core TS9 reflects the marly, non-organic nature of much of the core material. This site was in the south-central region of the slough.

Element Accumulation Rates in Sediments

Tables 11 and 12 present the element accumulation rates (EAR, expressed both as g $m^{-2} yr^{-1}$ and $\mu g\ cm^{-2} yr^{-1}$) for selected major and trace elements in five sediment cores extracted from Taylor Slough. These same data (tables 11 and 12) are plotted in figures 8, 9, and 10.

Figures 8, 9 and 10 are down-core plots of major element (Al, Ca, Fe, K, Mg, Na, and P), trace element (Cr, Cu, Ni, Pb, and Zn), and Hg accumulation rates, respectively, for core sites TS1, TS7, TS7E, TS9, and TS15 (see fig. 2). Unlike the concentration plots of figures 4, 5, and 6 above, accumulation plots are less vulnerable to variations in sedimentation throughout the core profile that can cause dilution of the target analyte. Accumulation rates are normalized to time and minimize the problem of covariance among different sedimentary components (Rood and others, 1995). Nevertheless, a comparison of an element's concentration plot with its accumulation rate plot shows that they are very similar indeed. This is due to the uniform bulk density and sedimentation rate measurements throughout the length of most of the cores (tables 11 and 12).

Many of the down-core patterns discussed above for both the major and trace elements are much less obvious in the examination of the accumulation rate plots. For example, the generally higher concentration of Cu and Zn near the surface of cores TS2 and TS15 is not at all obvious in the accumulation plots. Chromium, however, continues to show a general increase in accumulation with depth that parallels its concentration trends. Not surprisingly, because of the higher sedimentation rates observed at the core site TS1 (fig. 2), most elements express their highest accumulation rates at the head of the Slough. For example, the EAR values for Pb in TS1 are two orders of magnitude greater than for any of the other cores.

Patterns for Pb (fig. 9) typically show a small spike between 8-12 cm in depth. Studies such as those by Weiss and others (1999) attribute this spike to the global industrial atmospheric input of Pb that resulted in a significant Pb enrichment in peat during two major periods--from about 1880-1920 and from 1960-1980. Our data are not as precisely delimited as those presented by Weiss and others; however, table 10 shows that this spike in our data represents a period of from 20 years ago (core TS1) to 60-180 years ago (cores TS7, TS9, TS7E, and TS15). Certainly cores TS9 and TS15 (fig. 9) correspond most closely to typical patterns of Pb accumulation trends reported in the literature. More work at the sites where these cores were taken may be of interest in future attempts to further define Pb trends in Everglades peat.

Figure 10 shows total mercury accumulation rates as well as the approximate geochronology for five of the Taylor Slough cores (TS1, TS7, TS7E, TS9, and TS15). Because of the inability to successfully collect the upper 0-2 cm in many of these cores, and a sedimentation rate of about 0.1 cm yr^{-1} (except core TS1), the calculated ages of the uppermost core samples was highly variable. Except for core TS1, the total Hg accumulation rates are within the range of those reported for the Water Conservation Areas by Delfino and others (1993) and Rood and others (1995). The high EAR values for TS1 directly reflect high sediment accumulation rates and not high total Hg concentrations. These EAR values are several-times greater (~200 to ~320 $\mu g\ m^{-2}\ yr^{-1}$) than those found in post-1985 core material from WCA (23-141 $\mu g\ m^{-2}\ yr^{-1}$)(Delfino and others, 1993). In addition, our data do not show greater total mercury accumulation rates near the surface (past 90+ years) as do these authors. This uniformity in Hg accumulation rate patterns in our data is the result of uniform Hg concentrations (not highly variable down-core) and of the very low calculated accumulation rates. Mercury accumulation rate data varied as follows: core TS1, 200-320 $\mu g\ m^{-2}\ yr^{-1}$; core TS7, 6.8-63 $\mu g\ m^{-2}\ yr^{-1}$; core TS7E, 19-62 $\mu g\ m^{-2}\ yr^{-1}$; core TS9, 12-71 $\mu g\ m^{-2}\ yr^{-1}$; core TS15, 2.2-10 $\mu g\ m^{-2}\ yr^{-1}$.

Sawgrass Biogeochemistry

Enrichment factors (EF) were calculated to measure the magnitude of element uptake in sawgrass relative to element bioavailability. This technique has also been used to assess possible anthropogenic vs. geogenic (natural) additions to plant chemistry when plants have been employed as air quality biomonitors (Wiersma and others,1992; Gough and others, 1994). The calculation takes the form:

$$EF = \frac{[X] \text{ in sawgrass}/[Al] \text{ in sawgrass}}{[X] \text{ in sediment}/[Al] \text{ in sediment}}$$

where [X] and [Al] are the concentrations of the element of concern and of Al, respectively, in plant material, relative to their concentrations in sediment. This procedure normalizes the data with respect to a geochemical reference (in this case Al). Aluminum is used because it is a conservative, lithogenic element and because in neutral substrates (pH near 7.0) it is relatively unavailable for plant uptake. Because sawgrass has a relatively shallow rhizomatous, branching root system (Steward and Ornes, 1975), we used the average for the concentration of elements in the top 30 cm of core material (where the majority of the root biomass is found) for the calculation of the EF. Assuming that the plant material has been properly cleaned before analysis, the EF is a measure of the relative uptake of an element from its substrate—a sort of "bioavailability" assessment—in the top 30 cm of sediment.

Figures 11A, 11B, and 11C present EF bar plots for selected major and trace elements for sawgrass leaf and root material at six core sites in Taylor Slough. The sites, with paired bars (for leaf (L) and root (R) material), are arranged roughly north/south along the Slough (fig. 2). Root material was not sampled at the core TS7 site and core TS9 lacks EF data for Cu because of a large number of Cu concentration values in sediment that were below the LLD of 2 ppm (table 6).

In general, except for Fe, the EF values in root were lower than in leaf tissue. In many instances this difference was substantial—greater than an order of magnitude. These EF values indicate that sawgrass tissue has a greater tendency to accumulate elements relative to the substrate within which it is growing. The high EF values may indicate a physiological compensation mechanism that allows for element uptake and accumulation by sawgrass in low nutrient sediments (Gunderson, 1994).

Figures 11A, 11B, and 11C also show a general north/south trend with higher EF values in the north (the core site TS1 does, however, show somewhat smaller EF values for most of the elements, especially in root tissue). Of particular interest in this study are the Hg values that also follow this trend. These data suggest a general process, regional in scope, that governs the uptake of elements in Taylor Slough. Even the elements that do not show a regional trend of decreasing element concentration in sediment from north/south (Mg, Na, Hg, and Zn, table 6) show strong decreasing north/south EF trends. For example, the concentration of Na in sediment increases north/south as the sites approach Florida Bay—a reflection of a subsurface salinity gradient. Nevertheless, figure 11B shows a strong north/south EF decrease.

Further, core sediment texture and composition does not show a north/south component. There appears to be no relation between bulk density and organic matter content on a regional scale (figs. 2, 7, and 12). In figure 12 the cores do appear distinct in composition, however, and each core does express a unique plot. For example, core TS1 (furthest north) appears intermediate in both bulk density and organic matter whereas core TS9 (south-central part of the Slough) has high bulk density but low organic matter. The two sites furthest south (core TS15 and TS16) have low bulk density and high organic matter—but so does core TS7 which is located at the north end of the Slough. How these data relate to the proportion of marl vs. organic carbon awaits examination.

Water Chemistry

Table 9 lists the analyses for the concentration of elements in surface water collected at six sites in Taylor Slough. Little interpretation of these data is offered at this time. The samples are generally arranged north/south (fig. 2). In general, the data are regionally very uniform with the possible exception of Ba, Co, Mn, Ni, and Sr. All total Hg analyses were below the 0.2 $\mu g\ L^{-1}$ detection limit for the atomic absorption spectrometry method used. This detection limit is two orders of magnitude above the values reported by Hurley and others (1998) for surface water in the canals that feed the Water Conservation Areas further north.

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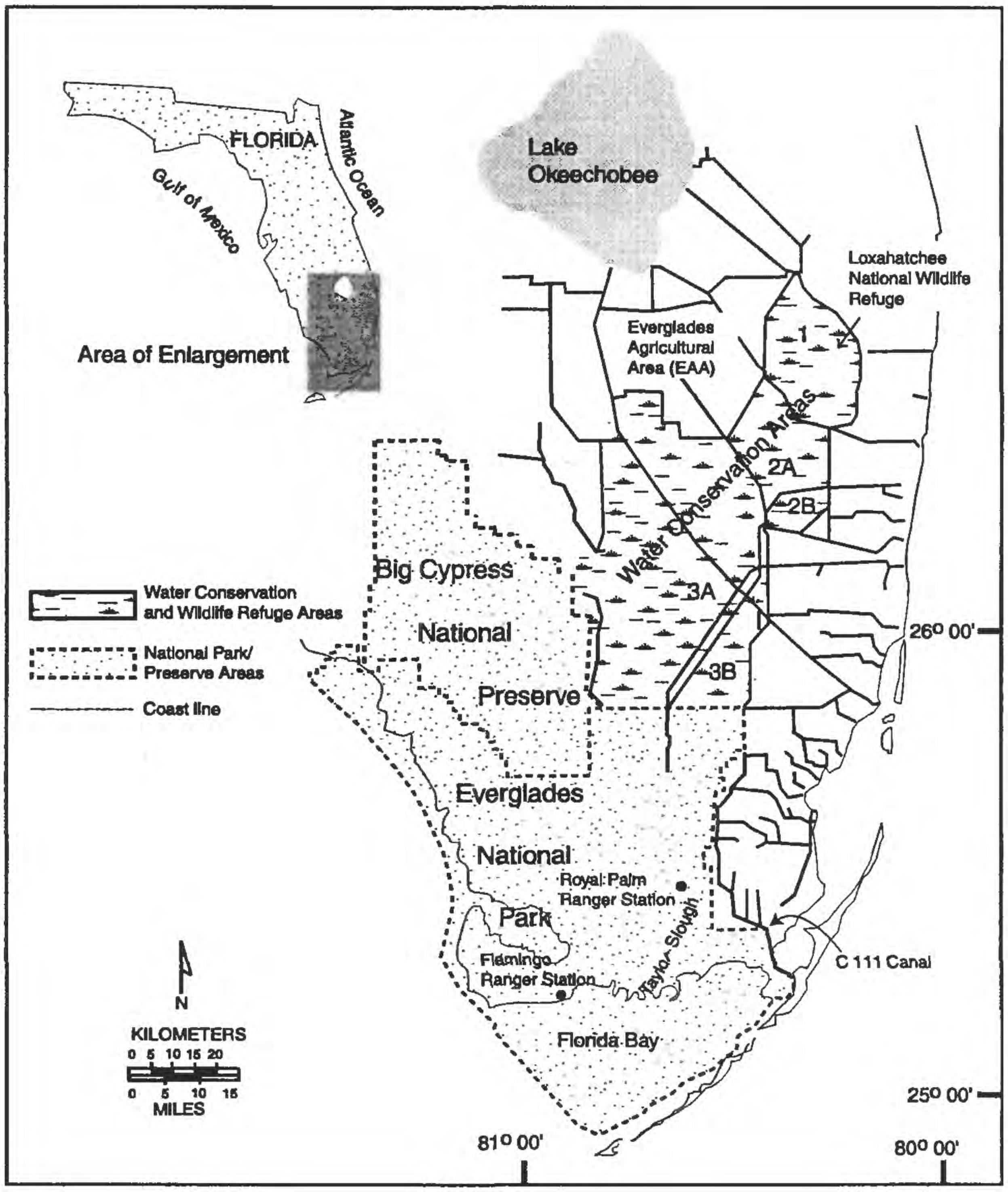
FLORIDA
Atlantic Ocean
Gulf of Mexico
Area of Enlargement
Lake Okeechobee
Loxahatchee National Wildlife Refuge
Everglades Agricultural Area (EAA)
1
Water Conservation Areas
2A
2B
3A
3B
Big Cypress National Preserve
Water Conservation and Wildlife Refuge Areas
National Park/ Preserve Areas
Coast line
26° 00'
Everglades National Park
Royal Palm Ranger Station
Taylor Slough
Flamingo Ranger Station
C 111 Canal
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KILOMETERS
0 5 10 15 20
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Florida Bay
25° 00'
81° 00'
80° 00'

Figure 1.

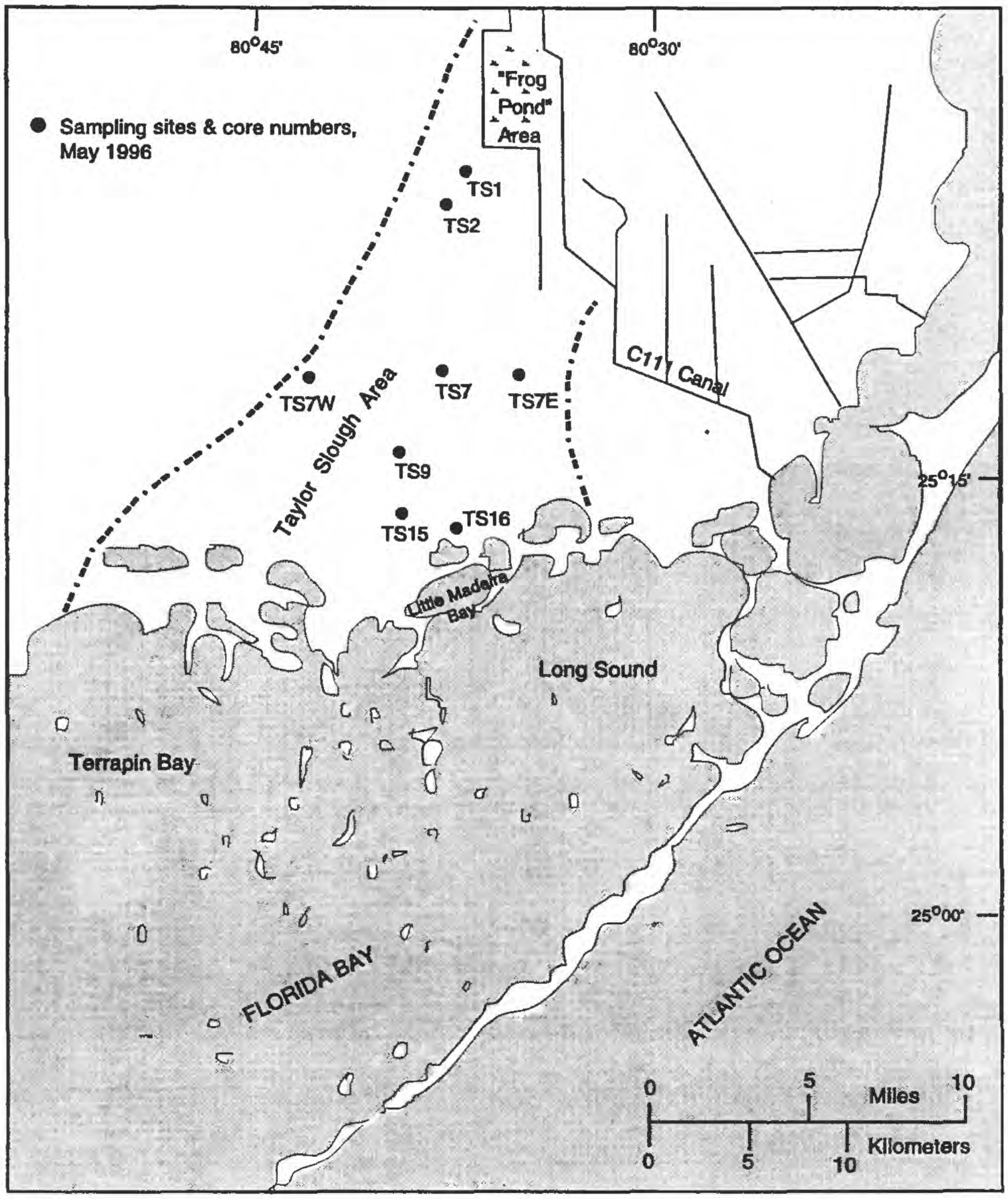
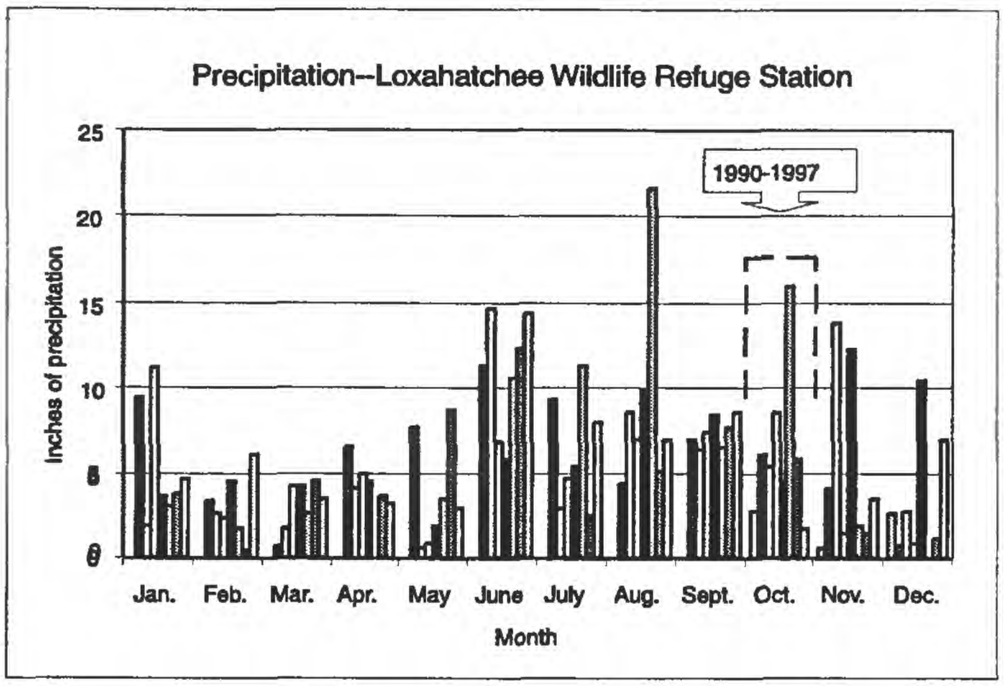
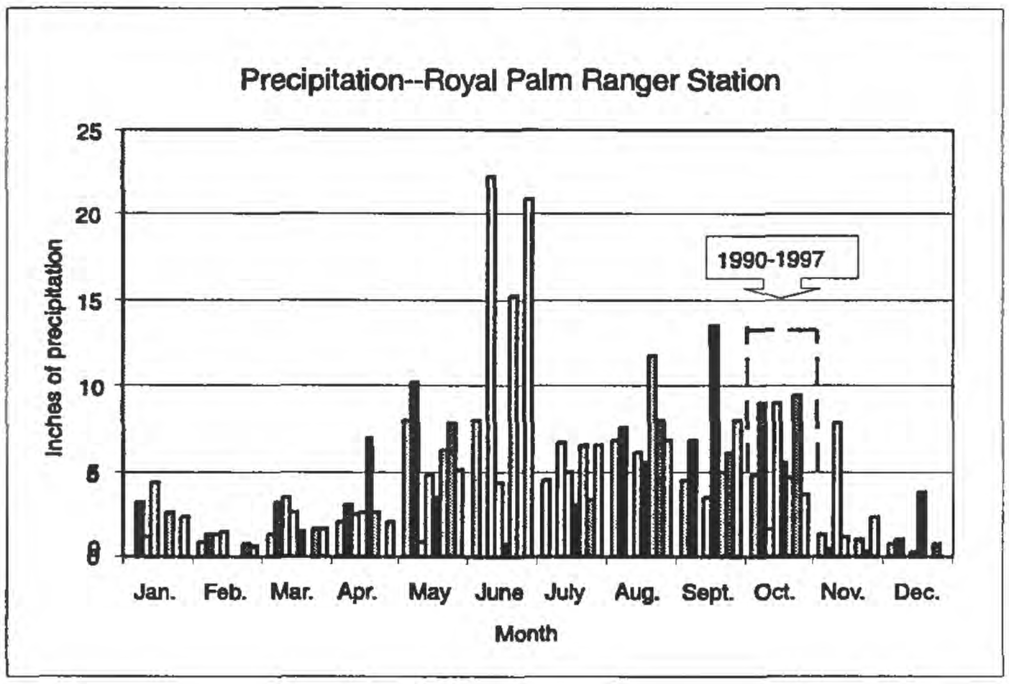

80°45'
80°30'
● Sampling sites & core numbers, May 1996
"Frog Pond" Area
TS1
TS2
TS7W
TS7
TS7E
TS9
TS15
TS16
Taylor Slough Area
C111 Canal
25°15'
Little Madeira Bay
Long Sound
Terrapin Bay
25°00'
FLORIDA BAY
ATLANTIC OCEAN
0
5
10
Miles
0
5
10
Kilometers

Figure 2.


Precipitation--Loxahatchee Wildlife Refuge Station
Inches of precipitation
25
20
15
10
5
0
1990-1997
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Month


Precipitation--Royal Palm Ranger Station
Inches of precipitation
25
20
15
10
5
0
1990-1997
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Month

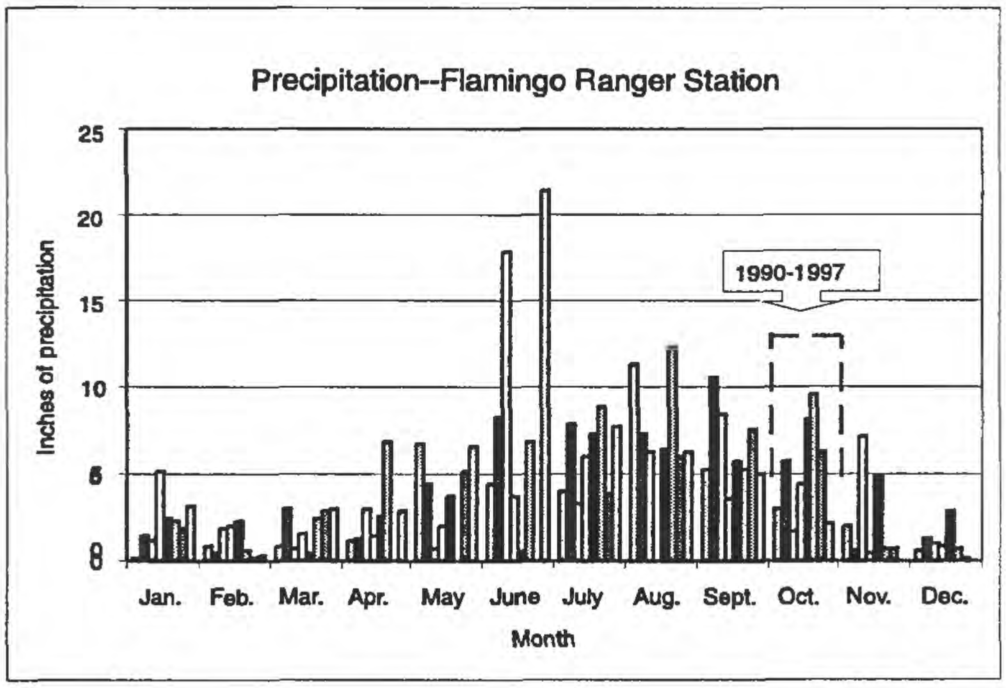

Precipitation--Flamingo Ranger Station
Inches of precipitation
25
20
15
10
5
0
1990-1997
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Month

Figure 3.

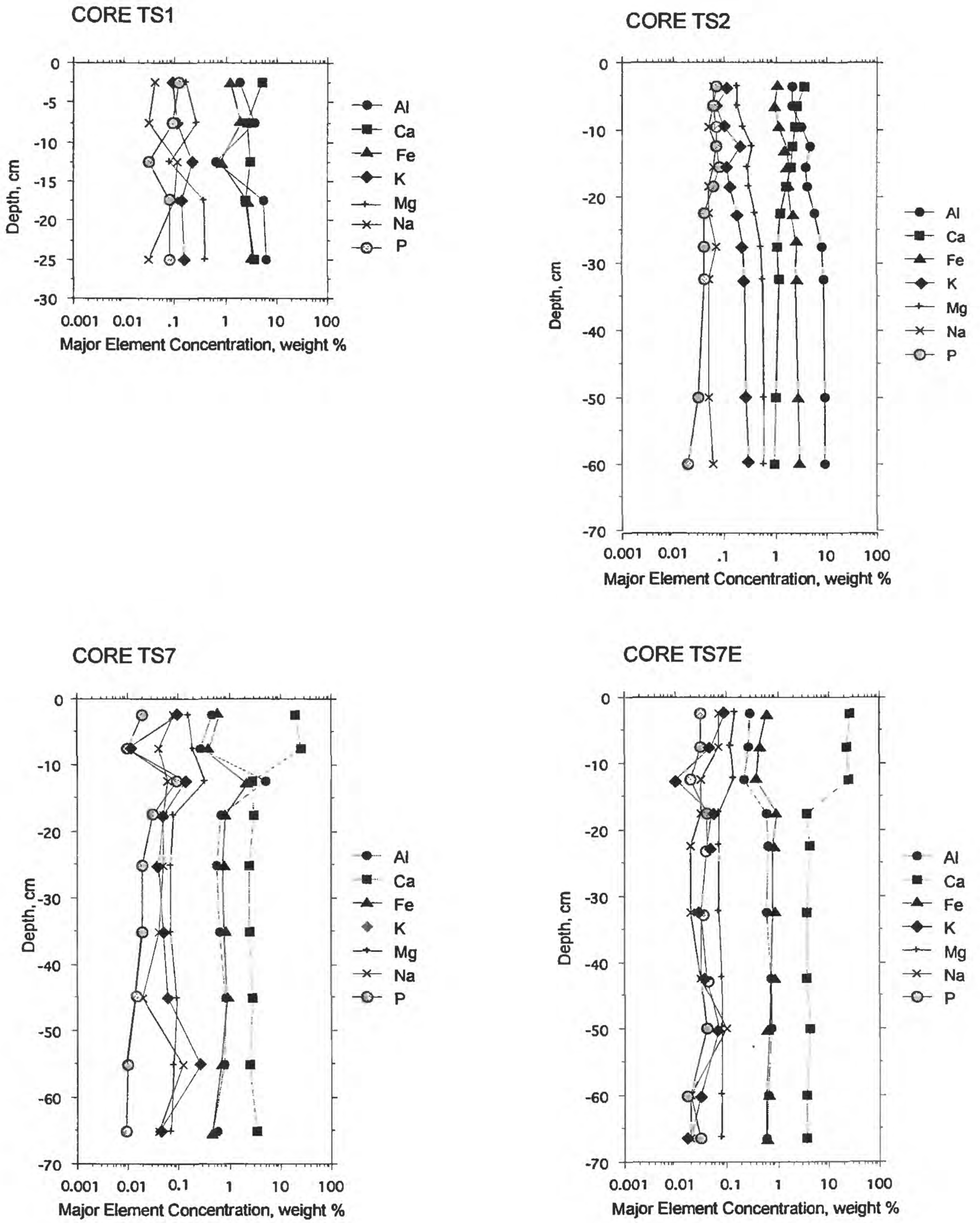

CORE TS1
CORE TS2
CORE TS7
CORE TS7E
Depth, cm
0
-5
-10
-15
-20
-25
-30
-40
-50
-60
-70
0.001
0.01
.1
0.1
1
10
100
Major Element Concentration, weight %
Al
Ca
Fe
K
Mg
Na
P

Figure 4.

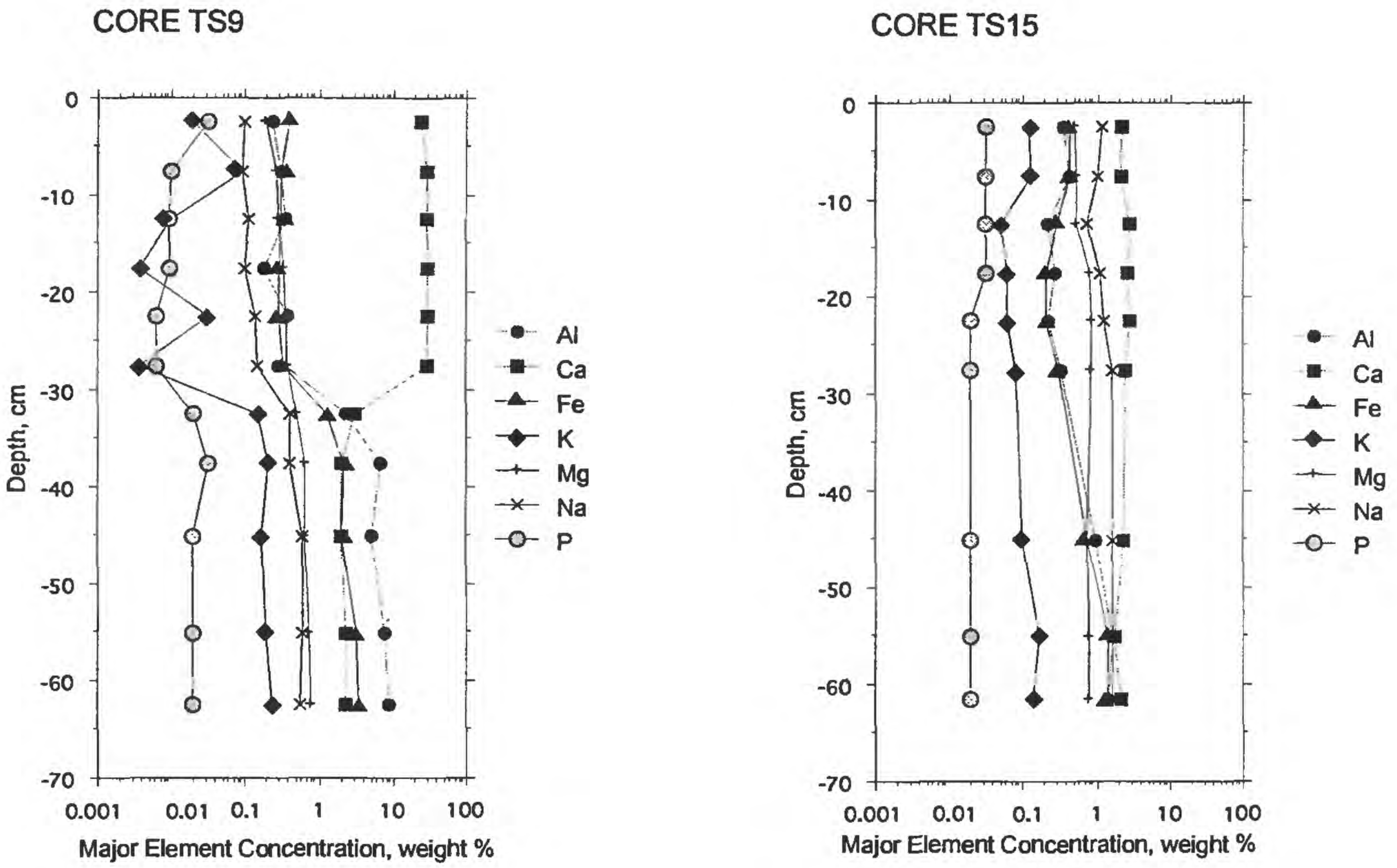


Figure 4. (continued)

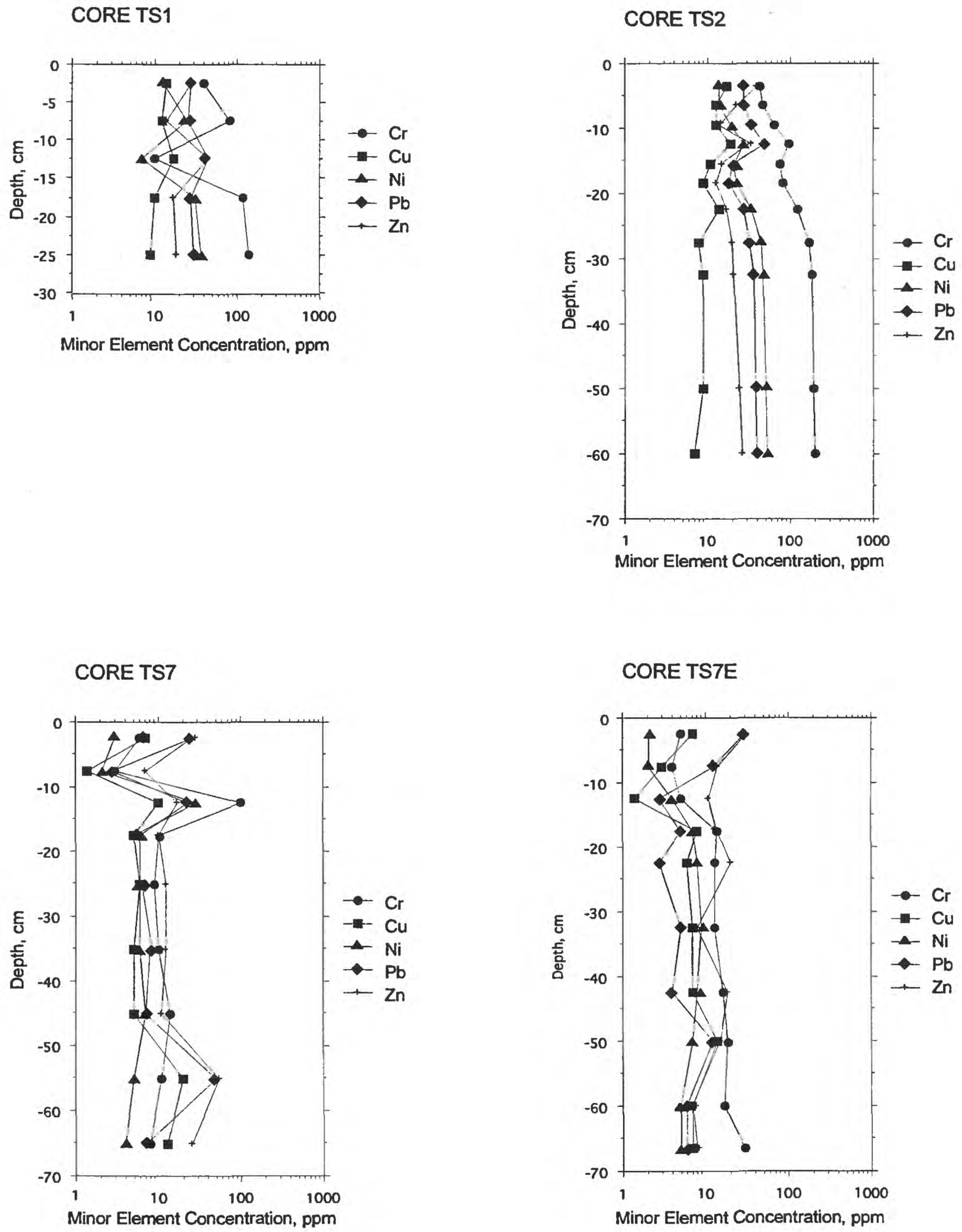

CORE TS1
CORE TS2
CORE TS7
CORE TS7E
Depth, cm
0
-5
-10
-15
-20
-25
-30
-40
-50
-60
-70
1
10
100
1000
Minor Element Concentration, ppm
Cr
Cu
Ni
Pb
Zn

Figure 5.

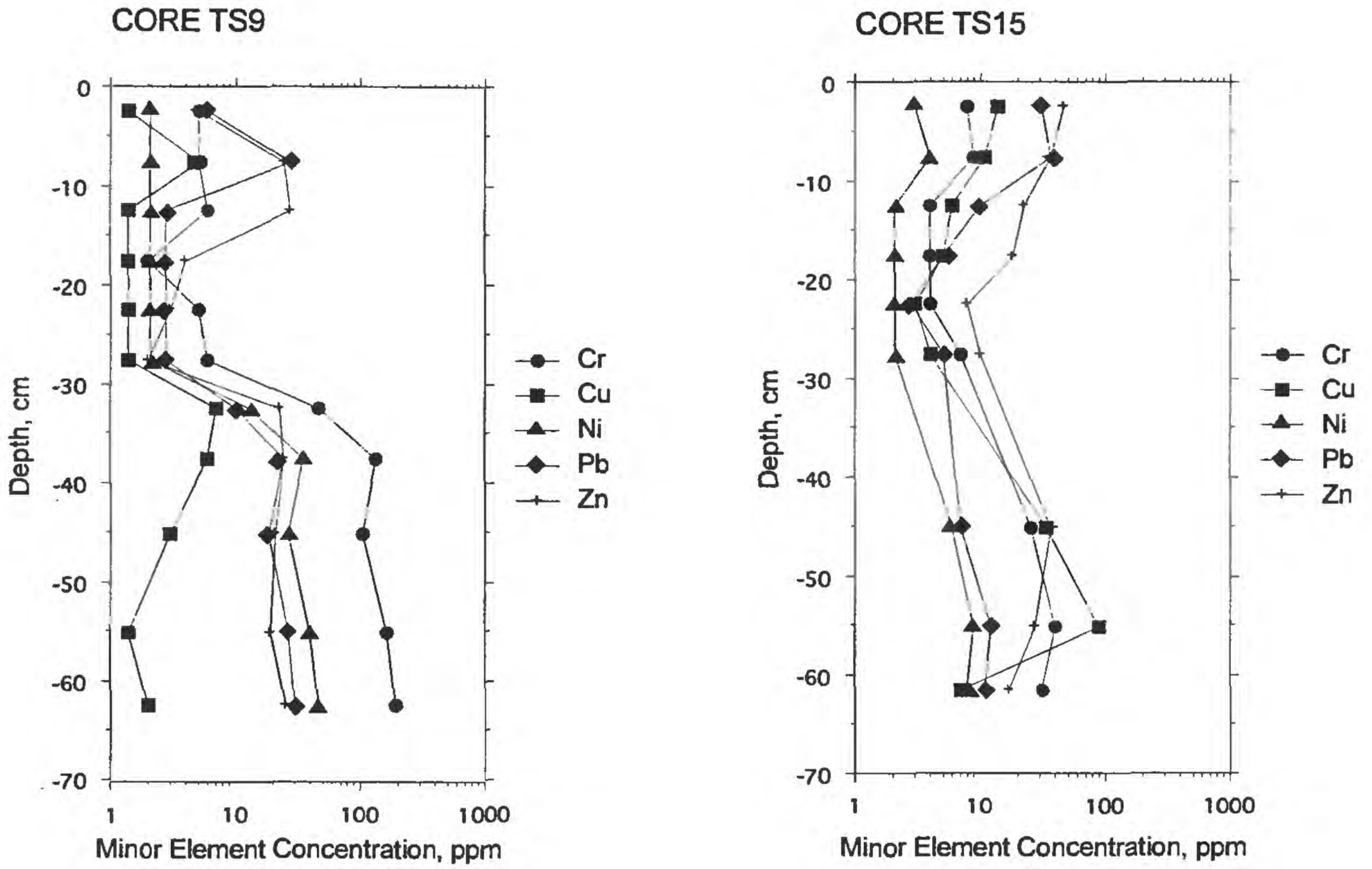


Figure 5. (continued)

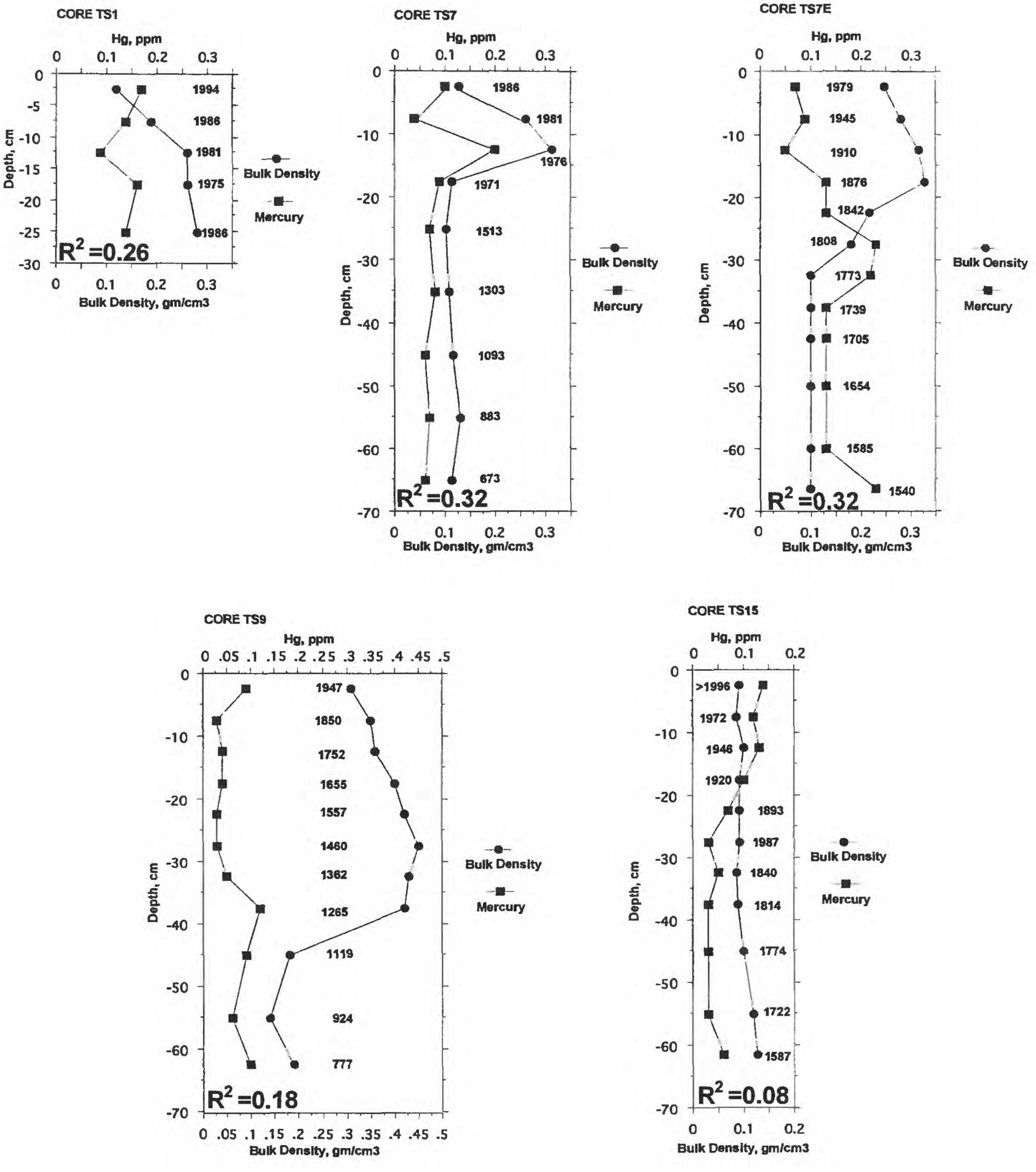

CORE TS1
Hg, ppm
Depth, cm
Bulk Density, gm/cm3
1994
1986
1981
1975
1986
R² =0.26
Bulk Density
Mercury
CORE TS7
1986
1981
1976
1971
1513
1303
1093
883
673
R² =0.32
CORE TS7E
1979
1945
1910
1876
1842
1808
1773
1739
1705
1654
1585
1540
R² =0.32
CORE TS9
1947
1850
1752
1655
1557
1460
1362
1265
1119
924
777
R² =0.18
CORE TS15
>1996
1972
1946
1920
1893
1987
1840
1814
1774
1722
1587
R² =0.08

Figure 6.

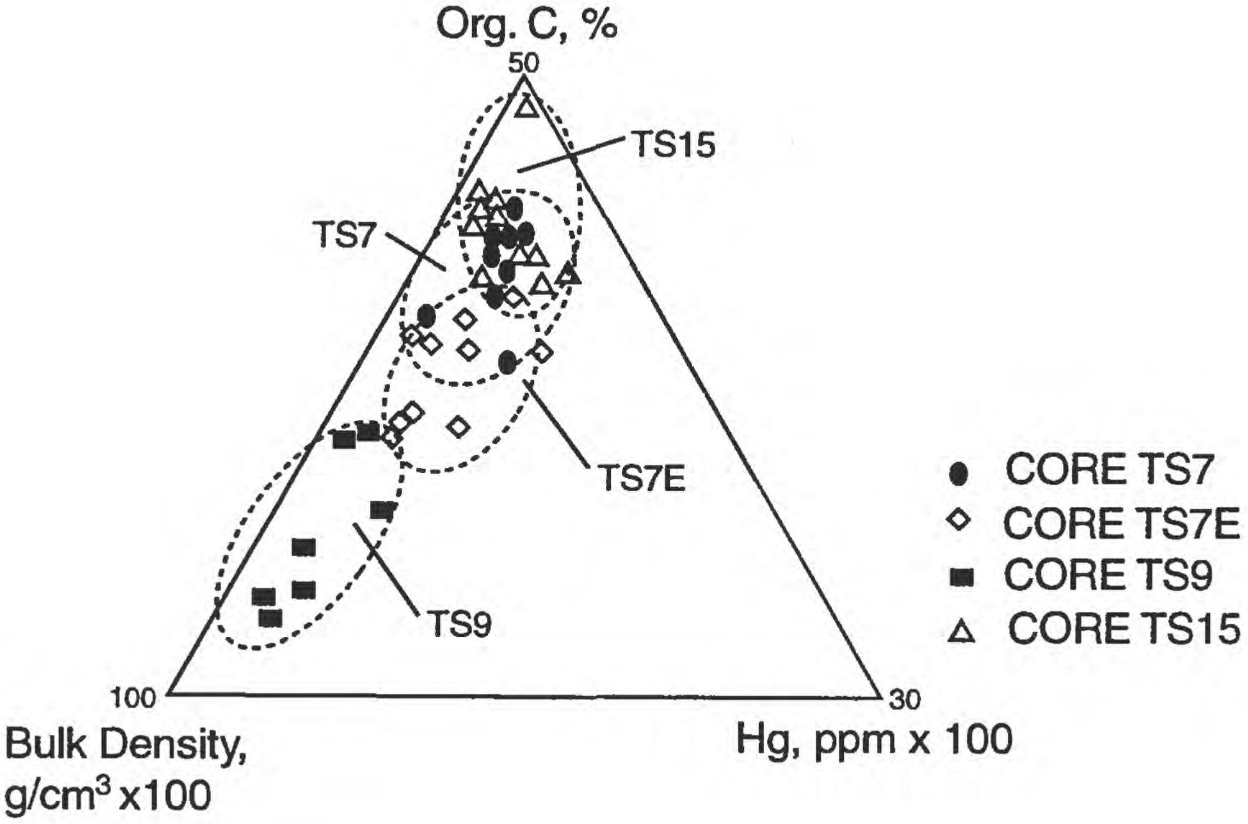

Org. C, %
50
TS15
TS7
TS7E
TS9
100
30
Bulk Density, g/cm3 x100
Hg, ppm x 100
● CORE TS7
◇ CORE TS7E
■ CORE TS9
△ CORE TS15

Figure 7.

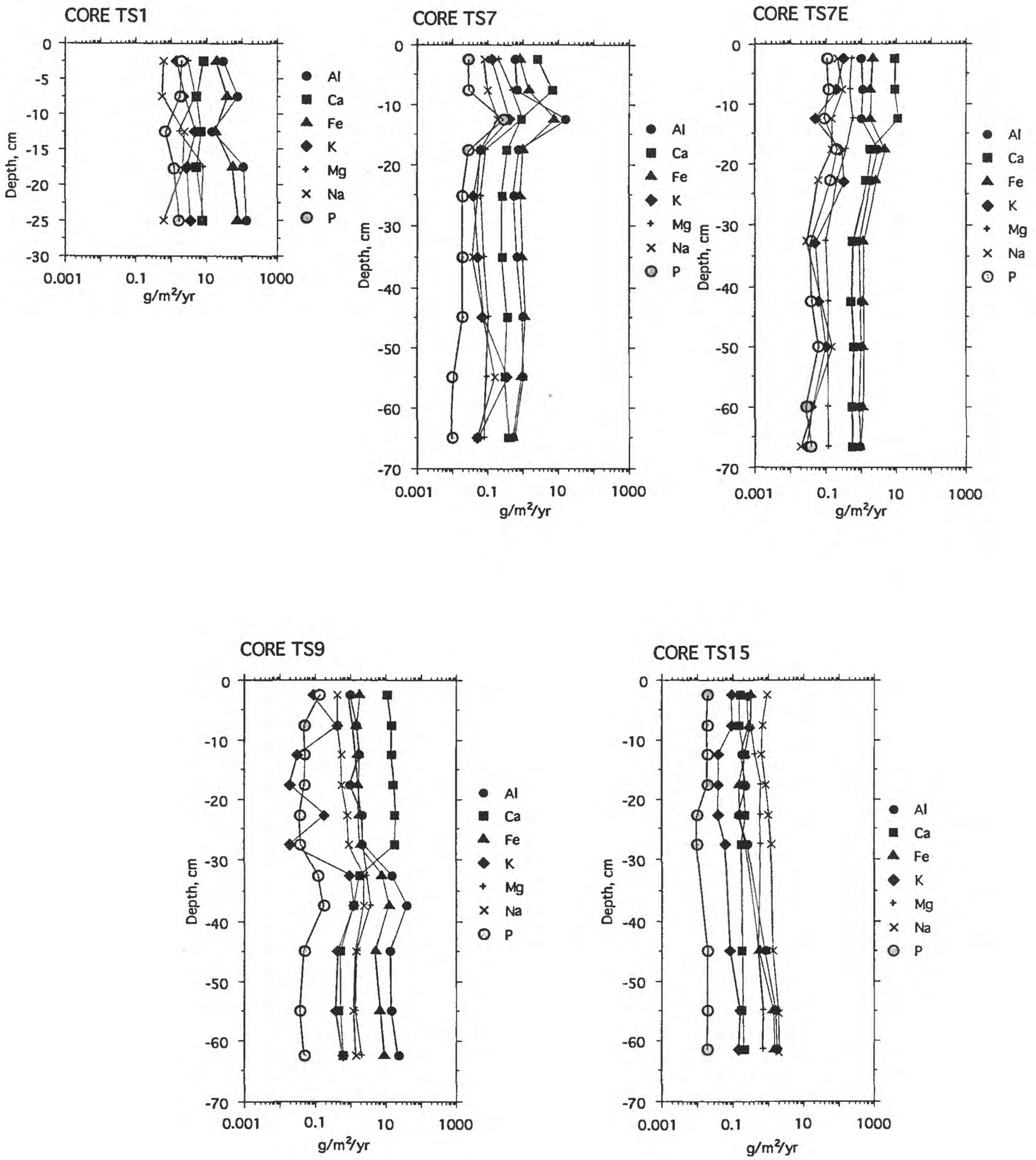

CORE TS1
CORE TS7
CORE TS7E
CORE TS9
CORE TS15
Depth, cm
g/m²/yr
0
-5
-10
-15
-20
-25
-30
-40
-50
-60
-70
0.001
0.1
10
1000
Al
Ca
Fe
K
Mg
Na
P

Figure 8.

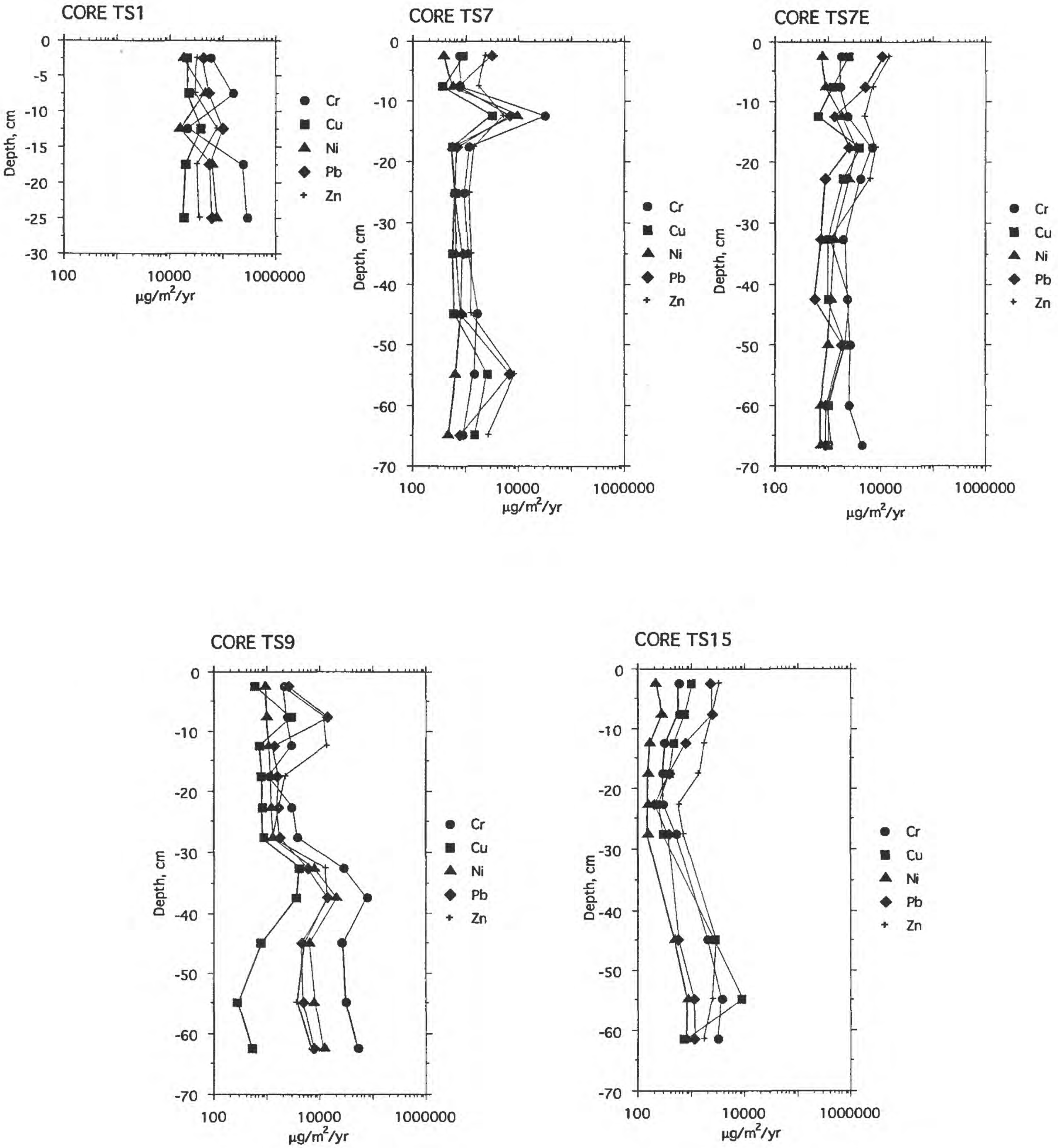

CORE TS1
Depth, cm
μg/m²/yr
CORE TS7
Depth, cm
μg/m²/yr
CORE TS7E
Depth, cm
μg/m²/yr
CORE TS9
Depth, cm
μg/m²/yr
CORE TS15
Depth, cm
μg/m²/yr
● Cr
■ Cu
▲ Ni
◆ Pb
+ Zn
0
-5
-10
-15
-20
-25
-30
-40
-50
-60
-70
100
10000
1000000

Figure 9.

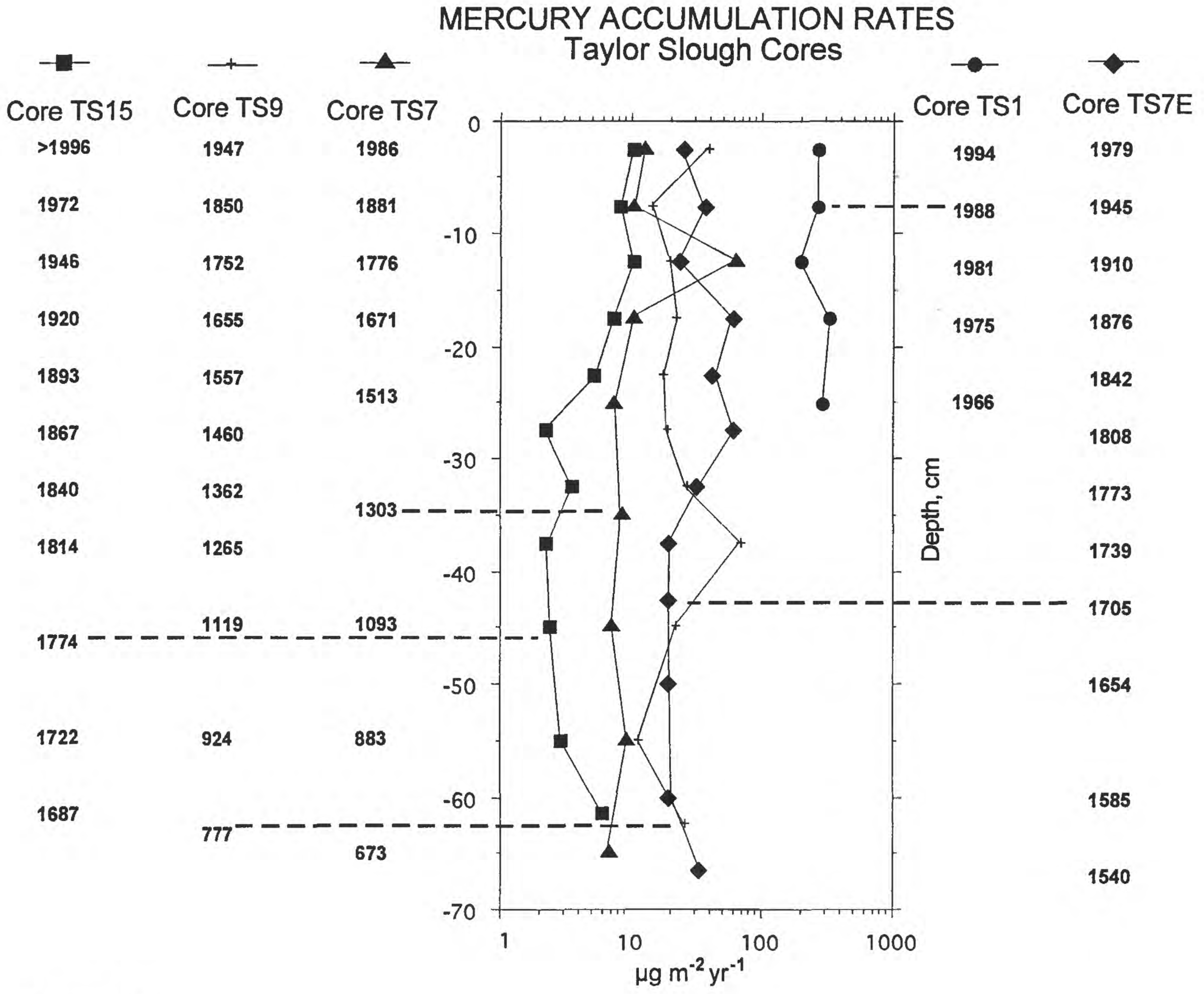

MERCURY ACCUMULATION RATES
Taylor Slough Cores
Core TS15
>1996
1972
1946
1920
1893
1867
1840
1814
1774
1722
1687
Core TS9
1947
1850
1752
1655
1557
1460
1362
1265
1119
924
777
Core TS7
1986
1881
1776
1671
1513
1303
1093
883
673
Core TS1
1994
1988
1981
1975
1966
Core TS7E
1979
1945
1910
1876
1842
1808
1773
1739
1705
1654
1585
1540
Depth, cm
0
-10
-20
-30
-40
-50
-60
-70
1
10
100
1000
µg m-2 yr-1

Figure 10.

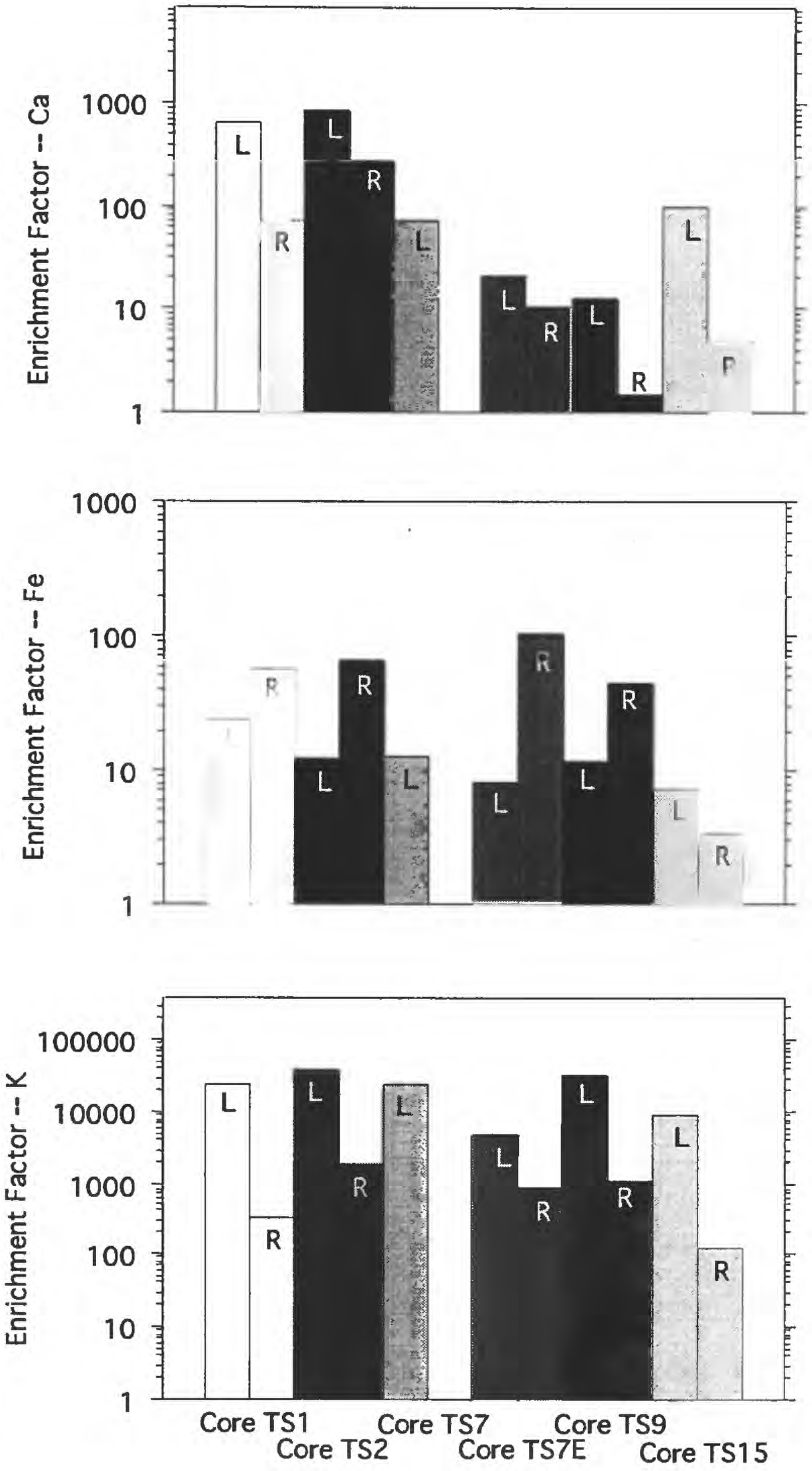

Enrichment Factor -- Ca
1000
100
10
1
L
R
L
R
L
L
R
L
R
L
R
Enrichment Factor -- Fe
1000
100
10
1
R
R
L
L
R
L
R
L
L
R
Enrichment Factor -- K
100000
10000
1000
100
10
1
L
R
L
R
L
L
R
L
R
L
R
Core TS1
Core TS2
Core TS7
Core TS7E
Core TS9
Core TS15

Figure 11A.

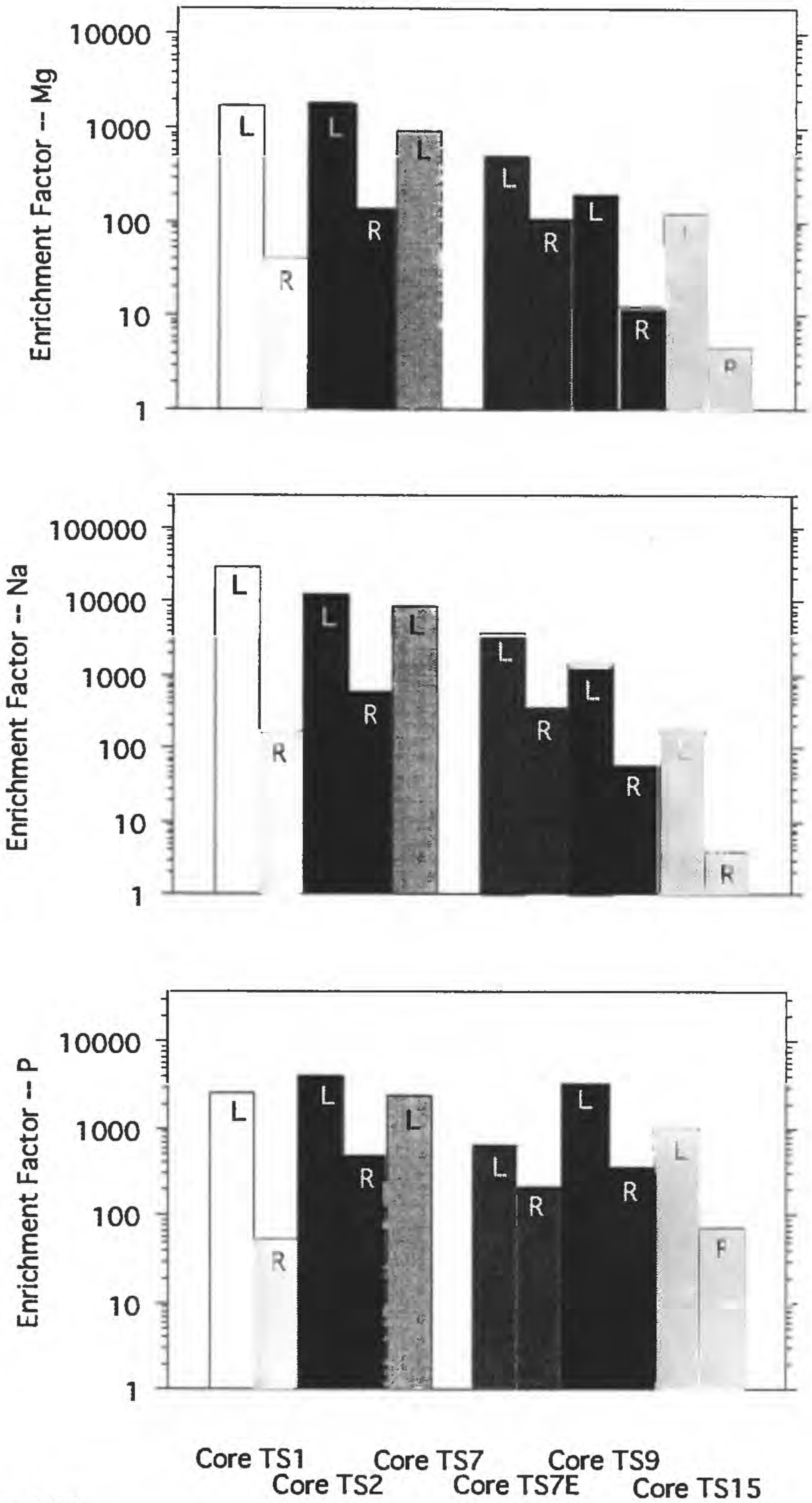

Enrichment Factor -- Mg
10000
1000
100
10
1
Enrichment Factor -- Na
100000
10000
1000
100
10
1
Enrichment Factor -- P
10000
1000
100
10
1
L
R
Core TS1
Core TS2
Core TS7
Core TS7E
Core TS9
Core TS15

Figure 11B.

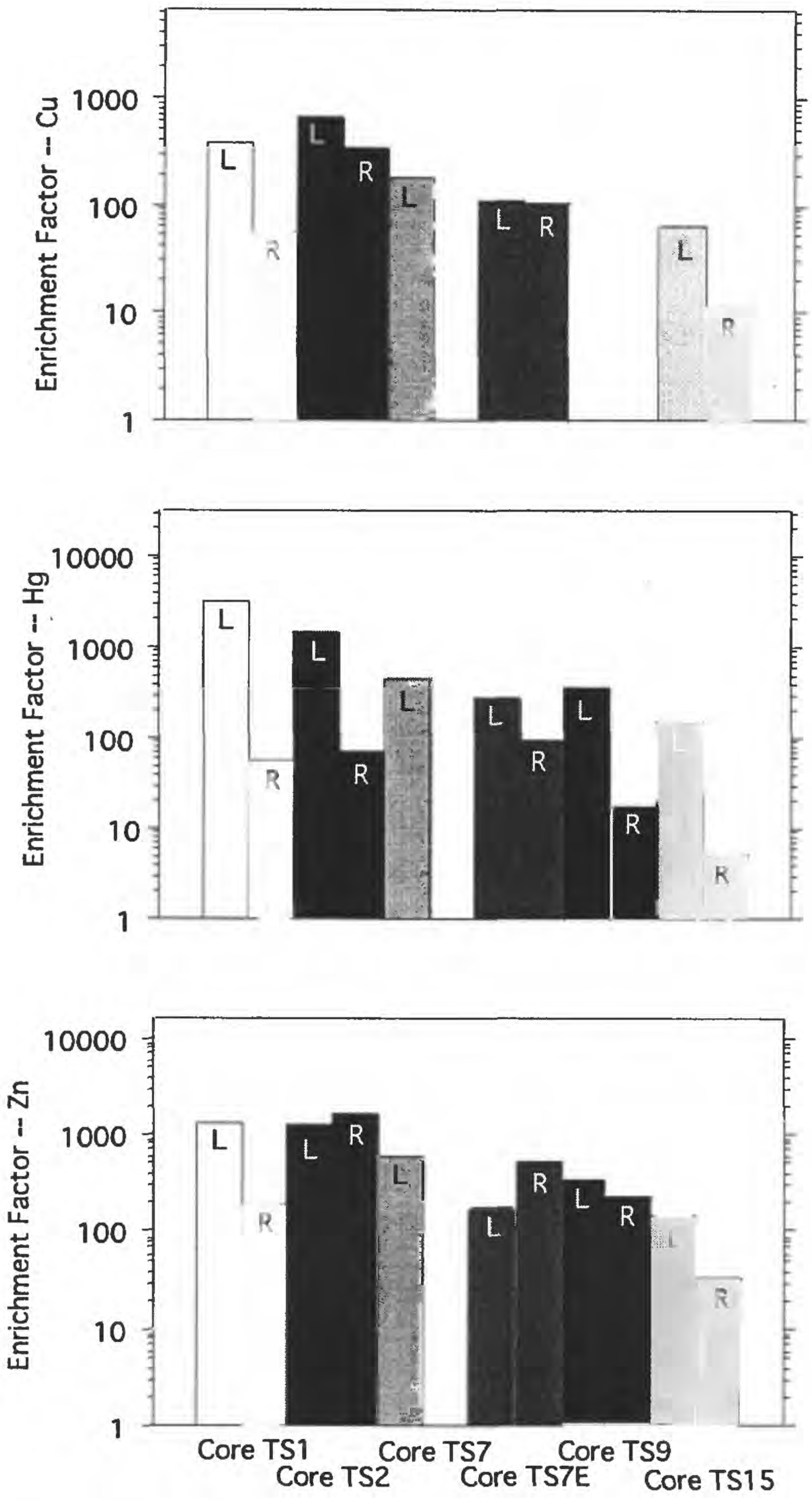
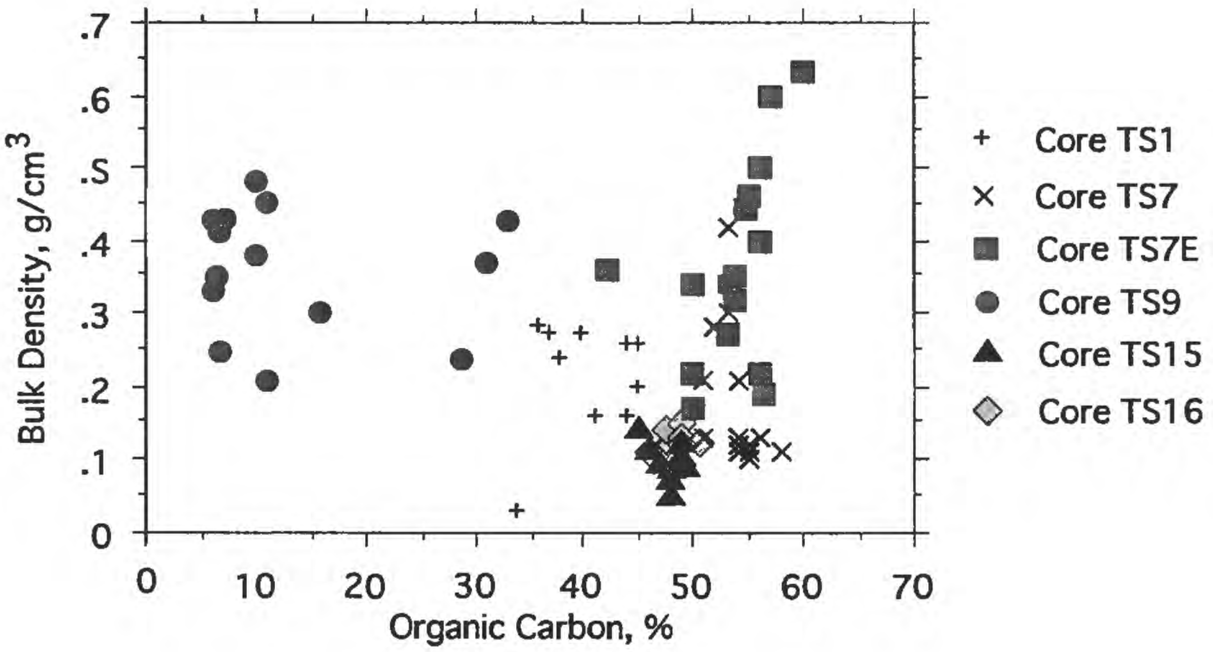

Enrichment Factor -- Cu
1000
100
10
1
Enrichment Factor -- Hg
10000
1000
100
10
1
Enrichment Factor -- Zn
10000
1000
100
10
1
L
R
Core TS1
Core TS2
Core TS7
Core TS7E
Core TS9
Core TS15

Figure 11C.



.7
.6
.5
.4
.3
.2
.1
0
Bulk Density, g/cm3
0
10
20
30
40
50
60
70
Organic Carbon, %
+ Core TS1
× Core TS7
■ Core TS7E
● Core TS9
▲ Core TS15
◇ Core TS16

Figure 12.

Table 1. Sample identification, location, sampling date, and general description of study sites in Taylor Slough, Florida, May 1996.

[site no. keyed to fig. 2; *, sites emphasized in this report; Sed, sediment (from core); SL, sawgrass leaf tissue; SR, sawgrass root tissue; W, surface water]

Site no.	Field ID	N latitude	W longitude	Sample type	Date collected	General comments
*TS1	51796-1	25 24.999	80 35.679	Sed, SL, SR	5/17/96	Cores 1, 2, 3, 4; northern-most site near pump station; sawgrass moderate
*TS2	52296-19	25 24.306	80 36.377	Sed, SL, SR, W	5/22/96	Cores 15, 16, 17, 18; 0.5 km north of ENP main road near bridge over Taylor Slough; sawgrass dense
TS7W	52496-31	25 17.419	80 40.496	Sed, SL, SR, W	5/24/96	Cores 31, 32; western slough fringe; sawgrass moderate
*TS7	51796-5	25 17.231	80 38.788	Sed, SL, SR	5/17/96	Cores 5, 6, 11, 12; center of slough, scattered red mangrove; sawgrass moderate
*TS7E	52096-14	25 17.231	80 38.780	Sed, SL, SR W	5/20/96	Cores 13, 14, 30; eastern slough fringe; sawgrass moderate
*TS9	52096-10	25 14.230	80 40.936	Sed, Sl, SR, W	5/20/96	Cores 7, 8, 9, 10; upper terminus of dense, red mangrove; sawgrass in distinct hummocks on slough fringe
*TS15	52496-23	25 12.119	80 41.189	Sed, SL, SR, W	5/24/96	Cores 22, 23, 24, 25; slough center about 3 km north of Little Madeira Bay; sawgrass in distinct hummocks, dense; abundant red mangrove
TS16	52496-27	25 11.722	80 39.842	Sed, SL, SR	5/24/96	Cores 26, 27, 28, 29; east of TS15 closer to Taylor Cr.; sawgrass in distinct hummocks, dense; abundant red mangrove

Table 2. Analytical methods and the approximate lower limits of determination for the concentration of elements in plants, organic-rich sediments, and water.

	ICP-AES		ICP-MS
Element	Plant*	Sediment**	Water
Al	0.01%	0.005%	NA
Ca	0.01%	0.005%	NA
Fe	0.01%	0.005%	NA
Mg	0.01%	0.005%	NA
Na	0.01%	0.005%	NA
P	0.01%	0.005%	NA
Ti	0.01%	0.005%	NA
K	0.10%	0.005%	NA
Ag	4 ppm	2 ppm	4 ppb
As	20 ppm	10 ppm	1 ppb
Au	20 ppm	8 ppm	0.1 ppb
B	NA	NA	NA
Ba	2ppm	1ppm	0.5ppb
Be	2ppm	1ppm	0.1ppb
Bi	20ppm	10ppm	0.7ppb
Cd	4ppm	2ppm	0.2ppm
Ce	8ppm	5ppm	0.1ppb
Co	2ppm	2ppm	0.1ppb
Cr	2ppm	2ppm	0.5ppb
Cu	2ppm	2ppm	2.0ppb
Eu	4ppm	2ppm	0.1ppb
Ga	8ppm	4ppm	0.3ppb
Ge	NA	NA	0.3ppb
Ho	8ppm	4ppm	0.1ppb
La	4ppm	2ppm	0.1ppb
Li	4ppm	2ppm	2ppb
Mn	8ppm	4ppm	0.5ppb
Mo	4ppm	2ppm	0.1ppb
Nb	8ppm	4ppm	0.2ppb
Nd	8ppm	9ppm	0.2ppb
Ni	4ppm	3ppm	0.5ppb
Pb	8ppm	4ppm	0.3ppb
Sc	4ppm	2ppm	0.8ppb
Si	NA	NA	NA
Sn	20ppm	5ppm	0.2ppb
Sr	4ppm	2ppm	1.0ppb
Ta	80ppm	40ppm	0.1ppb
Th	8ppm	6ppm	1ppb
U	200ppm	100ppm	0.1ppb
V	4ppm	2ppm	0.5ppb
W	NA	NA	0.1ppb
Y	4ppm	2ppm	0.8ppb
Yb	2ppm	1ppm	0.7ppb
Zn	4ppm	2ppm	4.0ppb
Zr	NA	NA	0.1ppb

	Cold Vapor AA		
Element	Plant**	Sediment**	Water
Hg	20ppb	20ppb	0.2ppb

* concentrations are on an ash weight basis; ** concentrations are on a dry weight basis
NA = not applicable (either not determined or data obtained was not used in this study)
% = percent; ppb = parts per billion (µg/L or µg/kg); ppm = parts per million (mg/L or µg/g)

Table 3.--Quality control for the inductively coupled plasma-atomic emission spectrometry analysis of organic-rich sediment material.

Laboratory number	LLD[1]	2	0.005	10	8	1	1	10	0.005
	Element	Ag, ppm	Al, %	As, ppm	Au, ppm	Ba, ppm	Be, ppm	Bi, ppm	Ca, %
	Mean	3.1	6.3	43	--	805	2.7	--	0.55
	%RSD[2]	22%	2%	11%	--	3%	18%	--	4%
	Target Value[3]	3.1	6.09	37	0.345	764	2.4	1.33	0.58
	% Difference[4]	1.4	2.2	17%	--	5.3%	13%	--	-5%
C-100587	SAR-M[5]	3.0	6.1	39	<8	781	2.0	<10	0.53
C-100595	SAR-M[5]	2.0	6.1	38	<8	788	2.0	<10	0.53
C-100610	SAR-M[5]	3.0	6.4	45	<8	818	3.0	<10	0.56
C-100622	SAR-M[5]	3.0	6.3	49	<8	807	3.0	<10	0.58
C-100636	SAR-M[5]	3.0	6.4	50	<8	838	3.0	<10	0.57
C-100650	SAR-M[5]	4.0	6.2	41	<8	789	3.0	<10	0.55
C-100665	SAR-M[5]	4.0	6.3	40	<8	813	3.0	<10	0.56

Laboratory number	LLD[1]	2	5	2	2	2	2	0.005	4
	Element	Cd, ppm	Ce, ppm	Co, ppm	Cr, ppm	Cu, ppm	Eu, ppm	Fe, %	Ga, ppm
	Mean	3.7	122	11	89	340	--	4.30	23
	%RSD[2]	13%	4%	7%	11%	3%	--	3%	12%
	Target Value[3]	4.8	120	11	101	320	0.67	3.2	20
	% Difference[4]	-23%	2%	0%	-12%	6.3%	--	4.4	14%
C-100587	SAR-M[5]	3.0	116	10	93	325	<2	3.22	23
C-100595	SAR-M[5]	3.0	122	10	88	329	<2	3.26	18
C-100610	SAR-M[5]	4.0	125	11	67	342	2	3.38	23
C-100622	SAR-M[5]	4.0	125	12	91	351	2	3.47	26
C-100636	SAR-M[5]	4.0	126	12	97	350	<2	3.44	26
C-100650	SAR-M[5]	4.0	116	11	93	334	2	3.36	22
C-100665	SAR-M[5]	4.0	125	11	92	350	<2	3.40	22

Laboratory number	LLD[1]	4	0.005	2	2	0.005	4	2	0.005
	Element	Ho, ppm	K, %	La, ppm	Li, ppm	Mg, %	Mn, ppm	Mo, ppm	Na, %
	Mean	--	3.10	54	34	0.457	5450	13.0	1.20
	%RSD[2]	--	9%	3%	6%	3%	2%	7%	2%
	Target Value[3]	1.7	2.9	61	30	0.5	5200	12	1.19
	% Difference[4]	--	5.9%	-11%	13.3%	-4.0%	4.8%	13.1%	-0.8%
C-100587	SAR-M[5]	<4	3.13	51	32	0.462	5280	12.0	1.16
C-100595	SAR-M[5]	<4	3.19	56	32	0.467	5330	13.0	1.17
C-100610	SAR-M[5]	<4	3.23	56	37	0.488	5440	13.0	1.23
C-100622	SAR-M[5]	<4	3.20	55	34	0.485	5520	14.0	1.19
C-100636	SAR-M[5]	<4	3.22	56	36	0.499	5530	15.0	1.20
C-100650	SAR-M[5]	<4	3.18	53	33	0.473	5450	14.0	1.16
C-100665	SAR-M[5]	<4	2.49	54	34	0.485	5590	14.0	1.16

[1] LLD, lower limit of analytical determination (ppm or percent).

[2] Percent relative standard deviation.

[3] Value considered most acceptable by USGS quality control staff.

[4] Percent difference between mean and target values. Anything >20% must be interpreted with caution.

[5] Analytical value for USGS blind, standard reference materials.

Laboratory number	LLD[1]	4	9	3	0.005	4	2	5
	Element	Nb, ppm	Nd, ppm	Ni, ppm	P, %	Pb, ppm	Sc, ppm	Sn, ppm
	Mean	35	55	43	0.100	1020	8	--
	%RSD[2]	13%	9%	3%	3%	3%	11%	--
	Target Value[3]	31	51	41	0.08	960	8.3	9.4
	% Difference[4]	15.2%	8.7%	3.8%	-13.6%	6.1%	-0.2%	--
C-100587	SAR-M[5]	33	46	41	0.067	984	7	<5
C-100595	SAR-M[5]	27	51	42	0.068	994	7	<5
C-100610	SAR-M[5]	39	58	42	0.070	1050	9	6
C-100622	SAR-M[5]	39	58	44	0.072	1030	9	<5
C-100636	SAR-M[5]	39	58	44	0.072	1050	9	<5
C-100650	SAR-M[5]	34	59	42	0.068	990	8	5
C-100665	SAR-M[5]	39	58	43	0.067	1030	9	<5

Laboratory number	LLD[1]	2	40	6	0.005	100	2	2
	Element	Sr, ppm	Ta, ppm	Th, ppm	Ti, ppm	U, ppm	V, ppm	Y, ppm
	Mean	147	--	19	0.293	--	66	30
	%RSD[2]	3%	--	8%	16%	--	3%	9%
	Target Value[3]	156	1.3	18	0.35	2.6	66	33
	% Difference[4]	-5.8%	--	4.0%	-3.1%	--	-0.4%	-9.5%
C-100587	SAR-M[5]	141	<40	17	0.302	<100	62	28
C-100595	SAR-M[5]	142	<40	18	0.298	<100	64	25
C-100610	SAR-M[5]	148	<40	20	0.359	<100	68	31
C-100622	SAR-M[5]	148	<40	19	0.363	<100	67	31
C-100636	SAR-M[5]	150	<40	21	0.350	<100	68	33
C-100650	SAR-M[5]	149	<40	17	0.354	<100	65	29
C-100665	SAR-M[5]	151	<40	19	0.348	<100	66	32

Laboratory number	LLD[1]	1	2
	Element	Yb, ppm	Zn, ppm
	Mean	3	990
	%RSD[2]	15%	3%
	Target Value[3]	3.2	890
	% Difference[4]	2.7%	11.5%
C-100587	SAR-M[5]	3	965
C-100595	SAR-M[5]	3	938
C-100610	SAR-M[5]	3	1020
C-100622	SAR-M[5]	3	1010
C-100636	SAR-M[5]	4	1020
C-100650	SAR-M[5]	3	970
C-100665	SAR-M[5]	4	1010

Table 4. Quality control for the inductively coupled plasma-atomic emission spectrometry analysis of plant material.

[Standard reference materials are identified by NIST ID number and by laboratory number; Analysis 1 and Analysis 2 are duplicate analyses of a sawgrass leaf sample from the study area; values in parentheses are non-certified; % R is the percent difference between the certified and determined values]

Element	Determined Value	Certified value	% R	Determined value	Certified value	% R	Analysis 1	Analysis 2
	NIST 1547 "peach leaves"			NIST 1575 "pine needles"			Sample no.: F-012743	
Al, %	0.01	0.01	<1	0.06	0.05	-5	0.18	0.18
As, ppm	2.6	3.1	17	<20	0.21	--	<20	<20
Ba, ppm	21	21	<1	9.36	--	--	128	128
Be, ppm	<2	--	--	<2	--	--	<2	<2
Bi, ppm	<2	--	--	<2	--	--	<20	<20
Ca, %	3.3	3.2	-4	0.41	0.41	<1	24	25
Cd, ppm	<0.4	0.03	--	<0.4	(<0.5)	--	<4	<4
Ce, ppm	<8	0.28	--	<8	(0.40)	--	<8	<8
Co, ppm	0.21	(0.02)	--	0.21	(0.10)	--	7.0	7.8
Cr, ppm	1.1	0.80	-41	2.7	2.6	-5	13	14
Cu, ppm	19	17	-16	2.8	3.0	5	177	183
Eu, ppm	<0.4	--	--	<0.4	--	--	<4	<4
Fe, %	0.01	0.01	<1	0.02	0.02	<1	4.4	4.4
Ga, ppm	<8	--	--	<8	--	--	<8	<8
Hg, ppm	0.08	0.12	77	--	--	--	0.02	0.02
K, %	2.3	1.8	-29	0.42	0.37	-23	11.7	9.4
La, ppm	<4	(0.19)	--	<4	(0.2)	--	<4	<4
Li, ppm	<4	--	--	0.48	--	--	<4	<4
Mg, %	0.58	0.58	1	0.11	--	--	1.7	1.7
Mn, ppm	23	23	2	678	675	<1	470	460
Mo, ppm	<0.4	--	--	<0.4	--	--	20	20
Na, %	0.04	0.02	-170	0.01	--	--	1.5	1.8
Nd, ppm	4.20	--	--	0.80	--	--	32	33
Ni, ppm	0.63	0.60	-4	2.4	(3.5)	--	8.0	8.2
P, %	0.15	0.13	-16	0.12	0.12	<1	1.1	1.1
Pb, ppm	12	13	6	9.3	10.8	14	7.3	8.4
Sc, ppm	<4	--	--	<4	--	--	<4	<4
Sr, ppm	108	100	-8	4.9	4.8	-1	1180	1190
Ti, %	--	--	--	--	--	--	<0.01	<0.01
V, ppm	<0.4	--	--	0.43	--	--	28	28
Y, ppm	<4	--	--	<4	--	--	<4	<4
Yb, ppm	<2	--	--	<2	--	--	<2	<2
Zn, ppm	28	29	5	58	--	--	1380	1380

Table 5.--Quality control for the cold vapor atomic absorption spectrometry analysis of mercury in organic-rich sediment material.

[--, not determined]

Laboratry number	Job number	Standard ref. material[1]	Certified value (ppm)	Determined value (ppm)	Standard ref. material[2]	Certified value (ppm)	Determined value (ppm)
F-017055	WP48	SAR-M	0.141	0.13	SRM 1572	0.08	0.085
F-017060	WP49	SAR-M	0.141	0.11	SRM 1572	0.08	0.085
F-017074	WP50	SAR-M	0.141	0.10	SRM 1572	0.08	0.085
F-017084	WP51	SAR-M	0.141	0.10	SRM 1572	0.08	0.11
F-017096	WP52	SAR-M	0.141	0.09	SRM 1572	0.08	0.11
F-017108	WP53	SAR-M	0.141	--	SRM 1572	0.08	0.11
F-017121	WP54	SAR-M	0.141	0.10	SRM 1572	0.08	0.11

[1] Internal USGS blind standard reference material; Animas River sediment, moderately mineralized

[2] National Bureau of Standards, 1983 (pine needles)

Table 6.-Chemical analysis results for the concentration of elements in organic-rich sediment core samples.

[Concentrations are expressed on a dry weight basis; see figure 2 for location of core sampling sites; arithmetic means and standard deviations are calculated using the entire core for those elements without censoring (no LLD values); intvl. = interval in cm]

FieldNo	Core Intvl.	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	B, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
		Core TS1, Taylor Slough																	
596-RK1	0-5	1.9	5.2	1.3	0.09	0.17	0.04	0.12	0.08	92	< 2	< 10	< 8	-	57	< 1	< 10	< 2	16
596-RK2	5-10	3.8	2.7	2.0	0.11	0.26	0.03	0.09	0.19	61	< 2	< 10	< 8	-	72	1	< 10	< 2	36
596-RK3	10-15	0.66	3.1	0.80	0.22	0.08	0.11	0.03	0.03	225	< 2	< 10	< 8	-	64	< 1	< 10	< 2	6
596-RK4	15-19	5.6	2.4	2.7	0.14	0.37	0.10	0.08	0.28	75	< 2	< 10	< 8	-	83	2	< 10	< 2	55
596-RK5	20-30	6.3	3.7	3.5	0.16	0.40	0.03	0.08	0.31	105	< 2	< 10	< 8	-	86	2	< 10	< 2	64
Arithmetic mean		3.7	3.4	2.1	0.14	0.26	0.06	0.08	0.18	112	-	-	-	-	72	-	-	-	35
Standard dev.		2.4	1.1	1.1	0.05	0.13	0.04	0.03	0.12	66	-	-	-	-	12	-	-	-	25
		Core TS2, Taylor Slough																	
596-RK6	2-5	2.1	3.7	1.1	0.12	0.18	0.06	0.07	0.10	68	< 2	< 10	< 8	-	73	< 1	< 10	< 2	23
596-RK7	5-8	2.2	2.7	0.99	0.07	0.18	0.06	0.06	0.10	45	< 2	< 10	< 8	-	54	< 1	< 10	< 2	23
596-RK8	8-11	3.2	2.5	1.2	0.10	0.24	0.05	0.07	0.16	59	< 2	< 10	< 8	-	66	< 1	< 10	< 2	37
596-RK9	11-14	4.9	2.1	1.6	0.20	0.34	0.07	0.07	0.24	186	< 2	< 10	< 8	-	102	1	< 10	< 2	56
596-RK10	14-17	3.9	2.0	1.9	0.11	0.28	0.06	0.08	0.19	72	< 2	< 10	< 8	-	75	< 1	< 10	< 2	42
596-RK11	17-20	4.1	1.6	1.8	0.13	0.30	0.05	0.06	0.21	70	< 2	< 10	< 8	-	82	1	< 10	< 2	49
596-RK12	20-25	6.1	1.3	2.0	0.18	0.40	0.05	0.04	0.31	96	< 2	< 10	< 8	-	116	2	< 10	< 2	79
596-RK13	25-30	8.1	1.1	2.6	0.24	0.52	0.07	0.04	0.43	115	< 2	12	< 8	-	130	3	< 10	< 2	97
596-RK14	30-35	9.0	1.2	2.5	0.25	0.56	0.05	0.04	0.47	112	< 2	< 10	< 8	-	140	3	< 10	< 2	111
596-RK15	35-40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
596-RK16	45-55	9.3	1.0	2.9	0.26	0.59	0.05	0.03	0.48	133	< 2	15	< 8	-	153	3	< 10	< 2	107
596-RK17	55-65	9.8	0.96	3.1	0.30	0.61	0.06	0.02	0.51	143	< 2	12	< 8	-	163	3	< 10	< 2	108
Arithmetic mean		5.7	1.83	2.0	0.18	0.38	0.06	0.05	0.29	100	-	-	-	-	105	-	-	-	67
Standard dev.		2.9	0.87	0.7	0.08	0.18	0.01	0.02	0.16	43	-	-	-	-	38	-	-	-	35
		Core TS7, Taylor Slough																	
596-RK18	0-5	0.46	20	0.62	0.10	0.16	0.08	0.02	0.02	128	< 2	< 10	< 8	-	57	< 1	< 10	< 2	< 5
596-RK19	5-10	0.27	26	0.38	0.01	0.19	0.04	0.01	0.01	70	< 2	< 10	< 8	-	28	< 1	< 10	< 2	< 5
596-RK20	10-15	5.0	2.8	2.4	0.14	0.32	0.06	0.09	0.25	68	< 2	< 10	< 8	-	90	2	< 10	< 2	49
596-RK21	15-20	0.67	3.1	0.86	0.05	0.08	0.05	0.03	0.03	35	< 2	< 10	< 8	-	44	< 1	< 10	< 2	6
596-RK22	20-30	0.56	2.5	0.75	0.04	0.07	0.05	0.02	0.02	17	< 2	< 10	< 8	-	38	< 1	< 10	< 2	< 5
596-RK23	30-40	0.64	2.5	0.79	0.05	0.07	0.04	0.02	0.03	34	< 2	< 10	< 8	-	34	< 1	< 10	< 2	< 5
596-RK24	40-50	0.82	2.9	0.91	0.06	0.09	0.02	0.02	0.04	20	< 2	< 10	< 8	-	32	< 1	< 10	< 2	< 5
596-RK25	50-60	0.78	2.4	0.68	0.26	0.08	0.12	0.01	0.04	280	< 2	< 10	< 8	-	78	< 1	< 10	< 2	8
596-RK26	60-70	0.47	3.4	0.45	0.04	0.07	0.04	0.009	0.02	83	< 2	< 10	< 8	-	37	< 1	< 10	< 2	< 5
Arithmetic mean		1.1	7.3	0.87	0.08	0.13	0.06	0.025	0.05	82	-	-	-	-	49	-	-	-	-
Standard dev.		1.5	9.0	0.60	0.08	0.09	0.03	0.025	0.08	82	-	-	-	-	22	-	-	-	-

FieldNo	Core Intvl.	Co, ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ge, ppm	Hg, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm
Core TS1, Taylor Slough																		
596-RK1	0-5	2	39	14	< 2	4	-	0.17	< 4	9	26	2	6	10	13	28	3	< 5
596-RK2	5-10	< 2	82	12	< 2	4	-	0.14	< 4	18	58	< 2	11	20	24	25	6	< 5
596-RK3	10-15	< 2	10	17	< 2	< 4	-	0.09	< 4	4	3	< 2	4	< 9	7	45	< 2	< 5
596-RK4	15-19	3	117	10	< 2	7	-	0.16	< 4	26	92	< 2	18	26	31	27	9	< 5
596-RK5	20-30	3	138	9	< 2	10	-	0.14	< 4	31	109	< 2	18	29	36	30	11	< 5
Arithmetic mean		-	77	12	-	-	-	0.14	-	18	58	-	11	-	22	31	-	-
Standard dev.		-	53	3	-	-	-	0.03	-	11	44	-	7	-	12	8	-	-
Core TS2, Taylor Slough																		
596-RK6	2-5	2	42	17	< 2	4	-	0.26	< 4	11	27	2	6	12	14	27	3	< 5
596-RK7	5-8	3	46	13	< 2	4	-	0.25	< 4	11	28	< 2	6	12	14	28	4	< 5
596-RK8	8-11	2	63	13	< 2	5	-	0.22	< 4	16	43	< 2	9	15	19	34	5	< 5
596-RK9	11-14	3	96	19	< 2	< 4	-	0.18	< 4	26	67	< 2	16	26	28	49	8	< 5
596-RK10	14-17	2	76	11	< 2	8	-	0.17	< 4	19	53	< 2	11	20	21	20	6	< 5
596-RK11	17-20	2	81	9	< 2	< 4	-	0.20	< 4	23	60	< 2	10	26	22	18	7	< 5
596-RK12	20-25	4	122	14	< 2	9	-	0.17	< 4	36	90	< 2	16	40	33	27	11	< 5
596-RK13	25-30	5	167	8	2	7	-	0.16	< 4	43	124	< 2	24	48	44	32	15	7
596-RK14	30-35	5	181	9	3	10	-	0.13	< 4	50	141	< 2	22	56	47	36	17	6
596-RK15	35-40	-	-	-	-	-	-	0.09	-	-	-	-	-	-	-	-	-	-
596-RK16	45-55	7	194	9	3	8	-	0.12	< 4	46	134	< 2	24	50	50	38	18	8
596-RK17	55-65	7	201	7	3	12	-	0.10	< 4	46	133	< 2	25	54	52	40	19	9
Arithmetic mean		4	115	12	-	-	-	0.17	-	30	82	-	15	33	31	32	10	-
Standard dev.		2	60	4	-	-	-	0.06	-	15	44	-	7	17	15	9	6	-
Core TS7, Taylor Slough																		
596-RK18	0-5	< 2	6	7	< 2	< 4	-	0.10	< 4	< 2	4	< 2	< 4	< 9	3	25	< 2	< 5
596-RK19	5-10	< 2	3	< 2	< 2	< 4	-	0.04	< 4	< 2	5	< 2	< 4	< 9	< 3	< 4	< 2	< 5
596-RK20	10-15	3	101	10	< 2	9	-	0.20	< 4	24	78	< 2	12	28	29	22	9	< 5
596-RK21	15-20	< 2	10	5	< 2	< 4	-	0.09	< 4	3	5	< 2	< 4	< 9	5	6	< 2	< 5
596-RK22	20-30	< 2	9	6	< 2	< 4	-	0.07	< 4	3	4	< 2	< 4	< 9	6	6	< 2	< 5
596-RK23	30-40	< 2	10	5	< 2	< 4	-	0.08	< 4	3	4	< 2	< 4	< 9	6	8	< 2	< 5
596-RK24	40-50	< 2	14	5	< 2	< 4	-	0.06	< 4	4	7	< 2	< 4	< 9	7	7	< 2	< 5
596-RK25	50-60	< 2	11	20	< 2	< 4	-	0.07	< 4	4	5	< 2	5	< 9	5	51	< 2	< 5
596-RK26	60-70	< 2	8	13	< 2	< 4	-	0.06	< 4	< 2	3	< 2	< 4	< 9	4	7	< 2	< 5
Arithmetic mean		-	19	9	-	-	-	0.09	-	-	13	-	-	-	-	-	-	-
Standard dev.		-	31	5	-	-	-	0.05	-	-	24	-	-	-	-	-	-	-

FieldNo	Core Intvl.	Sr, ppm	Ta, ppm	Th, ppm	U, ppm	V, ppm	W, ppm	Y, ppm	Yb, ppm	Zn, ppm	Zr, ppm
Core TS1, Taylor Slough											
596-RK1	0-5	263	< 40	< 6	< 100	37	-	10	< 1	27	-
596-RK2	5-10	200	< 40	< 6	< 100	61	-	20	2	14	-
596-RK3	10-15	126	< 40	< 6	< 100	10	-	2	< 1	44	-
596-RK4	15-19	187	< 40	8	< 100	78	-	28	2	17	-
596-RK5	20-30	204	< 40	9	< 100	87	-	34	3	18	-
Arithmetic mean		196	-	-	-	55	-	19	-	24	-
Standard dev.		49	-	-	-	31	-	13	-	12	-
Core TS2, Taylor Slough											
596-RK6	2-5	152	< 40	< 6	< 100	33	-	11	< 1	40	-
596-RK7	5-8	128	< 40	< 6	< 100	36	-	13	1	22	-
596-RK8	8-11	150	< 40	< 6	< 100	54	-	17	1	14	-
596-RK9	11-14	145	< 40	8	< 100	61	-	25	2	33	-
596-RK10	14-17	130	< 40	< 6	< 100	65	-	19	2	15	-
596-RK11	17-20	116	< 40	6	< 100	60	-	25	2	13	-
596-RK12	20-25	103	< 40	11	< 100	72	-	40	3	17	-
596-RK13	25-30	109	< 40	15	< 100	85	-	49	4	20	-
596-RK14	30-35	115	< 40	16	< 100	85	-	56	4	21	-
596-RK15	35-40	-	-	-	-	-	-	-	-	-	-
596-RK16	45-55	104	< 40	17	< 100	107	-	53	4	24	-
596-RK17	55-65	101	< 40	18	< 100	122	-	54	5	26	-
Arithmetic mean		123	-	-	-	71	-	33	-	22	-
Standard dev.		19	-	-	-	27	-	18	-	8	-
Core TS7, Taylor Slough											
596-RK18	0-5	413	< 40	< 6	< 100	8	-	< 2	< 1	25	-
596-RK19	5-10	558	< 40	< 6	< 100	4	-	< 2	< 1	7	-
596-RK20	10-15	195	< 40	8	< 100	74	-	30	2	17	-
596-RK21	15-20	138	< 40	< 6	< 100	13	-	3	< 1	10	-
596-RK22	20-30	126	< 40	< 6	< 100	12	-	< 2	< 1	12	-
596-RK23	30-40	133	< 40	< 6	< 100	15	-	3	< 1	12	-
596-RK24	40-50	160	< 40	< 6	< 100	20	-	3	< 1	11	-
596-RK25	50-60	131	< 40	< 6	< 100	12	-	3	< 1	54	-
596-RK26	60-70	154	< 40	< 6	< 100	7	-	< 2	< 1	25	-
Arithmetic mean		223	-	-	-	18	-	-	-	19	-
Standard dev.		155	-	-	-	21	-	-	-	15	-

FieldNo	Core Intvl.	Al, %	Ca, %	Fe, %	K, %	Mg, %	Na, %	P, %	Ti, %	Mn, ppm	Ag, ppm	As, ppm	Au, ppm	B, ppm	Ba, ppm	Be, ppm	Bi, ppm	Cd, ppm	Ce, ppm
		Core TS9, Taylor Slough																	
596-RK27	0-5	0.23	25	0.41	0.02	0.19	0.10	0.03	0.01	115	< 2	< 10	< 8	-	24	< 1	< 10	< 2	< 5
596-RK28	5-10	0.31	30	0.30	0.09	0.26	0.09	0.01	0.01	213	< 2	< 10	< 8	-	36	< 1	< 10	< 2	< 5
596-RK29	10-15	0.36	29	0.31	0.01	0.29	0.11	0.009	0.02	86	< 2	< 10	< 8	-	22	< 1	< 10	< 2	< 5
596-RK30	15-20	0.18	30	0.29	< 0.005	0.32	0.10	0.009	0.009	79	< 2	< 10	< 8	-	21	< 1	< 10	< 2	< 5
596-RK31	20-25	0.37	29	0.29	0.03	0.36	0.14	0.006	0.02	77	< 2	< 10	< 8	-	28	< 1	< 10	< 2	< 5
596-RK32	25-30	0.35	29	0.32	< 0.005	0.37	0.15	0.006	0.02	81	< 2	< 10	< 8	-	23	< 1	< 10	< 2	< 5
596-RK33	30-35	2.3	3.0	1.3	0.15	0.50	0.40	0.02	0.12	39	< 2	< 10	< 8	-	47	< 1	< 10	< 2	21
596-RK34	35-40	6.6	2.0	2.1	0.21	0.65	0.39	0.03	0.36	84	< 2	< 10	< 8	-	98	2	< 10	< 2	68
596-RK35	40-50	5.2	2.0	2.0	0.17	0.65	0.58	0.02	0.29	69	< 2	< 10	< 8	-	57	1	< 10	< 2	50
596-RK36	50-60	7.6	2.3	3.3	0.19	0.75	0.60	0.02	0.40	108	< 2	18	< 8	-	59	2	< 10	< 2	68
596-RK37	60-65	8.9	2.3	3.5	0.23	0.78	0.57	0.02	0.47	138	< 2	16	< 8	-	82	3	< 10	< 2	79
Arithmetic mean		2.9	17	1.3	-	0.47	0.29	0.02	0.16	99	-	-	-	-	45	-	-	-	-
Standard dev.		3.4	14	1.3	-	0.21	0.22	0.01	0.18	46	-	-	-	-	26	-	-	-	-
		Core TS15, Taylor Slough																	
596-RK38	0-5	0.36	2.2	0.42	0.12	0.49	1.2	0.03	0.02	133	< 2	< 10	< 8	-	37	< 1	< 10	< 2	< 5
596-RK39	5-10	0.42	2.1	0.43	0.13	0.52	1.0	0.03	0.02	148	< 2	< 10	< 8	-	44	< 1	< 10	< 2	6
596-RK40	10-15	0.22	2.8	0.28	0.05	0.53	0.74	0.03	0.01	56	< 2	< 10	< 8	-	28	< 1	< 10	< 2	< 5
596-RK41	15-20	0.26	2.6	0.20	0.06	0.80	1.1	0.03	0.01	18	< 2	< 10	< 8	-	30	< 1	< 10	< 2	< 5
596-RK42	20-25	0.22	2.9	0.21	0.06	0.85	1.3	0.02	0.01	14	< 2	< 10	< 8	-	32	< 1	< 10	< 2	< 5
596-RK43	25-30	0.33	2.4	0.30	0.08	0.83	1.7	0.02	0.02	20	< 2	< 10	< 8	-	25	< 1	< 10	< 2	< 5
596-RK44	30-35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
596-RK45	35-40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
596-RK46	40-50	0.99	2.3	0.72	0.10	0.72	1.6	0.02	0.02	26	< 2	< 10	< 8	-	35	< 1	< 10	< 2	< 5
596-RK47	50-60	1.7	1.8	1.4	0.17	0.81	1.7	0.02	0.09	34	< 2	< 10	< 8	-	42	< 1	< 10	< 2	18
596-RK48	60-63	1.4	2.1	1.4	0.14	0.76	1.6	0.02	0.07	31	< 2	< 10	< 8	-	34	< 1	< 10	< 2	16
Arithmetic mean		0.7	2.4	0.6	0.10	0.70	1.3	0.02	0.03	53	-	-	-	-	34	-	-	-	-
Standard dev.		0.6	0.4	0.5	0.04	0.15	0.3	0.01	0.03	51	-	-	-	-	6	-	-	-	-
		Core TS7E, Taylor Slough																	
596-RK49	0-5	0.28	26	0.58	0.09	0.15	0.07	0.03	0.01	192	< 2	< 10	< 8	-	35	< 1	< 10	< 2	< 5
596-RK50	5-10	0.26	22	0.44	0.05	0.12	0.07	0.03	0.01	123	< 2	< 10	< 8	-	30	< 1	< 10	< 2	< 5
596-RK51	10-15	0.22	24	0.38	0.01	0.14	0.03	0.02	0.009	88	< 2	< 10	< 8	-	18	< 1	< 10	< 2	< 5
596-RK52	15-20	0.62	3.6	0.97	0.05	0.07	0.03	0.04	0.02	19	< 2	< 10	< 8	-	43	< 1	< 10	< 2	< 5
596-RK53	20-25	0.63	4.2	0.81	0.04	0.07	0.02	0.04	0.02	20	< 2	< 10	< 8	-	39	< 1	< 10	< 2	< 5
596-RK54	25-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
596-RK55	30-35	0.58	3.8	0.77	0.03	0.07	0.02	0.03	0.02	21	< 2	< 10	< 8	-	35	< 1	< 10	< 2	< 5
596-RK56	35-40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
596-RK57	40-45	0.71	3.6	0.71	0.04	0.08	0.03	0.03	0.03	18	< 2	< 10	< 8	-	41	< 1	< 10	< 2	< 5
596-RK58	45-55	0.72	4.2	0.67	0.07	0.08	0.10	0.04	0.04	177	< 2	< 10	< 8	-	62	< 1	< 10	< 2	< 5
596-RK59	55-65	0.64	3.8	0.62	0.03	0.08	0.02	0.02	0.03	21	< 2	< 10	< 8	-	31	< 1	< 10	< 2	5
596-RK60	65-68	0.60	3.7	0.61	0.02	0.08	0.02	0.03	0.02	17	< 2	< 10	< 8	-	27	< 1	< 10	< 2	10
Arithmetic mean		0.53	9.9	0.66	0.04	0.09	0.04	0.03	0.02	70	-	-	-	-	36	-	-	-	-
Standard dev.		0.19	9.8	0.17	0.02	0.03	0.03	0.01	0.01	71	-	-	-	-	12	-	-	-	-

FieldNo	Core Intvl.	Co, ppm	Cr, ppm	Cu, ppm	Eu, ppm	Ga, ppm	Ge, ppm	Hg, ppm	Ho, ppm	La, ppm	Li, ppm	Mo, ppm	Nb, ppm	Nd, ppm	Ni, ppm	Pb, ppm	Sc, ppm	Sn, ppm
			Core TS9, Taylor Slough															
596-RK27	0-5	< 2	5	< 2	< 2	< 4	-	0.09	< 4	< 2	3	< 2	< 4	< 9	< 3	6	< 2	< 5
596-RK28	5-10	< 2	5	5	< 2	5	-	0.03	< 4	< 2	4	< 2	< 4	< 9	< 3	28	< 2	< 5
596-RK29	10-15	< 2	6	< 2	< 2	5	-	0.04	< 4	< 2	7	< 2	< 4	< 9	< 3	< 4	< 2	< 5
596-RK30	15-20	< 2	2	< 2	< 2	5	-	0.04	< 4	< 2	4	< 2	< 4	< 9	< 3	< 4	< 2	< 5
596-RK31	20-25	< 2	5	< 2	< 2	6	-	0.03	< 4	< 2	6	< 2	< 4	< 9	< 3	< 4	< 2	< 5
596-RK32	25-30	< 2	6	< 2	< 2	6	-	0.03	< 4	< 2	6	< 2	< 4	< 9	< 3	< 4	< 2	< 5
596-RK33	30-35	< 2	46	7	< 2	8	-	0.05	< 4	10	34	< 2	7	13	13	10	4	< 5
596-RK34	35-40	4	132	6	< 2	14	-	0.12	< 4	32	102	< 2	20	38	35	24	12	< 5
596-RK35	40-50	3	103	3	< 2	12	-	0.09	< 4	24	84	< 2	13	26	26	18	9	< 5
596-RK36	50-60	5	164	< 2	2	12	-	0.06	< 4	32	123	< 2	19	39	39	26	14	5
596-RK37	60-65	6	193	2	3	13	-	0.10	5	36	137	< 2	26	44	47	30	17	7
Arithmetic mean		-	61	-	-	-	-	0.06	-	-	46	-	-	-	-	-	-	-
Standard dev.		-	73	-	-	-	-	0.03	-	-	54	-	-	-	-	-	-	-
			Core TS15, Taylor Slough															
596-RK38	0-5	< 2	8	14	< 2	6	-	0.14	< 4	< 2	3	2	< 4	< 9	3	31	< 2	< 5
596-RK39	5-10	< 2	9	11	< 2	7	-	0.12	< 4	3	4	< 2	< 4	< 9	4	36	< 2	< 5
596-RK40	10-15	< 2	4	6	< 2	7	-	0.13	< 4	< 2	2	2	< 4	< 9	< 3	10	< 2	< 5
596-RK41	15-20	< 2	4	5	< 2	10	-	0.10	< 4	< 2	< 2	< 2	< 4	< 9	< 3	5	< 2	< 5
596-RK42	20-25	< 2	4	3	< 2	9	-	0.07	< 4	< 2	2	< 2	< 4	< 9	< 3	< 4	< 2	< 5
596-RK43	25-30	< 2	7	4	< 2	9	-	0.03	< 4	< 2	3	< 2	< 4	< 9	< 3	5	< 2	< 5
596-RK44	30-35	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-
596-RK45	35-40	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-
596-RK46	40-50	< 2	25	34	< 2	9	-	0.03	< 4	3	7	< 2	< 4	< 9	6	7	< 2	< 5
596-RK47	50-60	< 2	40	90	< 2	9	-	0.03	< 4	9	36	4	4	10	9	12	3	< 5
596-RK48	60-63	< 2	31	7	< 2	8	-	0.06	< 4	8	21	6	< 4	9	8	11	3	< 5
Arithmetic mean		-	15	19	-	8	-	0.07	-	-	-	-	-	-	-	-	-	-
Standard dev.		-	14	28	-	1	-	0.04	-	-	-	-	-	-	-	-	-	-
			Core TS7E, Taylor Slough															
596-RK49	0-5	< 2	5	7	< 2	4	-	0.07	< 4	< 2	3	< 2	< 4	< 9	< 3	30	< 2	< 5
596-RK50	5-10	< 2	4	3	< 2	< 4	-	0.09	< 4	< 2	3	< 2	< 4	< 9	< 3	12	< 2	< 5
596-RK51	10-15	< 2	5	< 2	< 2	4	-	0.05	< 4	< 2	2	< 2	< 4	< 9	4	< 4	< 2	< 5
596-RK52	15-20	< 2	14	8	< 2	< 4	-	0.13	< 4	3	3	< 2	< 4	< 9	7	5	< 2	< 5
596-RK53	20-25	< 2	13	6	< 2	< 4	-	0.13	< 4	3	3	< 2	< 4	< 9	8	< 4	< 2	< 5
596-RK54	25-30	-	-	-	-	-	-	0.23	-	-	-	-	-	-	-	-	-	-
596-RK55	30-35	< 2	13	7	< 2	< 4	-	0.22	< 4	2	3	< 2	< 4	< 9	9	5	< 2	< 5
596-RK56	35-40	-	-	-	-	-	-	0.13	-	-	-	-	-	-	-	-	-	-
596-RK57	40-45	< 2	16	7	< 2	< 4	-	0.13	< 4	3	3	< 2	< 4	< 9	8	4	< 2	< 5
596-RK58	45-55	< 2	18	14	< 2	< 4	-	0.13	< 4	3	5	< 2	< 4	< 9	7	12	< 2	< 5
596-RK59	55-65	< 2	17	7	< 2	< 4	-	0.13	< 4	4	4	< 2	< 4	< 9	5	6	< 2	< 5
596-RK60	65-68	< 2	30	7	< 2	4	-	0.23	< 4	7	4	< 2	< 4	< 9	5	6	< 2	< 5
Arithmetic mean		-	14	-	-	-	-	0.14	-	-	3	-	-	-	-	-	-	-
Standard dev.		-	8	-	-	-	-	0.06	-	-	1	-	-	-	-	-	-	-

FieldNo	Core Intvl.	Sr, ppm	Ta, ppm	Th, ppm	U, ppm	V, ppm	W, ppm	Y, ppm	Yb, ppm	Zn, ppm	Zr, ppm
Core TS9, Taylor Slough											
596-RK27	0-5	629	< 40	< 6	< 100	2	-	< 2	< 1	5	-
596-RK28	5-10	801	< 40	< 6	< 100	3	-	< 2	< 1	24	-
596-RK29	10-15	810	< 40	< 6	< 100	3	-	2	< 1	28	-
596-RK30	15-20	849	< 40	< 6	< 100	< 2	-	< 2	< 1	4	-
596-RK31	20-25	841	< 40	< 6	< 100	3	-	< 2	< 1	3	-
596-RK32	25-30	807	< 40	< 6	< 100	3	-	< 2	< 1	2	-
596-RK33	30-35	180	< 40	< 6	< 100	25	-	12	1	22	-
596-RK34	35-40	152	< 40	10	< 100	60	-	38	3	24	-
596-RK35	40-50	148	< 40	10	< 100	47	-	29	2	21	-
596-RK36	50-60	147	< 40	13	< 100	79	-	44	4	19	-
596-RK37	60-65	148	< 40	16	< 100	93	-	51	4	25	-
Arithmetic mean		501	-	-	-	-	-	-	-	16	-
Standard dev.		336	-	-	-	-	-	-	-	10	-
Core TS15, Taylor Slough											
596-RK38	0-5	277	< 40	< 6	< 100	8	-	< 2	< 1	47	-
596-RK39	5-10	260	< 40	< 6	< 100	8	-	2	< 1	37	-
596-RK40	10-15	285	< 40	< 6	< 100	5	-	< 2	< 1	22	-
596-RK41	15-20	300	< 40	< 6	< 100	4	-	< 2	< 1	18	-
596-RK42	20-25	294	< 40	< 6	< 100	4	-	< 2	< 1	8	-
596-RK43	25-30	271	< 40	< 6	< 100	5	-	< 2	< 1	10	-
596-RK44	30-35	-	-	-	-	-	-	-	-	-	-
596-RK45	35-40	-	-	-	-	-	-	-	-	-	-
596-RK46	40-50	248	< 40	< 6	< 100	8	-	3	< 1	36	-
596-RK47	50-60	230	< 40	< 6	< 100	15	-	14	1	28	-
596-RK48	60-63	213	< 40	< 6	< 100	18	-	11	< 1	17	-
Arithmetic mean		264	-	-	-	8	-	-	-	25	-
Standard dev.		29	-	-	-	5	-	-	-	13	-
Core TS7E, Taylor Slough											
596-RK49	0-5	501	< 40	< 6	< 100	7	-	< 2	< 1	31	-
596-RK50	5-10	427	< 40	< 6	< 100	7	-	< 2	< 1	14	-
596-RK51	10-15	490	< 40	< 6	< 100	7	-	< 2	< 1	11	-
596-RK52	15-20	169	< 40	< 6	< 100	23	-	3	< 1	14	-
596-RK53	20-25	183	< 40	< 6	< 100	19	-	3	< 1	20	-
596-RK54	25-30	-	-	-	-	-	-	-	-	-	-
596-RK55	30-35	195	< 40	< 6	< 100	18	-	3	< 1	8	-
596-RK56	35-40	-	-	-	-	-	-	-	-	-	-
596-RK57	40-45	199	< 40	< 6	< 100	19	-	3	< 1	18	-
596-RK58	45-55	211	< 40	< 6	< 100	18	-	3	< 1	15	-
596-RK59	55-65	211	< 40	< 6	< 100	20	-	6	< 1	7	-
596-RK60	65-68	195	< 40	< 6	< 100	24	-	10	< 1	8	-
Arithmetic mean		278	-	-	-	16	-	-	-	15	-
Standard dev.		136	-	-	-	7	-	-	-	7	-

Table 7. Chemical analysis results for the concentration of elements in sawgrass leaf material.

[X, laboratory duplicate analysis; Y, site replicate sample; na, not applicable; --, no data.
Sample sites arranged geographically north (**N**) to south (**S**)]

	Field number	Fig. 2 ID	Lab No	Ash, %	Hg, ppm	Al %	Ca %	Fe %	K %	Mg %	Na %	P %	Ti %	Mn ppm	Ag ppm
							ASH WEIGHT BASIS								
N	51796-01L	TS1	F-012749	2.8	--	0.02	12.0	0.26	19	2.4	9.8	1.10	< 0.01	610	< 4
I	52296-19L	TS2	F-012759	3.0	--	0.02	8.4	0.09	25	2.6	3.4	1.10	< 0.01	1100	< 4
I	71796-05L	TS7	F-012765	3.1	--	0.02	11.0	0.18	24	2.1	7.2	1.20	< 0.01	610	< 4
I	52496-31L	TS7W	F-012746	2.6	--	0.03	12.0	0.22	26	2.4	7.7	1.10	< 0.01	1500	< 4
I	52096-14L	TS7E	F-012764	3.0	--	0.02	16.0	0.25	11	2.5	7.9	0.99	< 0.01	1400	< 4
I	52096-14LX	TS7E	F-012744	2.8	--	0.02	16.0	0.23	13	2.5	7.7	0.99	< 0.01	1500	< 4
I	52096-10L	TS9	F-012750	3.8	--	< 0.01	11.0	0.12	26	1.8	5.6	1.20	< 0.01	1100	< 4
I	52096-10LX	TS9	F-012758	3.8	--	0.01	10.0	0.11	25	1.8	5.4	1.10	< 0.01	1100	< 4
I	52496-23L	TS15	F-012768	4.5	--	< 0.01	6.6	0.06	20	2.2	5.5	0.75	< 0.01	2700	< 4
I	52496-23LY	TS15	F-012761	3.8	--	0.01	8.1	0.04	21	2.7	5.9	0.93	< 0.01	3900	< 4
I	52496-27L	TS16	F-012769	2.7	--	0.03	9.9	0.24	21	3.1	7.6	1.10	< 0.01	1100	< 4
S	52496-27LY	TS16	F-012753	3.7	--	0.01	8.5	0.04	23	2.7	7.7	0.94	< 0.01	3900	< 4
							DRY WEIGHT BASIS								
N	51796-01L	TS1	F-012749	2.8	0.07	0.00056	0.34	0.0073	0.53	0.07	0.27	0.03	--	17	--
I	52296-19L	TS2	F-012759	3.0	0.04	0.00060	0.25	0.0027	0.75	0.08	0.10	0.03	--	33	--
I	71796-05L	TS7	F-012765	3.1	0.02	0.00062	0.34	0.0056	0.74	0.07	0.22	0.04	--	19	--
I	52496-31L	TS7W	F-012746	2.6	<0.02	0.00078	0.31	0.0057	0.68	0.06	0.20	0.03	--	39	--
I	52096-14L	TS7E	F-012764	3.0	0.04	0.00060	0.48	0.0075	0.33	0.08	0.24	0.03	--	42	--
I	52096-14LX	TS7E	F-012744	2.8	0.04	0.00056	0.45	0.0064	0.36	0.07	0.22	0.03	--	42	--
I	52096-10L	TS9	F-012750	3.8	<0.02	--	0.42	0.0046	0.99	0.07	0.21	0.05	--	42	--
I	52096-10LX	TS9	F-012758	3.8	<0.02	0.00038	0.38	0.0042	0.95	0.07	0.21	0.04	--	42	--
I	52496-23L	TS15	F-012768	4.5	<0.02	--	0.30	0.0027	0.90	0.10	0.25	0.03	--	122	--
I	52496-23LX	TS15	F-012761	3.8	<0.02	0.00038	0.31	0.0015	0.80	0.10	0.22	0.04	--	148	--
I	52496-27L	TS16	F-012769	2.7	<0.02	0.00081	0.27	0.0065	0.57	0.08	0.21	0.03	--	30	--
S	52496-27LY	TS16	F-012753	3.7	0.02	0.00037	0.31	0.0015	0.85	0.10	0.28	0.03	--	144	--

Field number	As ppm	Au ppm	Ba ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cu ppm	Ga ppm	La ppm	Li ppm	Mo ppm
ASH WEIGHT BASIS														
51796-01L	< 20	< 20	25	< 2	< 20	< 4	< 8	2	< 2	26	< 8	< 4	< 4	8
52296-19L	< 20	< 20	45	< 2	< 20	< 4	< 8	< 2	< 2	41	< 8	< 4	< 4	6
71796-05L	< 20	< 20	20	< 2	< 20	< 4	< 8	2	< 2	15	< 8	< 4	< 4	5
52496-31L	< 20	< 20	23	< 2	< 20	< 4	< 8	< 2	2	32	< 8	< 4	< 4	14
52096-14L	< 20	< 20	20	< 2	< 20	< 4	< 8	2	3	27	< 8	< 4	< 4	16
52096-14LX	< 20	< 20	20	< 2	< 20	< 4	< 8	< 2	2	21	< 8	< 4	< 4	16
52096-10L	< 20	< 20	60	< 2	< 20	< 4	< 8	< 2	4	15	< 8	< 4	< 4	9
52096-10LX	< 20	< 20	72	< 2	< 20	< 4	< 8	< 2	3	14	< 8	< 4	< 4	9
52496-23L	< 20	< 20	17	< 2	< 20	< 4	< 8	< 2	4	13	< 8	< 4	< 4	6
52496-23LY	< 20	< 20	20	< 2	< 20	< 4	< 8	< 2	3	27	10	< 4	< 4	10
52496-27L	< 20	< 20	110	< 2	< 20	< 4	< 8	< 2	3	40	< 8	< 4	< 4	11
52496-27LY	< 20	< 20	21	< 2	< 20	< 4	< 8	< 2	3	32	14	< 4	< 4	9
DRY WEIGHT BASIS														
51796-01L	--	--	0.70	--	--	--	--	0.06	--	0.73	--	--	--	0.22
52296-19L	--	--	1.35	--	--	--	--	--	--	1.23	--	--	--	0.18
71796-05L	--	--	0.62	--	--	--	--	0.06	--	0.47	--	--	--	0.16
52496-31L	--	--	0.60	--	--	--	--	--	0.05	0.83	--	--	--	0.36
52096-14L	--	--	0.60	--	--	--	--	0.06	0.09	0.81	--	--	--	0.48
52096-14LX	--	--	0.56	--	--	--	--	--	0.06	0.59	--	--	--	0.45
52096-10L	--	--	2.28	--	--	--	--	--	0.15	0.57	--	--	--	0.34
52096-10LX	--	--	2.74	--	--	--	--	--	0.11	0.53	--	--	--	0.34
52496-23L	--	--	0.77	--	--	--	--	--	0.18	0.59	--	--	--	0.27
52496-23LX	--	--	0.76	--	--	--	--	--	0.11	1.03	0.38	--	--	0.38
52496-27L	--	--	2.97	--	--	--	--	--	0.08	1.08	--	--	--	0.30
52496-27LY	--	--	0.78	--	--	--	--	--	0.11	1.18	0.52	--	--	0.33

Field number	Nd ppm	Ni ppm	Pb ppm	Sc ppm	Sr ppm	V ppm	Zn ppm	Total S %
						ASH WEIGHT BASIS		
51796-01L	18	< 4	< 8	< 4	620	< 4	170	--
52296-19L	12	4	< 8	< 4	440	< 4	120	--
71796-05L	11	< 4	< 8	< 4	560	< 4	120	--
52496-31L	8	4	< 8	< 4	650	< 4	250	--
52096-14L	21	< 4	< 8	< 4	610	< 4	150	--
52096-14LX	16	< 4	< 8	< 4	610	< 4	150	--
52096-10L	12	< 4	< 8	< 4	740	< 4	120	--
52096-10LX	12	< 4	< 8	< 4	670	< 4	120	--
52496-23L	< 8	< 4	< 8	< 4	590	< 4	92	--
52496-23LY	16	< 4	< 8	< 4	670	< 4	94	--
52496-27L	14	< 4	< 8	< 4	720	< 4	230	--
52496-27LY	11	< 4	< 8	< 4	690	< 4	98	--
						DRY WEIGHT BASIS		
51796-01L	0.50	--	--	--	17.4	--	4.8	0.09
52296-19L	0.36	0.12	--	--	13.2	--	3.6	0.10
71796-05L	0.34	--	--	--	17.4	--	3.7	0.10
52496-31L	0.21	0.10	--	--	16.9	--	6.5	0.09
52096-14L	0.63	--	--	--	18.3	--	4.5	0.09
52096-14LX	0.45	--	--	--	17.1	--	4.2	0.09
52096-10L	0.46	--	--	--	28.1	--	4.6	0.15
52096-10LX	0.46	--	--	--	25.5	--	4.6	0.10
52496-23L	--	--	--	--	26.6	--	4.1	0.37
52496-23LX	0.61	--	--	--	25.5	--	3.6	0.26
52496-27L	0.38	--	--	--	19.4	--	6.2	0.11
52496-27LY	0.41	--	--	--	25.5	--	3.6	0.26

Table 8. Chemical analysis results for the concentration of elements in sawgrass root material.

[X, laboratory duplicate analysis; Y, site replicate sample; --, no data.
Sample sites arranged geographically north (**N**) to south (**S**)]

	Field number	Fig. 2 ID	Lab No	Ash, %	Hg, ppm	Al %	Ca %	Fe %	K %	Mg %	Na %	P %	Ti %	Mn ppm
							ASH WEIGHT BASIS							
N	51796-01R	TS1	F-012756	4.7	--	0.38	25	12.0	4.9	1.1	1.0	0.53	0.02	1000
I	52296-19R	TS2	F-012743	3.4	--	0.18	24	4.4	11.0	1.7	1.6	1.10	< 0.01	470
I	52296-19RX	TS2	F-012766	3.4	--	0.19	25	4.4	9.7	1.7	1.5	1.10	< 0.01	450
I	52496-31R	TS7W	F-012767	3.7	--	0.56	21	8.8	12.0	1.4	2.4	0.84	0.03	790
I	52096-14R	TS7W	F-012757	3.0	--	0.06	24	9.4	6.2	1.6	2.3	1.00	< 0.01	360
I	51096-10R	TS9	F-012751	3.8	--	0.14	20	6.6	12.0	1.7	2.8	1.80	< 0.01	1300
I	52496-23R	TS15	F-012752	2.9	--	0.39	15	1.3	13.0	3.7	5.4	2.40	0.02	790
I	52496-23RY	TS15	F-012762	3.8	--	1.10	19	0.9	7.2	3.8	3.5	1.10	0.06	1300
S	52496-27R	TS16	F-012770	3.7	--	0.12	27	2.7	8.8	2.0	3.1	0.84	< 0.01	440
							DRY WEIGHT BASIS							
N	51796-01R	TS1	F-012756	4.7	0.04	0.018	1.18	0.56	0.23	0.05	0.05	0.02	0.0009	47
I	52296-19R	TS2	F-012743	3.4	0.02	0.006	0.82	0.15	0.37	0.06	0.05	0.04	--	16
I	52296-19RX	TS2	F-012766	3.4	<0.02	0.006	0.85	0.15	0.33	0.06	0.05	0.04	--	15
I	52496-31R	TS7W	F-012767	3.7	<0.02	0.021	0.78	0.33	0.44	0.05	0.09	0.03	0.0011	29
I	52096-14R	TS7W	F-012757	3.0	0.04	0.002	0.72	0.28	0.19	0.05	0.07	0.03	--	11
I	51096-10R	TS9	F-012751	3.8	<0.02	0.005	0.76	0.25	0.46	0.06	0.11	0.07	--	49
I	52496-23R	TS15	F-012752	2.9	0.02	0.011	0.44	0.04	0.38	0.11	0.16	0.07	0.0006	23
I	52496-23RY	TS15	F-012762	3.8	0.04	0.042	0.72	0.03	0.27	0.14	0.13	0.04	0.0023	49
S	52496-27R	TS16	F-012770	3.7	0.02	0.004	1.00	0.10	0.33	0.07	0.11	0.03	--	16

Field number	Ag ppm	As ppm	Au ppm	Ba ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cu ppm	Ga ppm	La ppm
	ASH WEIGHT BASIS												
51796-01R	< 4	< 20	< 20	150	< 2	< 20	< 4	< 8	6	17	73	< 8	< 4
52296-19R	< 4	< 20	< 20	130	< 2	< 20	< 4	< 8	7	13	180	< 8	< 4
52296-19RX	< 4	< 20	< 20	120	< 2	< 20	< 4	< 8	8	14	180	< 8	< 4
52496-31R	< 4	24	< 20	77	< 2	< 20	< 4	< 8	10	12	120	< 8	5
52096-14R	< 4	37	< 20	62	< 2	< 20	< 4	< 8	4	9	77	< 8	< 4
51096-10R	< 4	30	< 20	180	< 2	< 20	< 4	< 8	10	11	110	< 8	< 4
52496-23R	< 4	< 20	< 20	92	< 2	< 20	< 4	< 8	6	14	110	< 8	< 4
52496-23RY	< 4	< 20	< 20	140	< 2	< 20	< 4	10	6	24	94	< 8	6
52496-27R	< 4	< 20	< 20	110	< 2	< 20	< 4	< 8	4	8	40	< 8	< 4
	DRY WEIGHT BASIS												
51796-01R	--	--	--	7.1	--	--	--	--	0.28	0.80	3.4	--	--
52296-19R	--	--	--	4.4	--	--	--	--	0.24	0.44	6.1	--	--
52296-19RX	--	--	--	4.1	--	--	--	--	0.27	0.48	6.1	--	--
52496-31R	--	0.89	--	2.8	--	--	--	--	0.37	0.44	4.4	--	0.19
52096-14R	--	1.11	--	1.9	--	--	--	--	0.12	0.27	2.3	--	--
51096-10R	--	1.14	--	6.8	--	--	--	--	0.38	0.42	4.2	--	--
52496-23R	--	--	--	2.7	--	--	--	--	0.17	0.41	3.2	--	--
52496-23RY	--	--	--	5.3	--	--	--	0.38	0.23	0.91	3.6	--	0.23
52496-27R	--	--	--	4.1	--	--	--	--	0.15	0.30	1.5	--	--

Field number	Li ppm	Mo ppm	Nd ppm	Ni ppm	Pb ppm	Sc ppm	Sr ppm	V ppm	Zn ppm	Total S %
	ASH WEIGHT BASIS									
51796-01R	< 4	9	36	8	15	< 4	1400	21	470	--
52296-19R	< 4	20	32	8	8	< 4	1200	28	1400	--
52296-19RX	< 4	20	36	7	< 8	< 4	1200	28	1400	--
52496-31R	4	18	28	8	18	< 4	1400	21	1300	--
52096-14R	< 4	31	30	6	10	< 4	1200	10	1400	--
51096-10R	< 4	14	21	8	< 8	< 4	1200	65	1100	--
52496-23R	< 4	20	21	10	41	< 4	1900	24	1000	--
52496-23RY	10	16	30	18	64	< 4	2200	23	460	--
52496-27R	< 4	20	37	< 4	< 8	< 4	1400	7	1100	--
	DRY WEIGHT BASIS									
51796-01R	--	0.42	1.69	0.38	0.71	--	66	0.99	22	0.15
52296-19R	--	0.68	1.09	0.27	0.27	--	41	0.95	48	0.10
52296-19RX	--	0.68	1.22	0.24	0.00	--	41	0.95	48	0.09
52496-31R	0.15	0.67	1.04	0.30	0.67	--	52	0.78	48	0.10
52096-14R	--	0.93	0.90	0.18	0.30	--	36	0.30	42	0.08
51096-10R	--	0.53	0.80	0.30	0.00	--	46	2.47	42	0.16
52496-23R	--	0.58	0.61	0.29	1.19	--	55	0.70	29	0.54
52496-23RY	0.38	0.61	1.14	0.68	2.43	--	84	0.87	17	0.57
52496-27R	--	0.74	1.37	0.00	0.00	--	52	0.26	41	0.19

Table 9. Chemical analysis results for the concentration of elements (µg/L) in filtered surface water samples.

[Site number keyed to figure 2; <, > less than and greater than, respectively, the analytical limit of detection]

Site no.	Field ID	Lab No	Ag	As	Au	Ba	Be	Bi	Cd	Ce
TS2	52296-1-MSF	F-012196	29	< 1	< 0.1	18.0	< 0.1	< 0.7	< 0.2	< 0.1
TS7W	52496-3-MSF	F-012202	< 4	< 1	< 0.1	7.3	< 0.1	< 0.7	< 0.2	< 0.1
TS7E	52096-2-MSF	F-012194	< 4	1	< 0.1	17.0	< 0.1	< 0.7	< 0.2	< 0.1
TS9	52096-1-MSF	F-012193	< 4	3	< 0.1	24.0	0.1	< 0.7	< 0.2	< 0.1
TS15	52496-1-MSF	F-012200	< 4	15	0.4	43.0	< 0.1	< 0.7	< 0.2	< 0.1
TS16	52496-2-MSF	F-012201	< 4	2	< 0.1	34.0	< 0.1	< 0.7	< 0.2	0.1

Site no.	Co	Cr	Cs	Cu	Dy	Er	Eu	Gd	Ge	Ga
TS2	0.5	2.5	< 1	0.82	< 0.4	< 0.3	< 0.1	< 0.3	< 0.3	< 0.3
TS7W	0.2	1.0	< 1	1.10	< 0.4	< 0.3	< 0.1	< 0.3	< 0.3	< 0.3
TS7E	0.3	1.0	< 1	0.95	< 0.4	< 0.3	< 0.1	< 0.3	< 0.3	< 0.3
TS9	0.4	2.0	< 1	0.90	< 0.4	< 0.3	< 0.1	< 0.3	0.3	< 0.3
TS15	1.0	2.0	2.0	0.50	< 0.4	< 0.3	< 0.1	0.4	0.5	< 0.3
TS16	1.2	2.6	1.0	1.50	< 0.4	< 0.3	< 0.1	< 0.3	0.4	< 0.3

Site no.	Hf	Hg	Ho	In	La	Li	Mn	Mo	Nb	Nd
TS2	< 0.1	<.2	< 0.1	< 0.1	< 0.1	< 2	5.7	1.3	< 0.2	< 0.2
TS7W	< 0.1	<.2	< 0.1	< 0.1	< 0.1	< 2	2.9	0.2	< 0.2	< 0.2
TS7E	< 0.1	<.2	< 0.1	< 0.1	< 0.1	< 2	6.7	0.2	< 0.2	< 0.2
TS9	< 0.1	<.2	< 0.1	< 0.1	< 0.1	2	120	0.6	< 0.2	< 0.2
TS15	0.1	<.2	< 0.1	< 0.1	< 0.1	10	140	0.5	< 0.2	< 0.2
TS16	< 0.1	<.2	< 0.1	< 0.1	< 0.1	11	22	1.1	< 0.2	< 0.2

Site no.	Ni	Pb	Pr	Rb	Re	Sb	Sm	Sn	Sr	Ta
TS2	5.6	0.4	< 0.1	1.6	< 0.1	0.3	< 0.2	0.2	660	< 0.1
TS7W	4.0	< 0.3	< 0.1	1.0	< 0.1	< 0.2	< 0.2	< 0.2	620	< 0.1
TS7E	3.0	0.3	< 0.1	1.0	< 0.1	0.3	< 0.2	< 0.2	580	< 0.1
TS9	6.4	0.3	< 0.1	2.5	< 0.1	0.3	< 0.2	< 0.2	1000	< 0.1
TS15	15	< 0.3	< 0.1	13	< 0.1	0.2	< 0.2	0.3	>3000	< 0.1
TS16	11	< 0.3	< 0.1	8.6	< 0.1	< 0.2	< 0.2	< 0.2	2600	< 0.1

Site no.	Tb	Te	Th	Tl	Tm	U	V	W	Y	Yb
TS2	< 0.1	< 0.7	2.0	< 0.4	< 0.1	0.9	0.4	< 0.1	3.4	< 0.7
TS7W	0.1	< 0.7	< 1	< 0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.8	< 0.7
TS7E	< 0.1	< 0.7	< 1	< 0.4	< 0.1	< 0.1	0.3	< 0.1	3.4	< 0.7
TS9	< 0.1	< 0.7	1.0	0.4	< 0.1	< 0.1	0.8	< 0.1	4.1	< 0.7
TS15	0.1	< 0.7	< 1	< 0.4	< 0.1	< 0.1	10.0	< 0.1	4.2	< 0.7
TS16	< 0.1	< 0.7	< 1	< 0.4	< 0.1	< 0.1	6.1	0.1	4.8	< 0.7

Site no.	Zn	Zr
TS2	4.0	0.1
TS7W	2.0	< 0.1
TS7E	3.0	< 0.1
TS9	2.0	< 0.1
TS15	7.0	0.2
TS16	4.9	0.3

Table 10. Calculated sediment ages and depositional rates for ^{210}Pb-dated cores. Parameters used in the calculations are also shown.

[--, not determined; \, determined but data not presented; site number keyed to fig. 2;]

Depth top, cm	Depth bottom, cm	Center pt., cm	dry bulk density g/cm^3	Excess ^{210}Pb activity dpm/g	Depth interval date	Sedimentation rate cm/yr	Sediment accum. rate g/cm^2/yr
Site TS1 (51796-1; geochronology core no. 2; geochemistry core no. 1)							
0	2	1	0.03	20	1995	1.52	0.05
2	4	3	0.16	20	1994	1.28	0.20
4	6	5	0.16	19	1992	1.12	0.18
6	8	7	0.20	15	1989	1.00	0.20
8	10	9	0.26	14	1986	0.90	0.23
10	12	11	0.26	13	1983	0.84	0.22
12	14	13	0.25	13	1979	0.79	0.20
14	16	15	0.28	10	1979	0.79	0.22
16	18	17	0.24	14	1976	0.75	0.18
18	20	19	0.27	9.9	1973	0.74	0.20
20	22	21	0.29	8.0	1970	0.74	0.21
22	24	23	0.33	9.4	1969	0.78	0.26
Site TS7 (51796-5; geochronology core no. 6; geochemistry core no. 5)							
0	2	1	--	--	--	--	--
2	4	3	0.13	17	1975	0.05	0.01
4	6	5	0.21	4.6	1933	0.05	0.01
6	8	7	0.28	0.94	1892	0.05	0.01
8	10	9	0.30	0.45	1850	0.05	0.01
10	12	11	0.42	0.37	1808	0.05	0.02
12	14	13	0.21	0.31	1766	0.05	0.01
14	16	15	0.13	0.35	1724	0.05	0.01
16	19	17	0.12	0.31	1682	0.05	0.01
18	20	19	0.10	--	--	--	--
20	22	21	0.10	--	--	--	--
22	24	23	0.11	--	--	--	--
24	26	25	0.10	--	--	--	--
26	28	27	0.11	--	--	--	--
28	30	29	0.10	-0.06	1432	0.03	0.003
\	\	\	\	\	\	\	\
\	\	\	\	\	\	\	\
74	76	75	0.12	--	--	--	--
Site TS7E (52096-14; geochronology core no 13; geochemistry core no. 14)							
0	2	1	0.16	11	1989	0.15	0.02
2	4	3	0.34	7.2	1975	0.15	0.05
4	6	5	0.36	4.9	1962	0.15	0.05
6	8	7	0.22	--	--	--	--
8	10	9	0.27	1.8	1934	0.15	0.04
10	12	11	0.32	0.58	1920	0.15	0.05
12	14	13	0.34	0.67	1906	0.15	0.05
14	16	15	0.34	0.52	1893	0.15	0.05
16	18	17	0.35	0.38	1879	0.15	0.05
18	20	19	0.29	0.37	1865	0.15	0.04
20	22	21	0.21	--	--	--	--
22	24	23	0.19	--	--	--	--
24	26	25	0.17	--	--	--	--
26	28	27	0.14	--	--	--	--
28	30	29	0.23	0.37	1796	0.15	0.03
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\	\	\	\	\	\	\	\
74	76	75	0.84	--	--	--	--

Depth top, cm	Depth bottom, cm	Center pt., cm	dry bulk density g/cm^3	Excess ^{210}Pb activity dpm/g	Depth interval date	Sedimentation rate cm/yr	Sediment accum. rate $g/cm^2/yr$
Site TS9 (52096-10; geochronology core no. 7; geochemistry core no. 10)							
0	2	1	0.24	11	1976	0.05	0.01
2	4	3	0.30	3.3	1938	0.05	0.02
4	6	5	0.48	0.55	1899	0.05	0.02
6	8	7	0.39	0.71	1860	0.05	0.02
8	10	9	0.21	0.93	1821	0.05	0.01
10	12	11	0.25	0.20	1782	0.05	0.01
12	14	13	0.33	0.09	1743	0.05	0.02
14	16	15	0.43	0.10	1704	0.05	0.02
18	18	17	0.35	0.22	1665	0.05	0.02
18	20	19	0.43	0.05	1628	0.05	0.02
20	22	21	0.40	--	--	--	--
22	24	23	0.45	--	--	--	--
24	26	25	0.41	--	--	--	--
26	28	27	0.44	--	--	--	--
28	30	29	0.51	0.09	1431	0.05	0.03
\	\	\	\	\	\	\	\
\	\	\	\	\	\	\	\
68	70	69	0.22	--	--	--	--
Site TS15 (52496-23; geochronology core no 22; geochemistry core no. 23)							
0	2	1	--	29	--	--	--
2	4	3	0.05	30	--	--	--
4	6	5	0.09	29	1990	0.16	0.01
6	8	7	0.08	17	1980	0.16	0.01
8	10	9	0.09	11	1984	0.16	0.01
10	12	11	0.12	9.5	1951	0.16	0.02
12	14	11	0.10	6.6	1939	0.16	0.02
14	16	15	0.09	6.7	1939	0.16	0.01
16	18	17	0.09	3.8	1926	0.16	0.01
18	20	19	0.09	1.1	1913	0.16	0.01
20	22	21	0.09	1.1	1900	0.16	0.01
22	24	23	0.10	--	--	--	--
24	26	25	0.10	--	--	--	--
26	28	27	0.09	--	--	--	--
28	30	29	0.09	1.9	1837	0.11	0.01
\	\	\	\	\	\	\	\
\	\	\	\	\	\	\	\
76	78	77	0.16	--	--	--	--
Site TS16 (52496-27; geochronology core no 26; geochemistry core no. 27)							
0	2	1	0.11	14	--	--	--
2	4	3	0.11	22	1989	0.14	0.01
4	6	5	0.12	19	1974	0.14	0.02
6	8	7	0.14	9.8	1959	0.14	0.02
8	10	9	0.15	2.9	1944	0.14	0.02
10	12	11	0.13	2.2	1930	0.14	0.02
12	14	13	0.12	0.55	1915	0.14	0.02
14	16	15	0.13	0.67	1900	0.14	0.02
16	18	17	0.12	0.25	1885	0.14	0.02
18	20	19	0.14	0.05	1870	0.14	0.02
20	22	21	0.13	--	--	--	--
22	24	23	0.14	--	--	--	--
24	26	25	0.14	--	--	--	--
26	28	27	0.15	--	--	--	--
28	30	29	0.14	-0.44	1796	0.14	0.02
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\	\	\	\	\	\	\	\
74	76	75	0.24	--	--	--	--

Table 11. Element accumulation rates (EAR) calculated for selected major elements in organic-rich sediment core material. Data valid to two significant figures.

[--, no data; core name and location keyed to fig. 2]

Depth, cm	Bulk Density	Sedimentation Rate	Sediment Accumulation Rate (SAR)	Aluminum				Calcium			
	g/cm3	cm/yr	g/cm2/yr	Concentration ug/g	EAR µg/cm2/yr	EAR µg/m2/yr	EAR g/m2/yr	Concentration ug/g	EAR µg/cm2/yr	EAR µg/m2/yr	EAR g/m2/yr
	Core TS1										
2.5	0.12	1.31	0.16	19000	2987	29868000	30	52000	8174	8174400	8.2
7.5	0.19	1.01	0.19	38000	7292	72922000	73	27000	5181	5181300	5.2
12.5	0.26	0.84	0.22	6600	1441	14414400	14	31000	6770	6770400	6.8
17.5	0.26	0.78	0.20	56000	11357	113568000	114	24000	4867	4867200	4.9
25.0	0.28	0.75	0.21	63000	13230	132300000	132	37000	7770	7770000	7.8
	Core TS7										
2.5	0.127	0.1	0.013	4600	60	598000	0.60	200000	2600.0	2600000	2.6
7.5	0.262	0.1	0.026	2700	71	707400	0.71	260000	6812.0	6812000	6.8
12.5	0.314	0.1	0.031	50000	1570	15700000	16	28000	879.2	879200	0.88
17.5	0.115	0.1	0.012	6700	77	770500	0.77	31000	356.5	356500	0.36
25.0	0.104	0.1	0.010	5600	58	582400	0.58	25000	260.0	260000	0.26
35.0	0.109	0.1	0.011	6400	70	697600	0.70	25000	272.5	272500	0.27
45.0	0.118	0.1	0.012	8200	97	967600	0.97	29000	342.2	342200	0.34
55.0	0.131	0.1	0.013	7800	102	1021800	1.0	24000	314.4	314400	0.31
65.0	0.113	0.1	0.011	4700	53	531100	0.53	34000	384.2	384200	0.38
	Core TS7E										
2.5	0.248	0.145	0.036	2800	101	1006880	1.0	260000	9349.6	9349600	9.3
7.5	0.281	0.145	0.041	2600	106	1059370	1.1	220000	8963.9	8963900	9.0
12.5	0.316	0.145	0.046	2200	101	1008040	1.0	240000	10996.8	10996800	11.0
17.5	0.328	0.145	0.048	6200	295	2948720	2.9	36000	1712.2	1712160	1.7
22.5	0.217	0.145	0.031	6300	198	1982295	2.0	42000	1321.5	1321530	1.3
27.5	0.18	0.145	0.026	--	--	--	--	--	--	--	--
32.5	0.1	0.145	0.015	5800	84	841000	0.84	38000	551.0	551000	0.55
37.5	0.1	0.145	0.015	--	--	--	--	--	--	--	--
42.5	0.1	0.145	0.015	7100	103	1029500	1.0	36000	522.0	522000	0.52
50.0	0.1	0.145	0.015	7200	104	1044000	1.0	42000	609.0	609000	0.61
60.0	0.1	0.145	0.015	6400	93	928000	0.93	38000	551.0	551000	0.55
66.5	0.1	0.145	0.015	6000	87	870000	0.87	37000	536.5	536500	0.54

Depth, cm	Iron				Potassium				Magnesium			
	Concentra-tion	EAR	EAR	EAR	Concentra-tion	EAR	EAR	EAR	Concentra-tion	EAR	EAR	EAR
	ug/g	µg/cm2/yr	µg/m2/yr	g/m2/yr	ug/g	µg/cm2/yr	µg/m2/yr	g/m2/yr	ug/g	µg/cm2/yr	µg/m2/yr	g/m2/yr
		Core TS1										
2.5	13000	2044	20436000	20	900	141	1414800	1.4	1700	267	2672400	2.7
7.5	20000	3838	38380000	38	1100	211	2110900	2.1	2600	499	4989400	5.0
12.5	8000	1747	17472000	17	2200	480	4804800	4.8	800	175	1747200	1.7
17.5	27000	5476	54756000	55	1400	284	2839200	2.8	3700	750	7503600	7.5
25.0	35000	7350	73500000	74	1600	336	3360000	3.4	4000	840	8400000	8.4
		Core TS7										
2.5	6200	81	806000	0.8	1000	13.0	130000	0.13	1600	20.8	208000	0.21
7.5	5800	152	1519600	1.5	100	2.6	26200	0.03	1900	49.8	497800	0.50
12.5	24000	754	7536000	7.5	1400	44.0	439600	0.44	3200	100	1000000	1.00
17.5	8600	99	989000	1.0	500	5.8	57500	0.06	800	9.2	92000	0.09
25.0	7500	78	780000	0.8	400	4.2	41600	0.04	700	7.3	72800	0.07
35.0	7900	86	861100	0.9	500	5.5	54500	0.05	700	7.6	76300	0.08
45.0	9100	107	1073800	1.1	600	7.1	70800	0.07	900	10.6	106200	0.11
55.0	6800	89	890800	0.9	2600	34.1	340600	0.34	800	10.5	104800	0.10
65.0	4500	51	508500	0.5	400	4.5	45200	0.05	700	7.9	79100	0.08
		Core TS7E										
2.5	5800	209	2085680	2.1	900	32.4	323640	0.32	1500	53.9	539400	0.54
7.5	4400	179	1792780	1.8	500	20.4	203725	0.20	1200	48.9	488940	0.49
12.5	3800	174	1741160	1.7	100	4.6	45820	0.05	1400	64.1	641480	0.64
17.5	9700	461	4613320	4.6	500	23.8	237800	0.24	700	33.3	332920	0.33
22.5	8100	255	2548665	2.5	400	12.6	125860	0.13	700	22.0	220255	0.22
27.5	--	--	--	--	--	--	--	--	--	--	--	--
32.5	7700	112	1116500	1.1	300	4.4	43500	0.04	700	10.2	101500	0.10
37.5	--	--	--	--	--	--	--	--	--	--	--	--
42.5	7100	103	1029500	1.0	400	5.8	58000	0.06	800	11.6	116000	0.12
50.0	6700	97	971500	1.0	700	10.2	101500	0.10	800	11.6	116000	0.12
60.0	6200	90	899000	0.9	300	4.4	43500	0.04	800	11.6	116000	0.12
66.5	6100	88	884500	0.9	200	2.9	29000	0.03	800	11.6	116000	0.12

Depth, cm	Sodium				Phosphorus			
	Concentration	EAR	EAR	EAR	Concentration	EAR	EAR	EAR
	ug/g	*μg/cm2/yr*	*μg/m2/yr*	*g/m2/yr*	*ug/g*	*μg/cm2/yr*	*μg/m2/yr*	*g/m2/yr*
	Core TS1							
2.5	400	63	628800	0.63	1200	189	1886400	1.89
7.5	300	58	575700	0.58	900	173	1727100	1.73
12.5	1100	240	2402400	2.40	300	66	655200	0.66
17.5	1000	203	2028000	2.03	800	162	1622400	1.62
25.0	300	63	630000	0.63	800	168	1680000	1.68
	Core TS7							
2.5	800	10.4	104000	0.10	200	2.6	26000	0.03
7.5	400	10.5	104800	0.10	100	2.6	26200	0.03
12.5	600	18.8	188400	0.19	900	28.3	282600	0.28
17.5	500	5.8	57500	0.06	300	3.5	34500	0.03
25.0	500	5.2	52000	0.05	200	2.1	20800	0.02
35.0	400	4.4	43600	0.04	200	2.2	21800	0.02
45.0	200	2.4	23600	0.02	200	2.4	23600	0.02
55.0	1200	15.7	157200	0.16	100	1.3	13100	0.01
65.0	400	4.5	45200	0.05	90	1.0	10170	0.01
	Core TS7E							
2.5	700	25.2	251720	0.25	300	10.8	107880	0.11
7.5	700	28.5	285215	0.29	300	12.2	122235	0.12
12.5	300	13.7	137460	0.14	200	9.2	91640	0.09
17.5	300	14.3	142680	0.14	400	19.0	190240	0.19
22.5	200	6.3	62930	0.06	400	12.6	125860	0.13
27.5	--	--	--	--	--	--	--	--
32.5	200	2.9	29000	0.03	300	4.4	43500	0.04
37.5	--	--	--	--	--	--	--	--
42.5	300	4.4	43500	0.04	300	4.4	43500	0.04
50.0	1000	14.5	145000	0.15	400	5.8	58000	0.06
60.0	200	2.9	29000	0.03	200	2.9	29000	0.03
66.5	200	2.9	29000	0.03	300	4.4	43500	0.04

Depth, cm	Bulk Density	Sedimentation Rate	Sediment Accumulation Rate (SAR)	Aluminum				Calcium			
				Concentration	EAR	EAR	EAR	Concentration	EAR	EAR	EAR
	g/cm3	cm/yr	g/cm2/yr	ug/g	µg/cm2/yr	µg/m2/yr	g/m2/yr	ug/g	µg/cm2/yr	µg/m2/yr	g/m2/yr
	Core TS9										
2.5	0.31	0.14	0.043	2300	100	998200	1.0	250000	10850.0	10850000	11
7.5	0.35	0.14	0.049	3100	152	1519000	1.5	300000	14700.0	14700000	15
12.5	0.36	0.14	0.050	3600	181	1814400	1.8	290000	14616.0	14616000	15
17.5	0.4	0.14	0.056	1800	101	1008000	1.0	300000	16800.0	16800000	17
22.5	0.42	0.14	0.059	3700	218	2175600	2.2	290000	17052.0	17052000	17
27.5	0.45	0.14	0.063	3500	221	2205000	2.2	290000	18270.0	18270000	18
32.5	0.43	0.14	0.060	23000	1385	13846000	14	30000	1806.0	1806000	1.8
37.5	0.42	0.14	0.059	66000	3881	38808000	39	20000	1176.0	1176000	1.2
45.0	0.18	0.14	0.025	52000	1310	13104000	13	20000	504.0	504000	0.50
55.0	0.14	0.14	0.020	76000	1490	14896000	15	23000	450.8	450800	0.45
62.5	0.19	0.14	0.027	89000	2367	23674000	24	23000	611.8	611800	0.61
	Core TS15										
2.5	0.092	0.08	0.007	3600	26	264960	0.26	22000	161.9	161920	0.16
7.5	0.085	0.08	0.007	4200	29	285600	0.29	21000	142.8	142800	0.14
12.5	0.099	0.08	0.008	2200	17	174240	0.17	28000	221.8	221760	0.22
17.5	0.093	0.08	0.007	2600	19	193440	0.19	26000	193.4	193440	0.19
22.5	0.093	0.08	0.007	2200	16	163680	0.16	29000	215.8	215760	0.22
27.5	0.093	0.08	0.007	3300	25	245520	0.25	24000	178.6	178560	0.18
32.5	0.087	0.08	0.007	--	--	--	--	--	--	--	--
37.5	0.09	0.08	0.007	--	--	--	--	--	--	--	--
45.0	0.1	0.08	0.008	9900	79	792000	0.8	23000	184.0	184000	0.18
55.0	0.12	0.08	0.010	17000	163	1632000	1.6	18000	172.8	172800	0.17
61.5	0.128	0.08	0.010	14000	143	1433600	1.4	21000	215.0	215040	0.22

Depth, cm	Iron				Potassium				Magnesium			
	Concentra- tion	EAR	EAR	EAR	Concentra- tion	EAR	EAR	EAR	Concentra- tion	EAR	EAR	EAR
	ug/g	*µg/cm2/yr*	*µg/m2/yr*	*g/m2/yr*	*ug/g*	*µg/cm2/yr*	*µg/m2/yr*	*g/m2/yr*	*ug/g*	*µg/cm2/yr*	*µg/m2/yr*	*g/m2/yr*
		Core TS9										
2.5	4100	178	1779400	1.8	200	8.7	86800	0.09	1900	82.5	824600	0.82
7.5	3000	147	1470000	1.5	900	44.1	441000	0.44	2600	127	1274000	1.27
12.5	3100	156	1562400	1.6	100	5.0	50400	0.05	2900	146	1461600	1.46
17.5	2900	162	1624000	1.6	35	2.0	19600	0.02	3200	179	1792000	1.79
22.5	2900	171	1705200	1.7	300	17.6	176400	0.18	3600	212	2116800	2.12
27.5	3200	202	2016000	2.0	35	2.2	22050	0.02	3700	233	2331000	2.33
32.5	13000	783	7826000	7.8	1500	90.3	903000	0.90	5000	301	3010000	3.01
37.5	21000	1235	12348000	12	2100	123.5	1234800	1.23	6500	382	3822000	3.82
45.0	20000	504	5040000	5.0	1700	42.8	428400	0.43	6500	164	1638000	1.64
55.0	33000	647	6468000	6.5	1900	37.2	372400	0.37	7500	147	1470000	1.47
62.5	35000	931	9310000	9.3	2300	61.2	611800	0.61	7800	207	2074800	2.07
		Core TS15										
2.5	4200	31	309120	0.31	1200	8.8	88320	0.09	4900	36.1	360640	0.36
7.5	4300	29	292400	0.29	1300	8.8	88400	0.09	5200	35.4	353600	0.35
12.5	2800	22	221760	0.22	500	4.0	39600	0.04	5300	42.0	419760	0.42
17.5	2000	15	148800	0.15	600	4.5	44640	0.04	8000	59.5	595200	0.60
22.5	2100	16	156240	0.16	600	4.5	44640	0.04	8500	63.2	632400	0.63
27.5	3000	22	223200	0.22	800	6.0	59520	0.06	8300	61.8	617520	0.62
32.5	--	--	--	--	--	--	--	--	--	--	--	--
37.5	--	--	--	--	--	--	--	--	--	--	--	--
45.0	7200	58	576000	0.58	1000	8.0	80000	0.08	7200	57.6	576000	0.58
55.0	14000	134	1344000	1.34	1700	16.3	163200	0.16	8100	77.8	777600	0.78
61.5	14000	143	1433600	1.43	1400	14.3	143360	0.14	7600	77.8	778240	0.78

Depth, cm	Sodium				Phosphorus			
	Concentration ug/g	EAR µg/cm2/yr	EAR µg/m2/yr	EAR g/m2/yr	Concentration ug/g	EAR µg/cm2/yr	EAR µg/m2/yr	EAR g/m2/yr
	Core TS9							
2.5	1000	43.4	434000	0.43	300	13.0	130200	0.13
7.5	900	44.1	441000	0.44	100	4.9	49000	0.05
12.5	1100	55.4	554400	0.55	90	4.5	45360	0.05
17.5	1000	56.0	560000	0.56	90	5.0	50400	0.05
22.5	1400	82.3	823200	0.82	60	3.5	35280	0.04
27.5	1500	94.5	945000	0.95	60	3.8	37800	0.04
32.5	4000	240.8	2408000	2.41	200	12.0	120400	0.12
37.5	3900	229.3	2293200	2.29	300	17.6	176400	0.18
45.0	5800	146.2	1461600	1.46	200	5.0	50400	0.05
55.0	6000	117.6	1176000	1.18	200	3.9	39200	0.04
62.5	5700	151.6	1516200	1.52	200	5.3	53200	0.05
	Core TS15							
2.5	12000	88.3	883200	0.88	300	2.2	22080	0.02
7.5	10000	68.0	680000	0.68	300	2.0	20400	0.02
12.5	7400	58.6	586080	0.59	300	2.4	23760	0.02
17.5	11000	81.8	818400	0.82	300	2.2	22320	0.02
22.5	13000	96.7	967200	0.97	200	1.5	14880	0.01
27.5	17000	126.5	1264800	1.26	200	1.5	14880	0.01
32.5	--	--	--	--	--	--	--	--
37.5	--	--	--	--	--	--	--	--
45.0	16000	128.0	1280000	1.28	200	1.6	16000	0.02
55.0	17000	163.2	1632000	1.63	200	1.9	19200	0.02
61.5	16000	163.8	1638400	1.64	200	2.0	20480	0.02

Table 12. Element accumulation rates (EAR) calculated for selected minor (trace) elements in organic-rich sediment core material. Data valid to two significant figures.

[--, no data; core name and location keyed to fig. 2]

Depth, cm	Bulk Density	Sedimentation Rate	Sediment Accumulation Rate (SAR)	Chromium			Copper			Nickel		
				Concentration	EAR	EAR	Concentration	EAR	EAR	Concentration	EAR	EAR
	g/cm3	*cm/yr*	*g/cm2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*
	Core TS1											
2.5	0.12	1.31	0.16	39	6.1	61308	14	2.20	22008	13.0	2.04	20436
7.5	0.19	1.01	0.19	82	15.7	157358	12	2.30	23028	24.0	4.61	46056
12.5	0.26	0.84	0.22	10	2.2	21840	17	3.71	37128	7.0	1.53	15288
17.5	0.26	0.78	0.20	117	23.7	237276	10	2.03	20280	31.0	6.29	62868
25.0	0.28	0.75	0.21	138	29.0	289800	9	1.89	18900	36.0	7.56	75600
	Core TS7											
2.5	0.13	0.1	0.013	6	0.08	762	7.0	0.09	889	3.0	0.04	381
7.5	0.26	0.1	0.026	3	0.08	786	1.4	0.04	367	2.1	0.06	550
12.5	0.31	0.1	0.031	101	3.17	31714	10.0	0.31	3140	29.0	0.91	9106
17.5	0.12	0.1	0.012	10	0.12	1150	5.0	0.06	575	5.0	0.06	575
25.0	0.10	0.1	0.010	9	0.09	936	6.0	0.06	624	6.0	0.06	624
35.0	0.11	0.1	0.011	10	0.11	1090	5.0	0.05	545	6.0	0.07	654
45.0	0.12	0.1	0.012	14	0.17	1652	5.0	0.06	590	7.0	0.08	826
55.0	0.13	0.1	0.013	11	0.14	1441	20.0	0.26	2620	5.0	0.07	655
65.0	0.11	0.1	0.011	8	0.09	904	13.0	0.15	1469	4.0	0.05	452
	Core TS7E											
2.5	0.25	0.145	0.036	5	0.18	1798	7.0	0.25	2517	2.1	0.08	755
7.5	0.28	0.145	0.041	4	0.16	1630	3.0	0.12	1222	2.1	0.09	856
12.5	0.32	0.145	0.046	5	0.23	2291	1.4	0.06	641	4.0	0.18	1833
17.5	0.33	0.145	0.048	14	0.67	6658	8.0	0.38	3805	7.0	0.33	3329
22.5	0.22	0.145	0.031	13	0.41	4090	6.0	0.19	1888	8.0	0.25	2517
27.5	0.18	0.145	0.026	--	--	--	--	--	--	--	--	--
32.5	0.10	0.145	0.015	13	0.19	1885	7.0	0.10	1015	9.0	0.13	1305
37.5	0.10	0.145	0.015	--	--	--	--	--	--	--	--	--
42.5	0.10	0.145	0.015	16	0.23	2320	7.0	0.10	1015	8.0	0.12	1160
50.0	0.10	0.145	0.015	18	0.26	2610	14.0	0.20	2030	7.0	0.10	1015
60.0	0.10	0.145	0.015	17	0.25	2465	7.0	0.10	1015	5.0	0.07	725
66.5	0.10	0.145	0.015	30	0.44	4350	7.0	0.10	1015	5.0	0.07	725

Depth, cm	Mercury			Lead			Zinc		
	Concentration	EAR	EAR	Concentration	EAR	EAR	Concentration	EAR	EAR
	µg/g (ppm)	*µg/cm2/yr*	*µg/m2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*
	Core TS1								
2.5	0.17	0.0267	267	28.0	4.40	44016	27	4.24	42444
7.5	0.14	0.0269	269	25.0	4.80	47975	14	2.69	26866
12.5	0.09	0.0197	197	45.0	9.83	98280	44	9.61	96096
17.5	0.16	0.0324	324	27.0	5.48	54756	17	3.45	34476
25.0	0.14	0.0294	294	30.0	6.30	63000	18	3.78	37800
	Core TS7								
2.5	0.10	0.0013	12.7	25.0	0.32	3175	25	0.3175	3175
7.5	0.04	0.0010	10.5	2.8	0.07	734	7	0.1834	1834
12.5	0.20	0.0063	62.8	22.0	0.69	6908	17	0.5338	5338
17.5	0.09	0.0010	10.4	6.0	0.07	690	10	0.1150	1150
25.0	0.07	0.0007	7.3	6.0	0.06	624	12	0.1248	1248
35.0	0.08	0.0009	8.7	8.0	0.09	872	12	0.1308	1308
45.0	0.06	0.0007	7.1	7.0	0.08	826	11	0.1298	1298
55.0	0.07	0.0009	9.2	51.0	0.67	6681	54	0.7074	7074
65.0	0.06	0.0007	6.8	7.0	0.08	791	25	0.2825	2825
	Core TS7E								
2.5	0.07	0.0025	25.2	30.0	1.08	10788	31	1.1148	11148
7.5	0.09	0.0037	36.7	12.0	0.49	4889	14	0.5704	5704
12.5	0.05	0.0023	22.9	2.8	0.13	1283	11	0.5040	5040
17.5	0.13	0.0062	61.8	5.0	0.24	2378	14	0.6658	6658
22.5	0.13	0.0041	40.9	2.8	0.09	881	20	0.6293	6293
27.5	0.23	0.0060	60.0	--	--	--	--	--	--
32.5	0.22	0.0032	31.9	5.0	0.07	725	8	0.1160	1160
37.5	0.13	0.0019	18.9	--	--	--	--	--	--
42.5	0.13	0.0019	18.9	4.0	0.06	580	18	0.2610	2610
50.0	0.13	0.0019	18.9	12.0	0.17	1740	15	0.2175	2175
60.0	0.13	0.0019	18.9	6.0	0.09	870	7	0.1015	1015
66.5	0.23	0.0033	33.4	6.0	0.09	870	8	0.1160	1160

Depth, cm	Bulk Density	Sedimentation Rate	Sediment Accumulation Rate (SAR)	Chromium			Copper			Nickel		
				Concentration	EAR	EAR	Concentration	EAR	EAR	Concentration	EAR	EAR
	g/cm3	*cm/yr*	*g/cm2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*	*µg/g*	*µg/cm2/yr*	*µg/m2/yr*
	Core TS9											
2.5	0.31	0.14	0.043	5	0.22	2170	1.4	0.06	608	2.1	0.09	911
7.5	0.35	0.14	0.049	5	0.25	2450	5.0	0.25	2450	2.1	0.10	1029
12.5	0.36	0.14	0.050	6	0.30	3024	1.4	0.07	706	2.1	0.11	1058
17.5	0.40	0.14	0.056	2	0.11	1120	1.4	0.08	784	2.1	0.12	1176
22.5	0.42	0.14	0.059	5	0.29	2940	1.4	0.08	823	2.1	0.12	1235
27.5	0.45	0.14	0.063	6	0.38	3780	1.4	0.09	882	2.1	0.13	1323
32.5	0.43	0.14	0.060	46	2.77	27692	7.0	0.42	4214	13.0	0.78	7826
37.5	0.42	0.14	0.059	132	7.76	77616	6.0	0.35	3528	35.0	2.06	20580
45.0	0.18	0.14	0.025	103	2.60	25956	3.0	0.08	756	26.0	0.66	6552
55.0	0.14	0.14	0.020	164	3.21	32144	1.4	0.03	274	39.0	0.76	7644
62.5	0.19	0.14	0.027	193	5.13	51338	2.0	0.05	532	47.0	1.25	12502
	Core TS15											
2.5	0.09	0.08	0.007	8	0.06	589	14.0	0.10	1030	3.0	0.02	221
7.5	0.09	0.08	0.007	9	0.06	612	11.0	0.07	748	4.0	0.03	272
12.5	0.10	0.08	0.008	4	0.03	317	6.0	0.05	475	2.1	0.02	166
17.5	0.09	0.08	0.007	4	0.03	298	5.0	0.04	372	2.1	0.02	156
22.5	0.09	0.08	0.007	4	0.03	298	3.0	0.02	223	2.1	0.02	156
27.5	0.09	0.08	0.007	7	0.05	521	4.0	0.03	298	2.1	0.02	156
32.5	0.09	0.08	0.007	--	--	--	--	--	--	--	--	--
37.5	0.09	0.08	0.007	--	--	--	--	--	--	--	--	--
45.0	0.10	0.08	0.008	25	0.20	2000	34.0	0.27	2720	6.0	0.05	480
55.0	0.12	0.08	0.010	40	0.38	3840	90.0	0.86	8640	9.0	0.09	864
61.5	0.13	0.08	0.010	31	0.32	3174	7.0	0.07	717	8.0	0.08	819

Depth, cm	Mercury			Lead			Zinc		
	Concentration	EAR	EAR	Concentration	EAR	EAR	Concentration	EAR	EAR
	µg/g (ppm)	µg/cm2/yr	µg/m2/yr	µg/g	µg/cm2/yr	µg/m2/yr	µg/g	µg/cm2/yr	µg/m2/yr
	Core TS9								
2.5	0.09	0.0039	39.1	6.0	0.26	2604	5	0.2170	2170
7.5	0.03	0.0015	14.7	28.0	1.37	13720	24	1.1760	11760
12.5	0.04	0.0020	20.2	2.8	0.14	1411	28	1.4112	14112
17.5	0.04	0.0022	22.4	2.8	0.16	1568	4	0.2240	2240
22.5	0.03	0.0018	17.6	2.8	0.16	1646	3	0.1764	1764
27.5	0.03	0.0019	18.9	2.8	0.18	1764	2	0.1260	1260
32.5	0.05	0.0030	30.1	10.0	0.60	6020	22	1.3244	13244
37.5	0.12	0.0071	70.6	24.0	1.41	14112	24	1.4112	14112
45.0	0.09	0.0023	22.7	18.0	0.45	4536	21	0.5292	5292
55.0	0.06	0.0012	11.8	26.0	0.51	5096	19	0.3724	3724
62.5	0.10	0.0027	26.6	30.0	0.80	7980	25	0.6650	6650
	Core TS15								
2.5	0.14	0.0010	10.3	31.0	0.23	2282	47	0.3459	3459
7.5	0.12	0.0008	8.2	36.0	0.24	2448	37	0.2516	2516
12.5	0.13	0.0010	10.3	10.0	0.08	792	22	0.1742	1742
17.5	0.10	0.0007	7.4	5.0	0.04	372	18	0.1339	1339
22.5	0.07	0.0005	5.2	2.8	0.02	208	8	0.0595	595
27.5	0.03	0.0002	2.2	5.0	0.04	372	10	0.0744	744
32.5	0.05	0.0003	3.5	--	--	--	--	--	--
37.5	0.03	0.0002	2.2	--	--	--	--	--	--
45.0	0.03	0.0002	2.4	7.0	0.06	560	36	0.2880	2880
55.0	0.03	0.0003	2.9	12.0	0.12	1152	28	0.2688	2688
61.5	0.06	0.0006	6.1	11.0	0.11	1126	17	0.1741	1741