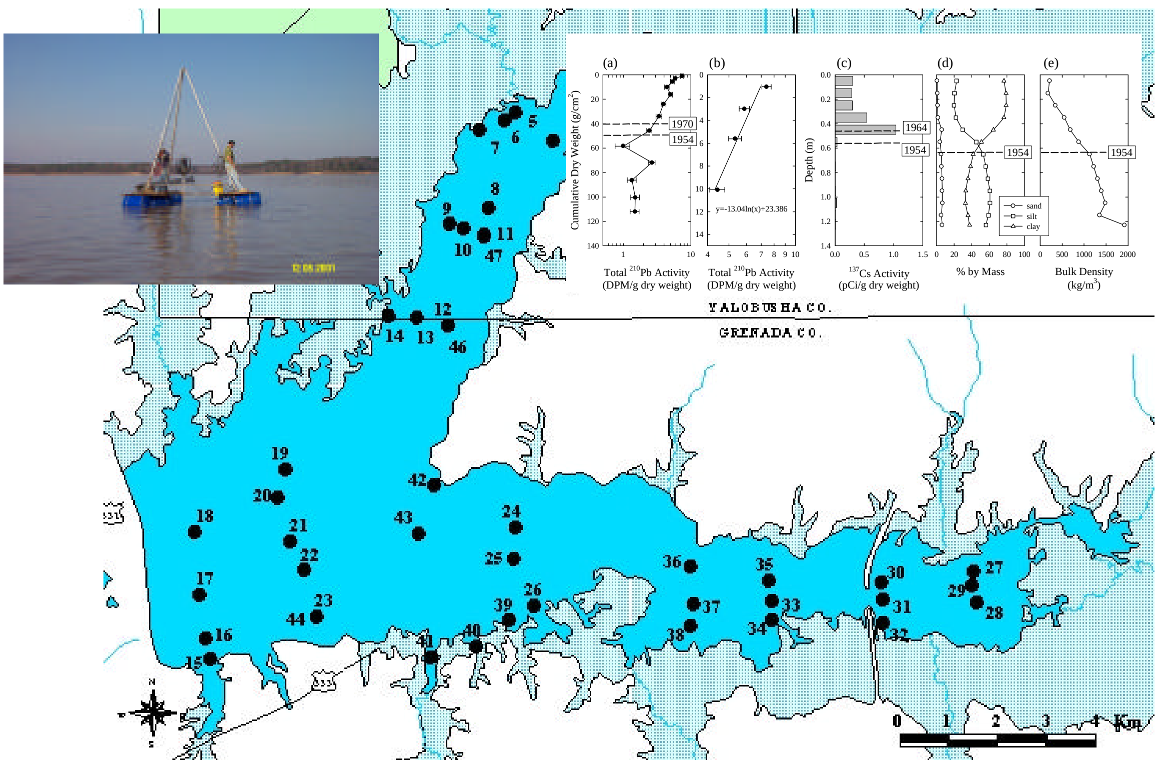
UNITED STATES DEPARTMENT OF AGRICULTURE

Agricultural Research Service

National Sedimentation Laboratory
Oxford, Mississippi 38655

Physical and Chemical Characteristics of Sediment Impounded within Grenada Lake, MS



By Sean J. Bennett and Fred E. Rhoton

Research Report No. 36 **January 2003**

EXECUTIVE SUMMARY

Streams in the Yalobusha River basin of north-central Mississippi have experienced severe erosion, bed incision, and channel widening due to channelization projects during the early 1900s and again in the 1950s and 1960s. Straightening of the Yalobusha River and Topashaw Creek has markedly altered the base level of these streams and promoted basin-wide degradation of the river channels. Changes in base level caused channel incision, bank destabilization, and channel widening. As a result, large volumes of sediment and woody riparian vegetation were delivered to the flow and subsequently transported through the river network. At the point where the channelized, straightened Yalobusha River met the natural, unchannelized meanders downstream, the woody debris in transport were deposited. These processes, left unrequited for decades, resulted in the rapid and progressive accumulation of a large woody debris plug on the lower Yalobusha River downstream of Calhoun City, MS. This debris accumulation has significantly increased the magnitude, frequency, and severity of flooding in the Calhoun City area. Before the U.S. Army Corps of Engineers initiates debris plug removal and channel improvements, an assessment of sedimentation within Grenada Lake located downstream of the plug is required. This report summarizes research data collected to meet this need.

Forty-seven continuous sediment cores, ranging in length from 0.55 to 2.55 m, were collected within Grenada Lake. Select cores were analyzed for particle size, agrichemicals, bulk sediment chemistry, bulk density, total carbon, and isotopes. Discrimination of post-impoundment sediment (sediment deposited since dam construction) and pre-impoundment sediment (parent material or pre-existing sediment) was accomplished by the use of chemical isotopes and variations in sediment texture and bulk density with depth. For the pre-impoundment materials, sediments are primarily composed of silt (50 to 75% by mass), with lesser amounts of sand (5 to 50% by mass) and clay (5 to 35% by mass). The bulk density of the sediment ranges from 1500 to 1700 kg/m^3. Total organic content is generally 0.5 to 1.0 kg/m^2. For the post-impoundment materials, sediments are primarily composed of clay (25 to 75% by mass), with lesser amounts of sand (5 to 10% by mass) and silt (50 to 75% by mass). The bulk density of the sediment ranges from 1300 to 1400 kg/m^3 and decreases significantly toward the surface. Total carbon content is about 1.5 kg/m^2 at depth, but none is found near the sediment surface.

Within Grenada Lake, the concentrations of major elements such as aluminum, calcium, iron, potassium, magnesium, phosphorus, and sulfur are higher in the post-impoundment sediment as compared to the pre-impoundment sediment. The concentrations of environmentally important elements such as arsenic, cadmium, chromium, copper, manganese, mercury, lead, selenium, and zinc are about two times higher in the post-impoundment sediment as compared to the pre-impoundment materials. In both cases, these higher element concentrations are due to the enrichment of clay in the post-impoundment sediments.

Within Grenada Lake, aldrin, dieldrin, endosulfan I, BHC-alpha, BHC-beta, BHC-gamma, DDD, DDE, DDT, heptachlor, and heptachlor epoxide are found in measurable concentrations. Compounds such as DDD, DDE, DDT, BHC-alpha, and heptachlor are found in nearly all sediment samples in comparable concentrations. The concentrations of these elements and agrichemicals are not atypical for agricultural watersheds in Mississippi.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

ACKNOWLEDGEMENTS

We gratefully acknowledge the technical assistance of Glenn Gray, Vince Cambell, Dan McChesney, Will Beard, Corey Patrick, and Collin Anderson. Terry Welch shipped some sediment samples to the University of Louisiana at Monroe for analysis. Financial and programmatic support was provided by Mr. Thomas L. Hengst, Senior Project Manager, Demonstration Erosion Control Project, U.S. Army Corps of Engineers (COE), Vicksburg District, MS.

1. INTRODUCTION

This report summarizes research results collected, tabulated, and analyzed by Dr. Sean J. Bennett, Geologist, and Dr. Fred E. Rhoton, Soil Scientist, USDA-ARS National Sedimentation Laboratory, Oxford, MS, within Grenada Lake. This field data collection program was initiated at the direct request of Mr. Thomas L. Hengst, Senior Project Manager, Demonstration Erosion Control Project, U.S. Army Corps of Engineers (COE), Vicksburg District, MS. Communications between the USDA-ARS and the COE began in January, 2002.

1.1 Background

A large number of stream channels in the Midwestern United States have been subjected to severe erosion and incision due to channelization programs during the early 1900s and again in the 1950s and 1960s (Simon and Rinaldi, 2000). These erosional processes, caused in many cases by migrating knickpoints several meters in height, were exacerbated by the low cohesive strength of the loess-derived soils. The streams within the Yalobusha River basin, located in north-central Mississippi within the bluff hills region of the state, have also experienced severe erosion, bed incision, and channel widening (Simon, 1998). Straightening of the Yalobusha River and Topashaw Creek, most recently as 1967, has markedly altered the base level of these streams and promoted basin-wide degradation of the river channels.

The primary results of changing base level within the Yalobusha River basin are channel incision, bank destabilization, and channel widening (Simon and Thomas, 2002). Large volumes of sediment and woody riparian vegetation were delivered to the flow and were transported through the river network (Downs and Simon, 2001). When the channelized, straightened Yalobusha River reaches met the natural, unchannelized meanders, the woody debris in transport would became snagged and deposited. These processes, left unrequited for decades, resulted in the rapid accumulation of a large woody debris plug on the lower Yalobusha River downstream of Calhoun City, MS. This is the third known debris accumulation in the last 60 years. Estimates by Simon (1998) and Downs and Simon (2001) suggest that as much as 5 m of sediment and debris has accumulated vertically since 1967 and input of vegetation due to bank failure in the vicinity of major knickpoints is around 28 m^3/yr. This debris accumulation has significantly increased the magnitude, frequency, and severity of flooding in the Calhoun City area.

1.2 Problem Statement

Before the Corps of Engineers initiates debris plug removal and channel improvements, an assessment of sedimentation within Grenada Lake located downstream of the plug is required. To meet this need, the following work was proposed (January, 2002).

1. Samples of the sediment trapped within Grenada Lake will be collected using vibracoring technology.
2. All sediment samples will be analyzed for particle size and bulk density, historical agrichemicals, and heavy metals and chemical elements.

3. The primary deliverable is a report summarizing sediment thickness, stratigraphy, and chemical and physical characteristics of the sediment impounded within Grenada Lake.

This report summarizes the main findings of the field data collection program within Grenada Lake. Descriptions of the methods and procedures as well as sample locations are also presented and discussed. The results of a subsurface geophysical survey of the lake and an assessment of sedimentation patterns will be presented elsewhere.

2. PROCEDURES

2.1 Sediment Coring

A commercially available vibracoring system was used to core sediments within Grenada Lake (Figures 2-1 to 2-4). Vibracoring is a common approach for obtaining undisturbed cores of unconsolidated sediment in saturated or nearly saturated conditions (Lanesky et al., 1979; Smith, 1984). This system uses a 1-HP motor that drives a pair of weights (masses) eccentrically mounted on two shafts, and it is housed within a watertight aluminum chamber so it can be immersed in water (Figure 2-1). The chamber (driver) was connected to the top of an aluminum irrigation pipe 1.5-mm in thickness and 76-mm in diameter that was cabled to a 4.2-m high aluminum tripod fitted with a battery-operated winch. The driver is equipped with a 50-ft power cord, thus limiting the depth of operation. Lengths of core pipe 4-m long were used, although longer lengths are possible. The tripod was mounted to a raft that could be easily carried and assembled on site, towed with a small boat, and anchored into position (Figures 2-1 to 2-4).

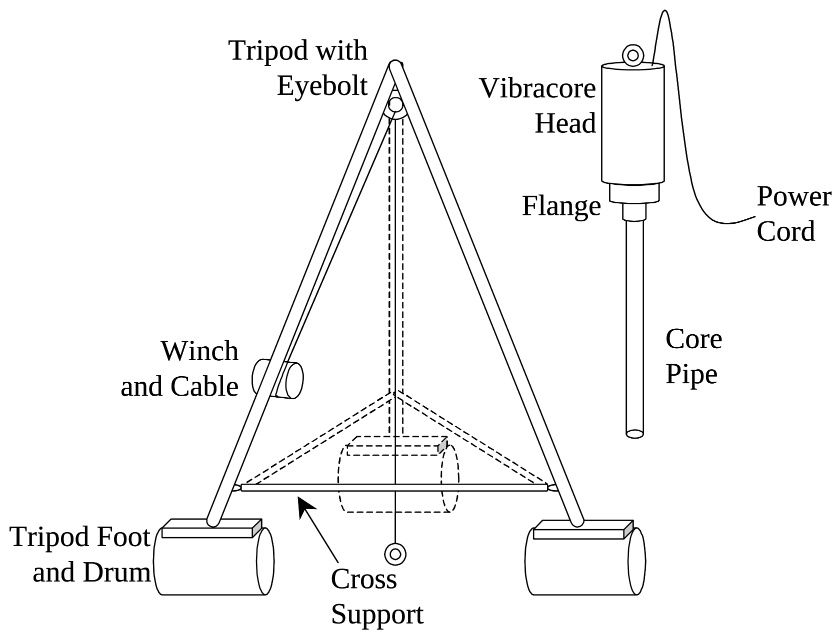


Figure 2-1. Schematic diagram of vibracoring system.

Figure 2-2. Picture of vibracorer taken on Grenada Lake.

Figure 2-3. Picture of the vibracorer taken during operation on the Yalobusha River. Core pipe is fully extended.

Figure 2-4. Picture of the vibracorer taken during operation on Grenada Lake. Core pipe is being pulled from the lake.

2.2 Bulk Density, Particle Size Analysis, and Total Carbon

Selected physical and chemical characteristics were determined for each of the sediment samples. Bulk density was determined by weighing the wet samples secured from known volumes, oven-drying the material, and re-weighing the sample. For particle size analysis, approximately 10 g of sediment was treated in H_2O_2 and shaken overnight in sodium hexametaphosphate for complete dispersion. Total percent clay (<2 μm) by mass was determined by siphoning off 5-mL of the dispersed sediment using the pipette method (Method 3A1, Soil Survey Staff, 1992). Total percent sand by mass was determined by wet sieving the remaining sample through a 53-μm sieve and weighing the dried sediment retained. Total percent silt by mass was calculated by subtracting the masses of sand and clay from the original sample mass. Amounts of total carbon (% by mass) were determined with a Leco CN 2000 carbon analyzer using a 2-g sediment sample. The total carbon data presented given here are normalized by the bulk density of the sediment (mass per unit area).

2.3 Agrichemical Analysis

All sediment used in quality assessment was sent to an independent laboratory (Soil-Plant Analysis Laboratory, University of Louisiana at Monroe) for analysis. Wet, unaltered sediment samples were collected from the cores, placed into aluminum foil, packed into coolers with ice, and shipped to the laboratory. Agrichemical concentrations were determined using standard methods approved by the U.S. Environmental Protection Agency (US-EPA, 1997). Table 2-1 lists the compounds examined in this study and their detection limits. The Appendix lists current USEPA standards for select pesticides and herbicides.

2.4 Bulk Chemical Analysis

All sediment used in bulk chemical assessment was sent to an independent laboratory (Activation Laboratories, LTD., Ontario, Canada). Approximately 5 g of oven-dried, crushed sediment was sent to the laboratory. A small subsample was digested using four acids (hydrofluouric HF, perchloric $HClO_4$, nitric HNO_3, and hydrochloric HCL; a near total digestion process) and analyzed for (1) 48 elements using an inductively coupled plasma spectrometer and (2) mercury using cold-vapor atomic absorption (cold vapor-flow injection mercury system). Table 2-2 lists the elements examined in this study and their detection limits. The Appendix lists current US-EPA standards for select elements.

2.5 Geospatial Data

In order to construct geospatial maps, global positioning satellite system (GPS) technology was employed. A commercially-available, hand-held global positioning receiver was used to determine the location of all cores. Geospatial data were differentially corrected (DGPS) using base station data from either Jackson or Okolona, MS and commercially-available software. Maps created using geographic information systems software were made available by the Mississippi Automated Resource Information System, Jackson, MS (http://www.maris.state.ms.us/). All geospatial data presented herein uses the Mississippi State

Transverse Mercator (MSTM) coordinates. All data collected using the hand-held receiver were converted from Universal Transverse Mercator (UTM) coordinates to MSTM coordinates.

Table 2-1. List of agrichemicals examined in this study with their detection limits and the method of detection (USEPA, 1997).

Compound	Units	Detection Limit	Method
		Pesticides	
Aldrin	ppb	1	SW-846 8081a, gas chromatography
BHC-alpha	ppb	1	SW-846 8081a, gas chromatography
BHC-beta	ppb	1	SW-846 8081a, gas chromatography
BHC-delta	ppb	1	SW-846 8081a, gas chromatography
BHC-gamma	ppb	1	SW-846 8081a, gas chromatography
Chlordane	ppb	1	SW-846 8081a, gas chromatography
DDD	ppb	1	SW-846 8081a, gas chromatography
DDE	ppb	1	SW-846 8081a, gas chromatography
DDT	ppb	1	SW-846 8081a, gas chromatography
Dieldrin	ppb	1	SW-846 8081a, gas chromatography
Endrin	ppb	1	SW-846 8081a, gas chromatography
Endrin aldehyde	ppb	1	SW-846 8081a, gas chromatography
Endosulfan I	ppb	1	SW-846 8081a, gas chromatography
Endosulfan II	ppb	1	SW-846 8081a, gas chromatography
Endosulfan sulfate	ppb	1	SW-846 8081a, gas chromatography
Heptachlor	ppb	1	SW-846 8081a, gas chromatography
Heptachlor epoxide	ppb	1	SW-846 8081a, gas chromatography
Toxaphene	ppb	1	SW-846 8081a, gas chromatography
		PCBs	
Aroclor 1016	ppb	1	SW-846 8082, gas chromatography
Aroclor 1221	ppb	1	SW-846 8082, gas chromatography
Aroclor 1232	ppb	1	SW-846 8082, gas chromatography
Aroclor 1242	ppb	1	SW-846 8082, gas chromatography
Aroclor 1248	ppb	1	SW-846 8082, gas chromatography
Aroclor 1254	ppb	1	SW-846 8082, gas chromatography
Aroclor 1260	ppb	1	SW-846 8082, gas chromatography

Table 2-2. List of agrichemicals examined in this study with their detection limits and the method of detection (USEPA, 1997). * denotes elements that may only be partially digested.

Element	Symbol	Units	Detection Limit
Silver	Ag	ppm	0.3
Aluminum*	Al	%	0.01
Arsenic	As	ppm	0.5
Gold	Au	ppb	2
Barium	Ba	ppm	50
Berylium	Be	ppm	1
Bismuth	Bi	ppm	2
Bromine	Br	ppm	0.5
Calcium	Ca	%	0.01
Cadmium	Cd	ppm	0.3
Cerium	Ce	ppm	3
Cobalt	Co	ppm	1
Chromium	Cr	ppm	2
Cesium	Cs	ppm	1
Copper	Cu	ppm	1
Europium	Eu	ppm	0.2
Iron	Fe	%	0.01
Hafnium	Hf	ppm	1
Mercury	Hg	ppb	5
Iridium	Ir	ppb	5
Potassium	K	%	0.01
Lanthanum	La	ppm	0.5
Lutetium	Lu	ppm	0.05
Magnesium	Mg	%	0.01
Manganese	Mn	ppm	1
Molybdenum	Mo	ppm	1
Sodium	Na	%	0.01
Neodymium	Nd	ppm	5
Nickel	Ni	ppm	1
Phosphorus	P	%	0.001
Lead	Pb	ppm	3
Rubidium	Rb	ppm	15
Sulfur	S	%	0.001
Antimony	Sb	ppm	0.1
Scandium	Sc	ppm	0.1
Selenium	Se	ppm	3
Samarium	Sm	ppm	0.1
Tin	Sn	%	0.01
Strontium	Sr	ppm	1
Tantalum	Ta	ppm	0.5
Terbium	Tb	ppm	0.5
Thorium	Th	ppm	0.2
Titanium	Ti	%	0.01
Uranium	U	ppm	0.5
Vanadium	V	ppm	2
Tungsten	W	ppm	1
Yttrium*	Y	ppm	1
Ytterbium	Yb	ppm	0.2
Zinc	Zn	ppm	1

3. CORE SAMPLE LOCATIONS

Figure 3-1 shows the location of Grenada Lake in relation to local communities. The purpose of site location for the sampling program was to collect as many as 50 sediment cores along the length of the Yalobusha River arm, the Skuna River arm, and within the main pool of Grenada Lake. A hand-held GPS receiver was used to define the geospatial coordinates for all sample locations.

Figure 3-2 shows all sample locations and Table 3-1 provides the exact UTM coordinates for each site. Core locations within the lake are numbered consecutively 1 through 47, with multiple cores extracted at same location, and numbered in accordance to the date obtained. Data results and analyses will be presented for Cores 1 to 44.

Table 3-1. Summary of Grenada Lake sediment cores, their date collected, and their UTM coordinates.

Core ID	Date Collected	Coordinates (UTM): NAD 83/False Easting =500000 m	
		Easting (m)	Northing (m)
1	10/17/2001	254854.1766	3755251.6268
2		253412.3511	3755634.0631
3		253409.5730	3755293.0174
4		253383.2670	3754738.2122
5		251202.8926	3754828.8772
6		250969.8545	3754673.0566
7		250473.5225	3754499.6743
8		250623.7632	3752928.0327
9	10/18/2001	249800.1444	3752602.5609
10		250081.0068	3752506.7401
11		250489.1701	3752357.6591
12		249707.3075	3750552.8643
13		249085.6820	3750731.5022
14		248530.0371	3750778.8219
15	11/16/2001	244653.2907	3744378.9397
16		244653.2907	3744378.9397
17	12/4/2001	244544.2871	3745263.3722
18		244479.0483	3746538.0785
19		246348.0526	3747752.9410
20		246184.6711	3747174.3123
21		246397.1772	3746303.5219
22	12/5/2001	246668.6157	3745703.1537
23		246891.8964	3744749.0919
24		250977.2553	3746451.0801
25		250908.5274	3745806.0558
26		251301.0535	3744853.6513
27	5/19/2002	260221.0092	3745314.2494
28	6/8/2002	260256.3438	3744681.4791
29		260173.9013	3745011.5593
30	6/9/2002	258360.3926	3745139.4440
31		258355.9805	3744795.1433
32		258358.6159	3744319.8133
33	6/16/2002	256087.5272	3744435.2546
34		256097.1202	3744796.0482
35		256057.1555	3745221.3121
36		254460.8458	3745563.9993
37		254527.9720	3744783.9983
38		254453.4148	3744367.4512
39		250803.8211	3744572.7729
40		250131.9704	3744083.8097
41		249181.7191	3743864.7320

Table 3-1 continued.

Core ID	Date Collected	Coordinates (UTM): NAD 83/False Easting =500000 m	
		Easting (m)	Northing (m)
42	6/19/2002	249332.5348	3747342.4269
43	6/19/2002	249007.5953	3746379.2637
44	6/20/2002	246910.5677	3744741.4264
45	10/1/2002	251950.8213	3754221.4620
46		249701.7919	3750541.4605
47		250494.2464	3752368.7526

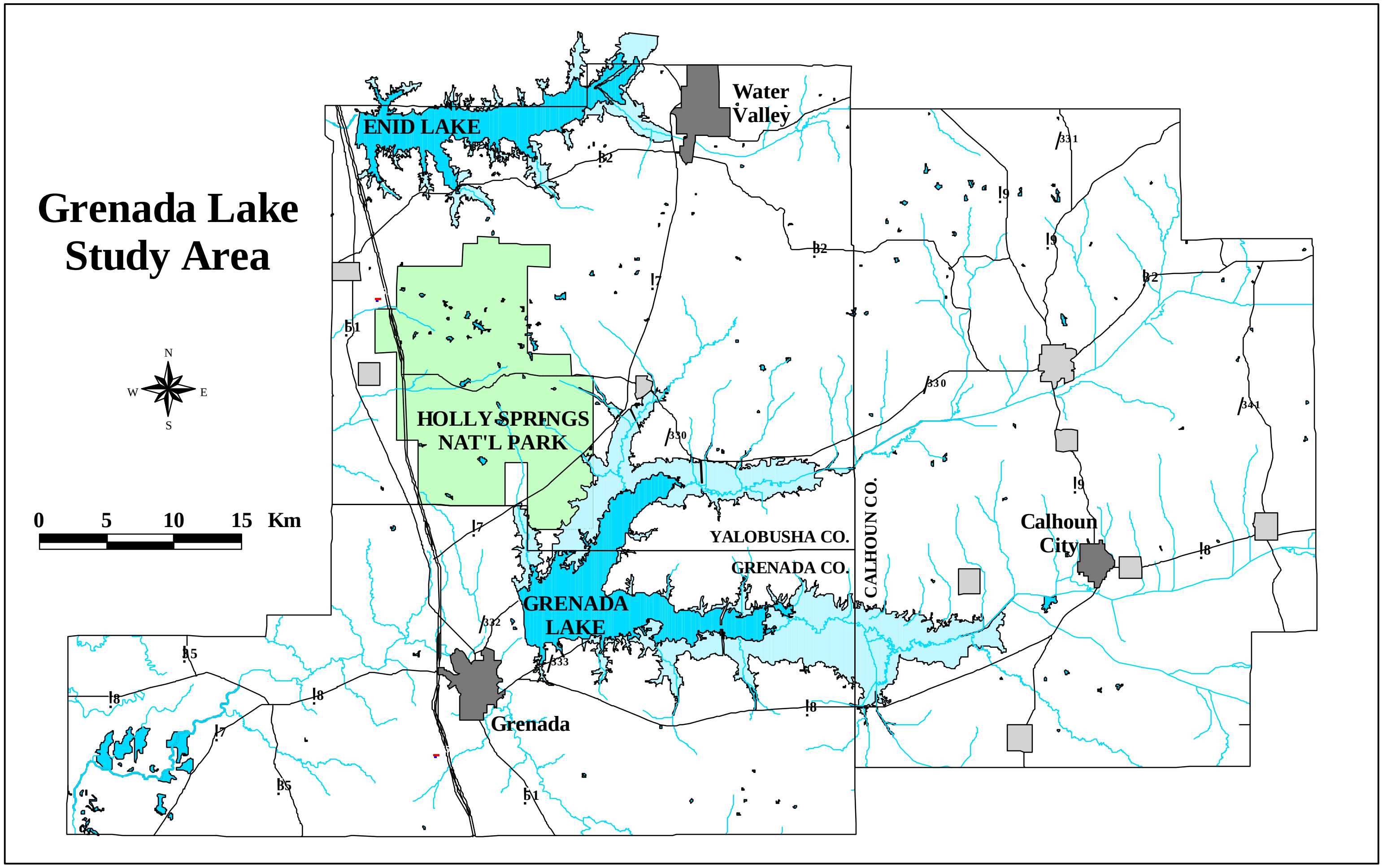


Figure 3-1. Map showing Grenada Lake and surrounding environs.

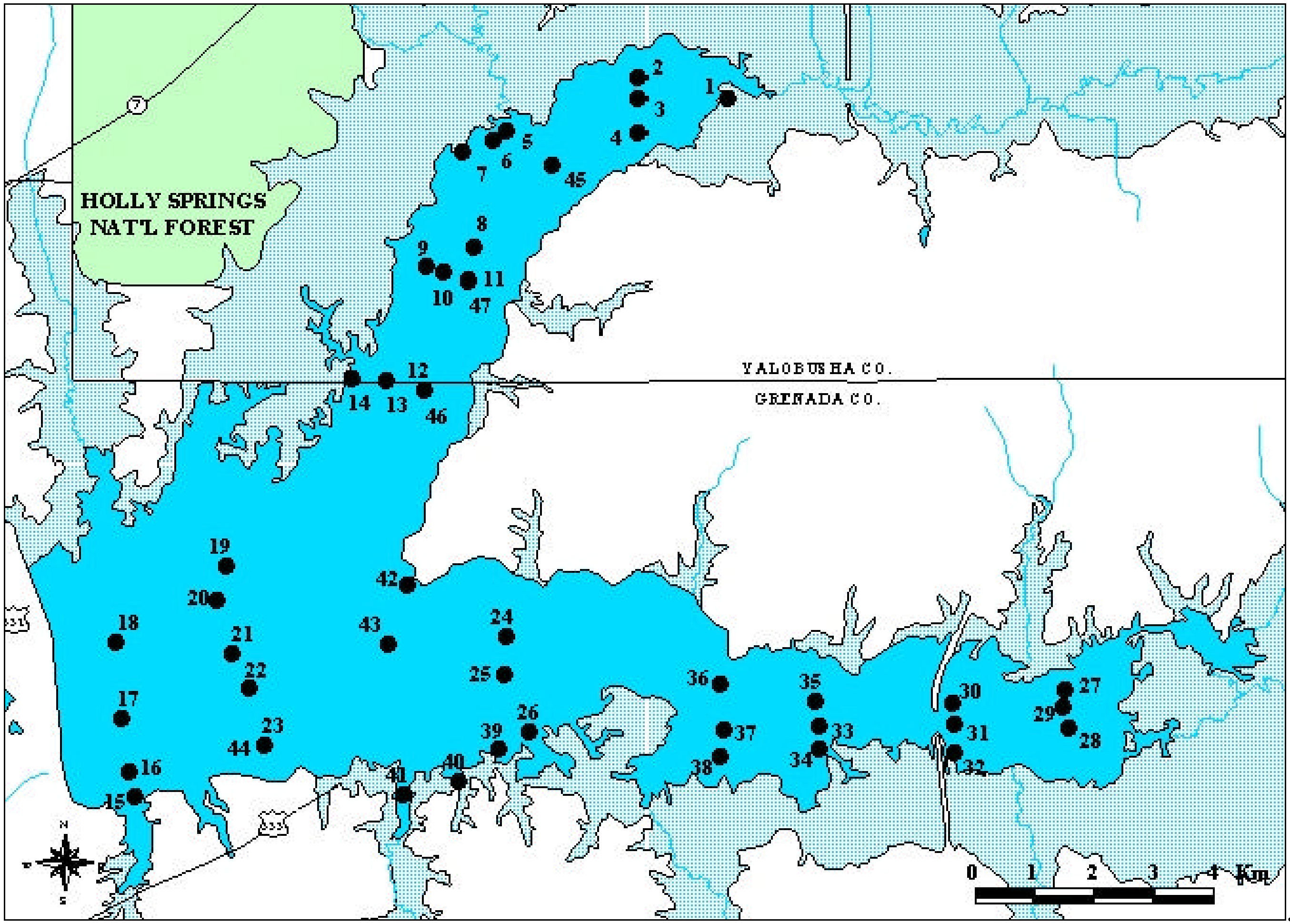


Figure 3-2. Map showing the locations of all cores in Grenada Lake study area.

4. RESULTS

4.1 Discriminating Between Pre- and Post-impoundment Sediment Deposition

The presentation and interpretation of the physical and chemical characteristics of the sediment within Grenada Lake depends on discriminating the post-impoundment sediment, or sediment that has accumulated since the construction of the dam, from the pre-impoundment sediment, or sediment that was present prior to the construction of the dam. This interpretation is based on the following evidence: (1) the use of chemical isotopes and their geochronological interpretation, and (2) variations in sediment texture and bulk density with depth. Two cores were chosen for this analysis: Core 22 and Core 43.

4.1.1 Use of Isotopes for Geochronological Interpretation

Two sediment cores were analyzed for radioactive lead (^{210}Pb; 22-year half-life) for the purpose of dating sediment horizons. Lead-210 is a natural product of the decay of ^{222}Rn gas, the daughter of ^{226}Ra, in the atmosphere (Binford and Brenner, 1986). The flux of ^{210}Pb to sediments in most lakes is across the air-water interface, with negligible supply from tributaries or terrestrial sources. Small quantities of ^{210}Pb are produced within lake sediments by the decay of ^{226}Ra. This fraction is called "supported" ^{210}Pb. "Unsupported" ^{210}Pb is that fraction delivered to the sediments from atmospheric fallout. The amount of unsupported ^{210}Pb in a sediment sample can be calculated by measuring both the ^{210}Pb and ^{226}Ra concentrations and subtracting the supported or in situ component. From this, a rate of accumulation can be derived.

Two sediment cores were analyzed for radioactive cesium (^{137}Cs; 30-year half-life) for the purpose of dating sediment horizons. Because ^{137}Cs is produced during nuclear fission, its presence in the environment is due to nuclear testing or releases from nuclear reactors (Ritchie and McHenry, 1990). First global deposition of ^{137}Cs occurred in 1954±2 and maximum deposition occurred in 1964±2 in the Northern Hemisphere, related to above ground nuclear testing, and in 1986 (Europe) due to the Chernobyl nuclear accident. Cesium-137 concentration can be used as a unique tracer for erosion and sedimentation because it is strongly adsorbed to clay and organic particles and is essentially non-exchangeable. The following assumptions are made herein: (1) ^{137}Cs falls onto the lake surface and attaches quickly to the suspended sediment in the water column, and (2) sediment deposition occurs shortly thereafter. However, surface soil particles eroded from the landscape may be another source of ^{137}Cs. Rates of sediment accumulation can be calculated by knowing the depth of these different ^{137}Cs horizons.

Sediment samples for ^{210}Pb and ^{137}Cs analyses were sent to Flett Research Ltd., Winnipeg, Canada. For ^{137}Cs analysis, dried and ground sediment is compressed at 10,000 PSI into a 2-1/8 inch diameter pancake and placed into an aluminum foil planchet. The sample is placed onto an Ortec GEM High Purity Germanium Coaxial detector (efficiency 18%) and completely surrounded by 2 inch lead shielding. The emission of ^{137}Cs is quantified by comparing the sample's counts per second with a NIST spiked clay gamma-ray emission-rate standard. The detection limit for a period of 80000 seconds is on the order of 0.5 DPM/g (detections per minute per gram) for a 10-g sample. The ^{210}Pb analysis is based on quantifying the amount of polonium-210 (^{210}Po; a grand-daughter of the ^{210}Pb decay sequence) in the sediment sample. The polonium is converted to chloride and distilled from the sediment at 500°C. The ^{210}Po distillate is digested in nitric acid, converted to a chloride salt, and precipitated onto a silver disk. The silver disk is placed into an Ortec alpha spectrometer for an 8-hour counting period and monitored for ^{210}Po and ^{209}Po isotopes as compared to the activity of a ^{209}Po spike added at the beginning of sample processing. Detection limits are on the order of 0.1 DPM/g (0.0017 Bq/g) for an 8-hour counting period using a 0.5-g sample.

4.1.2 Geochronological Results and Interpretations for Core 22

Figure 4-1 shows the geochronological results obtained for Core 22, plotted alongside the variation of sediment texture and sediment bulk density with depth. There is an exponential drop in the ^{210}Pb activity as a function of depth from 0 to 0.4 m. The surface activity is about 5 times the estimated average background ^{210}Pb (1.6 DPM/g) of the lower 0.5 m of the core. The sediment core shows two different sedimentation rates. Cesium-137 is approximately evenly distributed through the upper 0.3 m of the core (0.6 DPM/g), increases to 1.2 DPM/g in the 0.3 to 0.4 m section, and peaks at 2.3 DPM/g in the 0.4 to 0.5 m section.

The slope regression model of unsupported ^{210}Pb activity versus cumulative dry weight (g/cm^2) includes the upper 0.4 m of the core. The slope model assumes constant sedimentation and ^{210}Pb input. If the average ^{210}Pb activity of the deepest sections of the core (1.6 DPM/g) is the true background, then the closest corresponding sediment accumulation rate is about 0.4053 g/cm^2-yr, and this is has an associated background level of 1.5161 DPM/g. The regression plot, using 1.5161 DPM/g as background, is shown in Figure 4-1a.

Using a sedimentation rate of 0.4053 g/cm^2-yr, the age of the sediment at a depth of 0.4 m is calculated as cumulative mass (12.83 g/cm^2) divided by the sedimentation rate (0.4053 g/cm^2-yr), which is 31.66 years. The core was sampled in 2002, the date at 0.4 m depth would be about 1970 (Figure 4-1a). Using a dam construction date of 1954 and assuming a sedimentation rate of 0.4053 g/cm^2-yr), the calculated cumulative mass for this time period would be 19.45 g/cm^2, which corresponds to a depth of 0.5 m (Figure 4-1a).

For Core 22, the peak ^{137}Cs activity occurs at a depth of 0.4 to 0.5 m and little to no activity occurs below this level. It is concluded that this peak corresponds to the 1964 timeline, and the reduced activity at a depth of 0.5 to 0.6 m corresponds to the date of dam construction (1954; Figure 4-1c). These timelines derived correlate well the timelines determined using the ^{210}Pb data.

These timelines also correspond to depth variations in sediment texture and bulk density. Assuming that dam construction correlates to a subsurface depth of 0.5 m, the post-impoundment sediments are enriched in clay (up to 80% by mass) and depleted in both silt (about 20% by mass) and sand (about 0% by mass) as compared to the parent or pre-impoundment materials, which has more silt (up to 60% by mass) and sand (up to 5% by mass) and less clay (up to 35% by mass; Figure 4-1d). Moreover, the pre-impoundment sediments are denser (greater than 1400 kg/m^3) than the post-impoundment sediments (less than 1100 kg/m^3; Figure 4-1e), although this may be the results of compaction and dewatering due to burial.

4.1.3 Geochronological Results and Interpretations for Core 43

Figure 4-2 shows the geochronological results obtained for Core 43, plotted alongside the variation of sediment texture and sediment bulk density with depth. There is an irregular drop in the ^{210}Pb activity as a function of depth in the upper 0.8 m (or 80 g/cm^2) of core (Figure 4-2a). The surface activity is about two times the estimated average background ^{210}Pb activity level (1.076 DPM/g) of the deepest six sections. The ^{210}Pb activity data indicate varying sedimentation rates for this core.

The ^{137}Cs activity is undetectable in the upper portions of the core (0 to 0.1 m) and low for the middle portions (0.1 to 0.2 pCi/g for 0.1 to 0.5 m; Figure 4-2b). The peak in ^{137}Cs activity (about 0.6 pCi/g) occurs at a depth of 0.7 to 0.8 m. This peak is interpreted as the 1964 timeline. The significant ^{137}Cs activity observed above and below the maximum is attributed to post-depositional diffusion of the isotope or mixing within the sediments. The relatively constant ^{210}Pb activity observed in the deepest sections of the core is assumed to represent background levels.

Based on this information, sediment located at a depth of 0.9 m would have been deposited prior to 1958, or near the time the dam was constructed (1954). If the initial surface activity of ^{210}Pb in the core is assumed to be about 2 DPM/g, and the background is 1 DPM/g, then the surface excess ^{210}Pb would be only about 1 DPM/g. After nearly 44 years (or two half-lives of ^{210}Pb), the excess activity would drop to about 0.25 DPM/g, and this would not be significantly different from background. Thus, the observed ^{210}Pb profile in Core 43 is not at odds with the ^{137}Cs activity results. However, the slope regression model for ^{210}Pb cannot be applied here because a constant rate of sedimentation, i.e., a monotonic decrease in ^{210}Pb activity, is not observed.

In addition, the dam construction timeline derived from ^{137}Cs activity data does not correlate well with the variation in texture and bulk density (Figure 4-2c and d). There is a slight trend for clay to be enriched from a depth from 0.9 to 0.55 m within the core. Also, sediment bulk density is higher below the 1954 timeline (Figure 4-2b).

4.1.4 Discussion

Figures 4-1 and 4-2 show that the ^{137}Cs activity data within the sediments can be used to define the stratigraphic position of dam construction. Results from Core 22 show that the timelines derived from the ^{210}Pb data correlate well with the ^{137}Cs data. Moreover, these timelines also correspond to depth variations in sediment texture and bulk density. That is, the post-impoundment sediments are enriched in clay (up to 80% by mass) and depleted in both silt (about 20% by mass) and sand (about 0% by mass) as compared to the parent or pre-impoundment materials. The lack of correlation between the ^{137}Cs data and sediment texture in Core 43 may be due to (1) the mixing of sediment sources or (2) the dispersal or movement of sediment after deposition as the result of dam operation.

Based on the results obtained for Core 22, the interpretation of the physical and chemical characteristics of the sediment will be based on whether the materials have accumulated since dam construction. These interpretations will be based on the variations in sediment texture, which show the significant enrichment in clay content since construction. Those sediment cores that show ambiguous textural trends will not be interpreted in this manner.

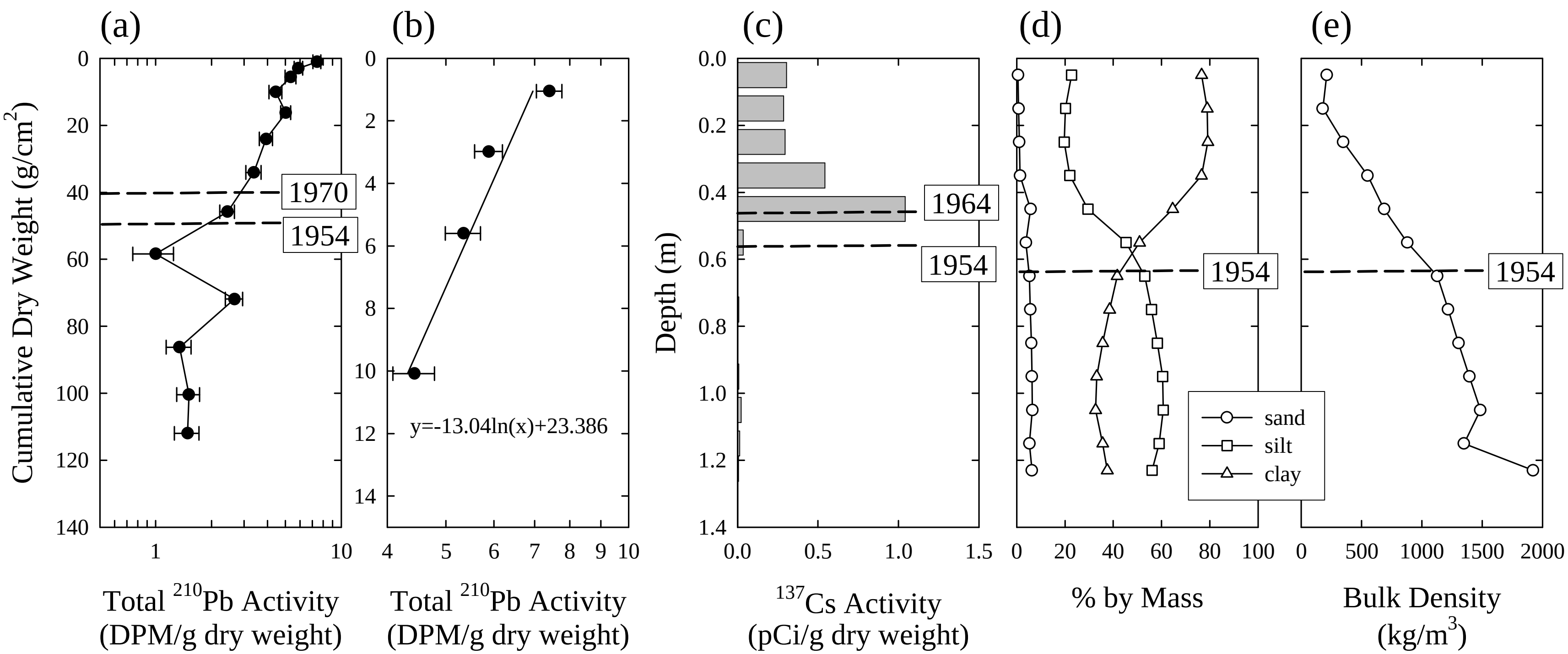


Figure 4-1. Geochronological results and interpretations for Core 22 showing (a) ^{210}Pb activity as a function of cumulative dry weight of sediment, (b) regression model for ^{210}Pb activity for the upper portion of the core, (c) ^{137}Cs activity as a function of core depth, variation of (d) sediment texture and (e) sediment bulk density with core depth. Interpreted timelines (1954, 1964, and 1970) are also shown. See Figure 3-2 for core location.

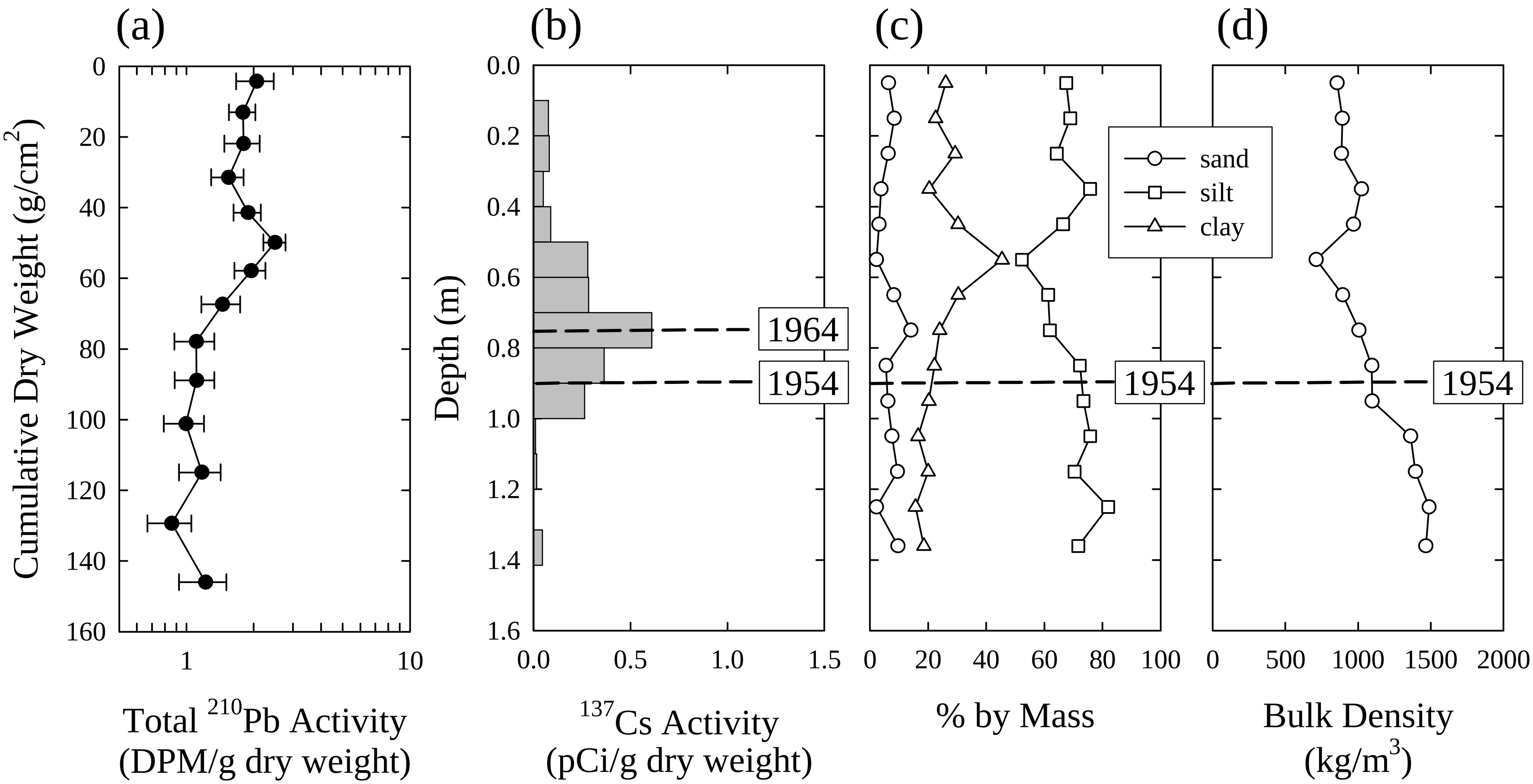


Figure 4-2. Geochronological results and interpretations for Core 43 showing (a) ^{210}Pb activity as a function of cumulative dry weight of sediment, (b) ^{137}Cs activity as a function of core depth, variation of (c) sediment texture and (d) sediment bulk density with core depth. Interpreted timelines (1954 and 1964) are also shown. See Figure 3-2 for core location.

4.2 Application of Geochronology to Cores with Particle Size Data

Table 4-1 lists the results of the particle size, soil bulk density, and total carbon analyses conducted for select sediment cores from Grenada Lake. Figures 4-3 and 4-4 show the variation of sediment texture with depth as a function of spatial position for the Skuna River arm and Yalobusha River arm, respectively, starting upstream and moving into the main reservoir pool.

The geochronological data presented above provides the necessary criterion for determining the division between post-impoundment sedimentation and pre-impoundment or parent material. This criterion is the significant enrichment of clay-sized particles and the depletion of silt-sized particles, and it has been applied to all sediment cores where textural variations are unambiguous (Figures 4-3 and 4-4; Table 4-1). Table 4-2 lists the depth to the 1954 horizon—the time of dam construction—for all cores successfully interpreted. The greatest sedimentation occurs in the upper reaches of the Yalobusha River, where as much as 1.2 to 1.3 m of sediment has accumulated since dam construction (Table 4-2; Figure 4-4). Within the main pool of Grenada Lake, the enrichment of clay-sized particles and the depletion of silt-sized particles are most apparent, and sediment accumulations are typically 0.5 to 0.9 m.

Table 4-2. Depth to 1954 horizon (time of dam construction) for those cores with particle size data and based on geochronological interpretation. Not all cores with particle size data were interpreted in this manner. Refer to Figures 4-3 and 4-4.

Core Number	Depth to 1954 horizon (m)
1	0.8
8	0.4
12	0.7
16	0.9
21	0.5
22	0.7
24	0.5
27	0.8
31	1.3
34	0.8
36	1.2
43	0.7
44	0.7

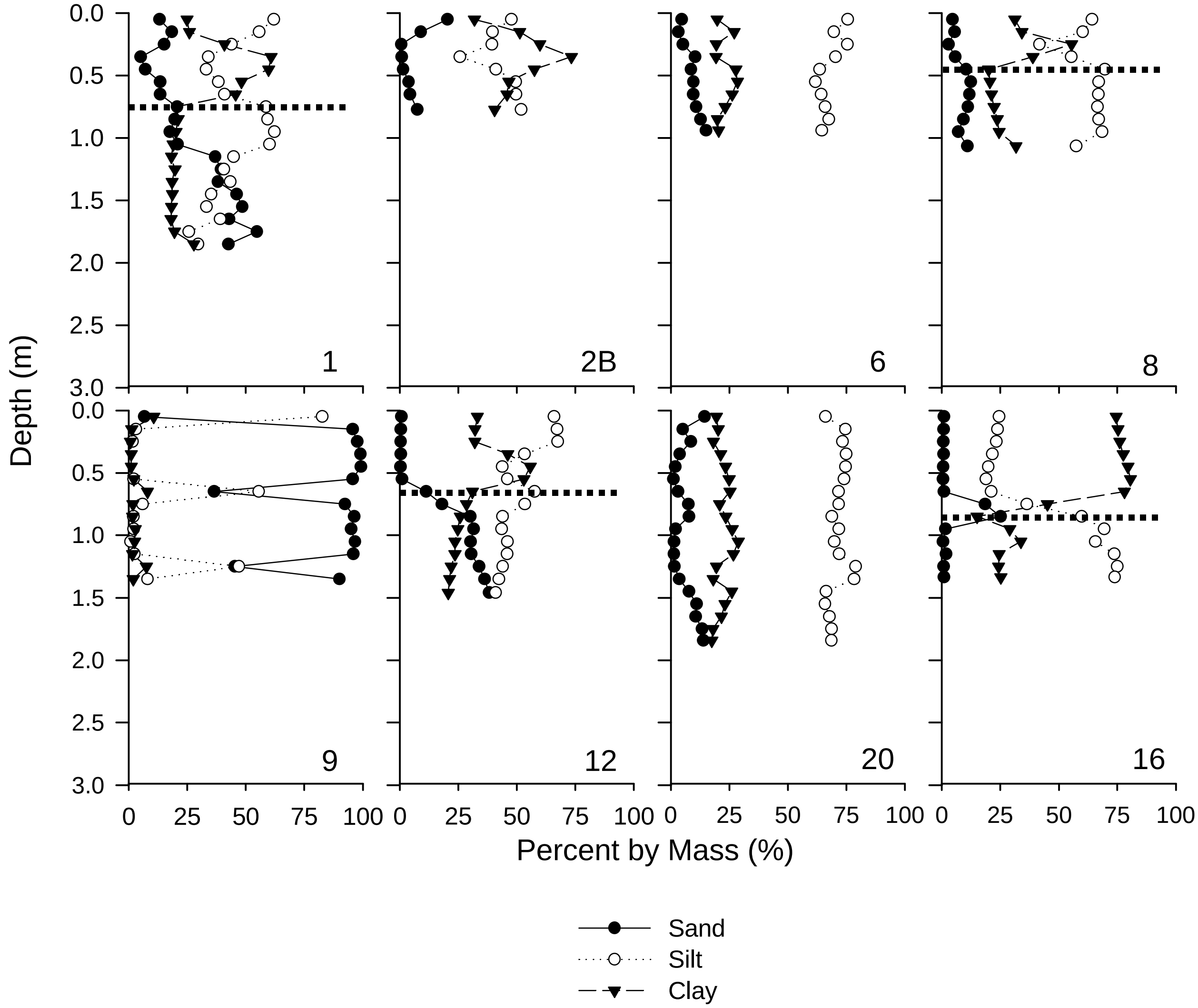


Figure 4-3. Variations in sediment texture with depth for select cores along the Skuna River arm of Grenada Lake, starting upstream (Core 1) and traversing into the main pool (Core 16). The dashed line demarcates the division between post-impoundment deposition and pre-impoundment sediment materials that could be interpreted with the geochronological data. Refer to Figure 3-2 for core locations.

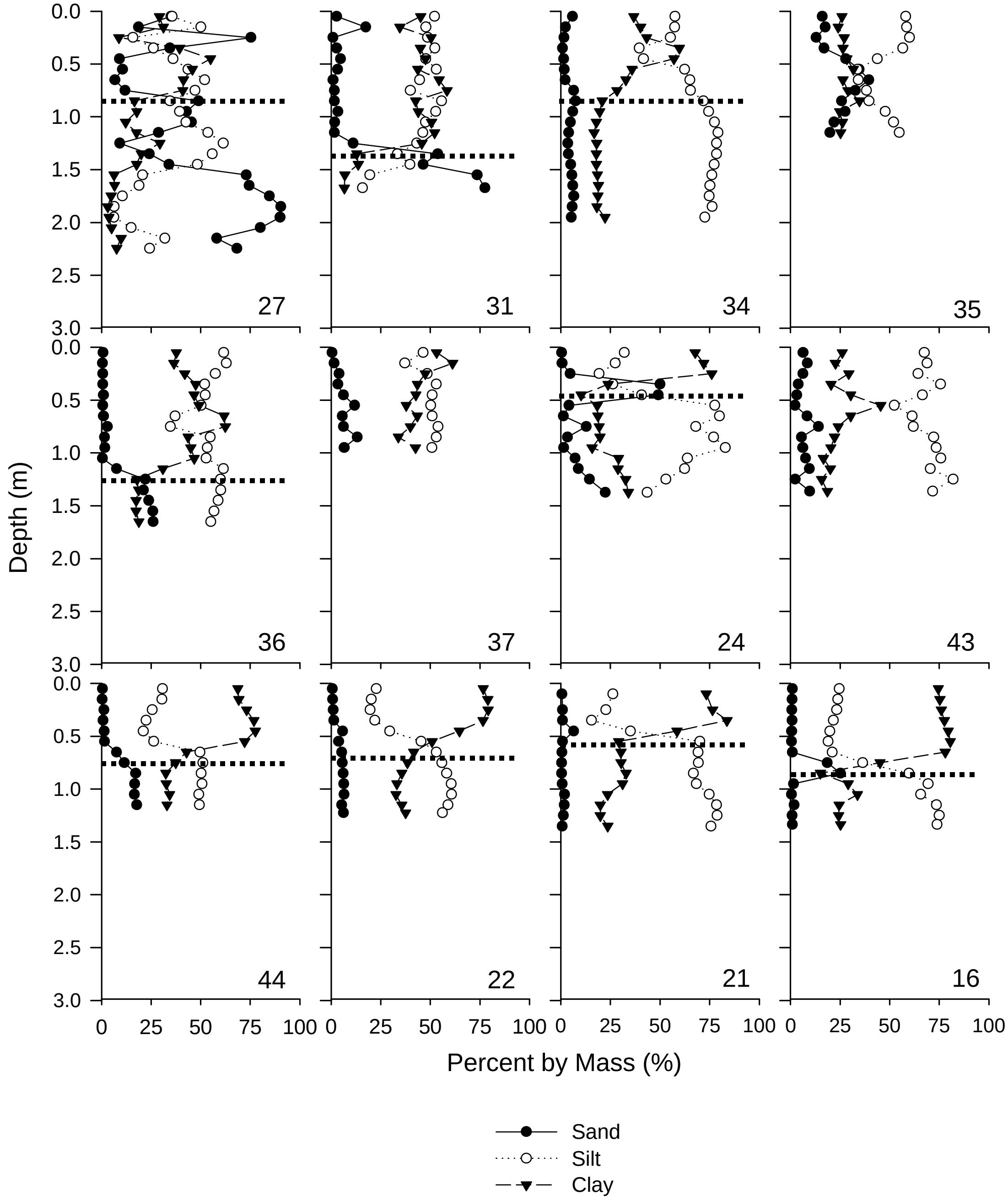


Figure 4-4. Variations in sediment texture with depth for select cores along the Yalobusha River arm of Grenada Lake, starting upstream (Core 27) and traversing into the main pool (Core 16). The dashed line demarcates the division between post-impoundment deposition and pre-impoundment sediment materials that could be interpreted with the geochronological data. Refer to Figure 3-2 for core locations.

Table 4-1. Summary of select physical and chemical parameters of sediment samples taken from the Grenada Lake cores. **Bold** text signifies post-impoundment sediment that could be interpreted with the geochronological data.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
1	**0.15**	**13.12**	**61.99**	**24.89**	**931.83**	**0.62**
	0.25	**18.39**	**55.68**	**25.93**	**1014.31**	**0.66**
	0.35	**15.19**	**43.89**	**40.92**	**955.22**	**0.75**
	0.45	**5.13**	**34.05**	**60.82**	**892.69**	**1.20**
	0.55	**7.10**	**33.09**	**59.81**	**814.92**	**2.15**
	0.65	**13.51**	**38.28**	**48.22**	**997.86**	**1.58**
	0.75	**13.39**	**40.95**	**45.65**	**995.87**	**1.05**
	0.85	20.65	58.62	20.73	1408.01	0.39
	0.95	19.66	59.28	21.07	1362.62	0.39
	1.05	17.53	62.24	20.23	1349.32	0.35
	1.15	20.82	60.20	18.97	1522.41	0.26
	1.25	36.88	44.84	18.29	1542.99	0.23
	1.35	39.47	40.70	19.83	1508.66	0.27
	1.45	38.11	43.41	18.49	1515.81	0.23
	1.55	46.08	35.22	18.70	1595.83	0.22
	1.65	48.50	33.23	18.27	1590.46	0.18
	1.75	42.83	39.04	18.13	1639.74	0.20
	1.85	54.76	25.71	19.53	1643.70	0.17
	1.95	42.57	29.67	27.76	1629.43	0.24
2B	0.05	20.38	47.69	31.93	529.17	0.89
	0.15	9.03	39.67	51.30	818.79	1.02
	0.25	0.67	39.43	59.90	836.20	1.03
	0.35	0.83	25.74	73.42	786.76	2.05
	0.45	1.44	41.04	57.52	920.82	1.83
	0.55	3.79	49.56	46.65	1222.67	1.47
	0.65	4.42	49.75	45.84	1209.18	1.48
	0.88	7.51	51.89	40.60	1340.93	1.17
3	0.01				591.74	
	0.04				885.51	
	0.06				1018.41	
	0.09				837.15	
	0.11				720.29	
	0.14				792.48	
	0.16				815.57	
	0.19				760.85	
	0.21				908.04	
	0.24				885.39	
	0.26				704.39	
	0.29				981.77	
	0.31				1062.06	

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
3	0.34				985.53	
	0.36				1152.37	
	0.39				1204.00	
	0.41				1078.30	
	0.44				1027.66	
	0.46				1232.62	
	0.49				1301.08	
	0.51				1238.63	
	0.54				1228.55	
	0.56				1225.14	
	0.59				1328.80	
	0.61				1187.89	
	0.64				1169.13	
	0.66				1375.05	
	0.69				1166.39	
	0.71				1217.66	
	0.74				1436.06	
	0.76				1248.05	
	0.79				1364.71	
	0.81				1327.81	
	0.84				1239.74	
	0.86				1161.77	
	0.89				1346.31	
	0.91				1300.85	
	0.94				1479.54	
	0.96				1279.00	
	0.99				1217.88	
	1.01				1408.23	
	1.04				1343.11	
	1.06				1400.42	
	1.09				1481.55	
	1.11				1208.62	
	1.14				1326.08	
	1.16				1278.50	
	1.19				1159.53	
	1.21				1331.55	
	1.24				1525.95	
	1.26				1247.91	
	1.29				1423.57	
	1.31				1265.31	

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
3	1.34				1428.95	
	1.36				1254.77	
	1.39				1448.33	
	1.41				1253.49	
	1.44				1453.85	
	1.46				1379.73	
	1.49				1357.12	
	1.51				1520.54	
	1.54				1292.88	
	1.56				1412.37	
	1.59				1451.57	
	1.61				1598.30	
	1.64				1479.10	
	1.66				1314.74	
	1.69				1368.93	
	1.71				1385.69	
	1.74				1438.87	
	1.76				1656.51	
4	0.05				1021.89	0.50
	0.15				1094.06	0.48
	0.25				1442.46	0.10
	0.35				1433.31	0.15
	0.45				1239.50	0.18
	0.55				1023.17	0.64
	0.65				1007.21	0.69
	0.75				1256.85	0.41
	0.85				1314.40	0.46
	0.95				1328.37	0.34
	1.05				1378.71	0.28
	1.15				1393.55	0.25
	1.25				1446.06	0.29
	1.35				1408.36	0.30
	1.45				1430.67	0.34
	1.55				1437.69	0.27
	1.66				1006.44	0.30

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
6	0.05	4.64	75.53	19.82	1285.19	0.47
	0.15	3.25	69.66	27.09	1178.94	0.50
	0.25	5.16	75.42	19.42	1384.58	0.51
	0.35	10.34	70.33	19.33	1374.69	0.76
	0.45	8.60	63.60	27.79	1299.97	0.58
	0.55	9.66	61.81	28.53	1335.24	0.34
	0.65	9.55	64.29	26.16	1472.13	0.22
	0.75	10.81	65.99	23.20	1466.81	0.20
	0.85	12.68	67.49	19.84	1525.86	0.12
	0.94	15.07	64.50	20.43	1693.24	0.12
7A	0.05				1259.35	0.49
	0.15				1205.52	0.62
	0.25				1181.11	0.51
	0.35				1041.39	0.89
	0.45				1121.58	1.54
	0.55				1167.92	1.32
	0.65				1437.90	0.97
	0.75				1383.93	0.75
	0.85				1561.88	0.45
	0.95				1442.36	0.47
	1.05				1422.75	0.37
	1.15				1563.61	0.29
	1.27				1506.65	0.25
7B	0.05				873.28	0.57
	0.15				1209.69	0.68
	0.25				1299.05	0.56
	0.35				1248.04	0.52
	0.45				1077.20	0.82
	0.55				1212.02	1.18
	0.65				1332.54	1.26
	0.75				1277.07	1.13
	0.85				1470.52	0.65
	0.95				1335.54	0.47
	1.05				1468.67	0.55
	1.15				1464.40	0.29
	1.25				1469.04	0.25
	1.35				1505.91	0.23
	1.45				1546.80	0.18

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
8	**0.05**	**4.57**	**64.19**	**31.24**	**712.87**	**0.79**
	0.15	**5.47**	**60.23**	**34.30**	**1057.05**	**0.75**
	0.25	**2.87**	**41.68**	**55.45**	**962.39**	**0.84**
	0.35	**5.73**	**55.34**	**38.94**	**1066.16**	**0.84**
	0.45	10.34	69.65	20.01	1420.20	0.60
	0.55	12.39	67.01	20.60	1422.08	0.34
	0.65	11.83	66.90	21.27	1349.49	0.31
	0.75	11.16	66.49	22.35	1364.26	0.32
	0.85	9.20	67.08	23.72	1393.84	0.26
	0.95	7.08	68.43	24.49	1447.27	0.22
	1.07	10.91	57.37	31.72	1618.87	0.22
9	0.05	6.64	82.65	10.71	943.98	0.71
	0.15	95.71	3.00	1.29	1347.23	0.09
	0.25	97.67	1.57	0.76	1618.31	0.03
	0.35	99.00	-0.04	1.04	1542.80	0.03
	0.45	99.20	-0.29	1.08	1611.84	0.02
	0.55	95.71	2.11	2.18	1492.37	0.16
	0.65	36.46	55.53	8.01	1212.84	0.82
	0.75	92.34	5.85	1.81	1324.47	0.04
	0.85	96.33	1.98	1.69	1450.95	0.03
	0.95	95.05	2.14	2.81	1470.99	0.04
	1.05	96.71	0.80	2.49	1598.37	0.04
	1.15	95.92	2.42	1.66	1059.09	0.25
	1.25	45.34	47.07	7.58	1171.87	1.59
	1.35	90.02	8.01	1.97	1473.62	0.08
10	0.05				725.68	0.72
	0.15				1023.96	0.69
	0.25				1015.06	0.78
	0.35				901.96	0.84
	0.45				856.15	1.21
	0.55				1072.86	1.50
	0.65				1235.60	0.80
	0.75				1232.17	0.87
	0.85				1330.52	0.87
	0.95				1326.29	0.81

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
11	0.15				1059.60	0.49
	0.25				1054.06	0.66
	0.35				1083.35	0.61
	0.45				1013.70	0.65
	0.55				1109.47	0.55
	0.65				1331.30	0.26
	0.75				1495.96	0.20
	0.85				1484.16	0.22
	0.95				1510.58	0.15
	1.05				1427.41	0.08
	1.15				1354.36	0.08
	1.25				1520.25	0.10
	1.35				1458.93	0.14
	1.45				1571.87	0.22
	1.55				1466.44	0.16
	1.65				1577.65	0.09
	1.75				1517.67	0.10
	1.85				1433.56	0.19
	1.95				1495.70	0.19
	2.05				1534.12	0.14
	2.15				1412.42	0.08
	2.25				1423.57	0.20
	2.35				1571.36	0.19
	2.45				1532.38	0.11
	2.55				1570.76	0.09
12	**0.05**	**0.76**	**65.97**	**33.27**	**141.17**	**0.88**
	0.15	**0.54**	**67.24**	**32.22**	**606.35**	**0.86**
	0.25	**0.43**	**67.44**	**32.13**	**887.24**	**0.74**
	0.35	**0.51**	**53.32**	**46.17**	**754.70**	**0.95**
	0.45	**0.39**	**43.80**	**55.81**	**793.85**	**0.90**
	0.55	**1.01**	**45.94**	**53.05**	**780.40**	**1.07**
	0.65	**11.29**	**57.67**	**31.04**	**1109.94**	**1.95**
	0.75	18.00	53.49	28.51	1391.79	0.99
	0.85	30.19	43.94	25.87	1217.84	0.58
	0.95	31.61	43.53	24.86	1622.56	0.40
	1.05	30.30	46.07	23.64	1600.81	0.30
	1.15	30.50	45.89	23.61	1418.90	0.23
	1.25	33.92	44.04	22.04	1562.46	0.20
	1.35	36.25	42.43	21.33	1570.42	0.15
	1.46	38.19	41.02	20.79	1607.72	0.14

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
13	0.05				249.08	0.96
	0.15				313.07	0.97
	0.25				248.63	0.99
	0.35				779.45	0.94
	0.45				883.32	0.81
	0.55				637.82	0.82
	0.65				904.87	0.78
	0.75				950.44	0.72
	0.85				895.62	0.82
	0.95				773.38	0.93
	1.05				696.67	1.01
	1.15				837.01	0.81
	1.25				716.79	0.93
	1.35				738.10	1.01
	1.45				838.55	0.88
	1.55				960.87	0.90
	1.65				415.00	1.29
	1.75				1056.04	1.20
	1.85				1280.10	0.84
	1.95				1316.77	0.76
	2.05				1369.21	0.71
	2.15				895.04	0.54
14	0.05				173.18	0.58
	0.15				988.80	0.48
	0.25				983.43	0.69
	0.35				1101.58	0.34
	0.45				840.80	0.49
	0.55				1222.29	0.44
	0.65				1142.49	0.43
	0.75				1007.55	0.49
	0.85				1000.68	0.50
	0.95				958.53	1.43
	1.05				1042.68	0.51
	1.15				1053.50	0.73
	1.25				1088.84	0.76
	1.35				1043.32	1.24
	1.45				1064.41	1.50
	1.55				1532.60	0.86

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
15A	0.05				1007.70	0.93
	0.15				1397.26	0.41
	0.25				1516.25	0.38
	0.35				1466.06	0.59
	0.45				1442.58	0.51
	0.55				1501.81	0.26
	0.65				1538.89	0.19
	0.75				1522.53	0.21
15B	0.05				475.79	1.27
	0.15				579.58	1.16
	0.25				655.01	1.01
	0.35				801.33	0.99
	0.45				1398.60	0.44
	0.55				1645.46	0.27
	0.65				1476.44	0.36
	0.75				1341.97	0.54
	0.85				1451.44	0.63
	0.95				1396.79	0.32
	1.05				1515.17	0.20
	1.15					0.15
	1.25				1101.71	0.20
16	**0.05**	**0.93**	**24.54**	**74.53**	**69.68**	**1.54**
	0.15	**0.80**	**23.85**	**75.35**	**188.21**	**1.48**
	0.25	**0.65**	**23.32**	**76.03**	**415.46**	**1.46**
	0.35	**0.83**	**21.65**	**77.52**	**494.97**	**1.40**
	0.45	**0.57**	**19.91**	**79.52**	**545.41**	**1.28**
	0.55	**0.51**	**18.89**	**80.60**	**539.22**	**1.27**
	0.65	**0.93**	**21.04**	**78.03**	**627.87**	**1.36**
	0.75	**18.49**	**36.32**	**45.19**	**945.35**	**1.02**
	0.85	**25.16**	**59.74**	**15.10**	**1355.94**	**0.71**
	0.95	1.53	69.40	29.07	1283.49	0.84
	1.05	0.53	65.64	33.83	1310.28	0.66
	1.15	1.85	73.60	24.55	1395.55	0.51
	1.25	0.75	74.96	24.30	1350.87	0.49
	1.34	0.91	73.88	25.21	1427.22	0.46

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
20	0.05	14.47	66.07	19.47	1490.49	0.41
	0.15	5.11	74.62	20.27	1451.54	0.32
	0.25	8.51	73.29	18.20	1455.57	0.56
	0.35	3.78	74.91	21.31	1352.09	0.67
	0.45	1.91	74.71	23.38	1208.99	0.73
	0.55	1.15	73.94	24.91	1281.03	0.76
	0.65	3.05	71.64	25.31	1235.72	0.46
	0.75	7.45	71.69	20.85	1362.58	0.52
	0.85	7.76	68.80	23.44	1339.60	0.93
	0.95	2.05	71.77	26.18	1182.92	1.41
	1.05	1.38	69.82	28.80	1206.88	1.27
	1.15	1.31	71.94	26.75	1162.34	1.15
	1.25	1.56	78.94	19.50	1305.88	0.46
	1.35	3.63	78.29	18.08	1386.72	0.40
	1.45	7.69	66.25	26.06	1389.89	0.63
	1.55	10.99	65.85	23.16	1545.24	0.47
	1.65	10.58	67.81	21.61	1435.58	0.39
	1.75	13.33	68.71	17.96	1519.36	0.22
	1.84	13.86	68.60	17.54	1560.05	0.21
21	**0.10**	**0.50**	**26.22**	**73.28**	**1401.61**	**1.37**
	0.25	**0.81**	**22.68**	**76.51**	**1256.50**	**1.36**
	0.35	**0.80**	**15.49**	**83.71**	**1242.77**	**1.28**
	0.45	**6.44**	**35.04**	**58.52**	**1227.08**	**2.57**
	0.55	0.86	70.00	29.14	1149.14	1.42
	0.65	0.52	69.24	30.25	1069.81	1.35
	0.75	0.34	69.31	30.35	1065.84	0.81
	0.85	0.32	66.82	32.86	931.09	0.71
	0.95	0.69	68.25	31.06	985.91	0.57
	1.05	1.76	74.72	23.52	644.13	0.37
	1.15	1.68	78.44	19.88	546.25	0.32
	1.25	1.30	78.81	19.88	501.14	0.27
	1.35	0.66	75.70	23.64	91.53	0.36
22	**0.05**	**0.60**	**22.76**	**76.64**	**210.55**	**1.45**
	0.15	**0.79**	**20.25**	**78.96**	**177.96**	**1.37**
	0.25	**1.06**	**19.75**	**79.19**	**347.86**	**1.26**
	0.35	**1.39**	**22.03**	**76.58**	**549.59**	**1.23**
	0.45	**5.81**	**29.55**	**64.64**	**687.60**	**3.18**
	0.55	**3.82**	**45.28**	**50.90**	**878.78**	**2.10**
	0.65	**5.29**	**53.06**	**41.65**	**1127.32**	**1.22**
	0.75	5.65	55.84	38.51	1216.76	0.89

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
22	0.85	6.09	58.28	35.64	1303.75	0.65
	0.95	6.33	60.55	33.12	1392.96	0.46
	1.05	6.54	60.75	32.70	1483.61	0.47
	1.15	5.31	59.03	35.66	1348.25	0.45
	1.23	6.31	56.14	37.54	1919.35	0.26
24	**0.05**	**0.34**	**31.93**	**67.73**	**72.50**	**1.38**
	0.15	**0.59**	**27.40**	**72.01**	**440.82**	**1.37**
	0.25	**4.69**	**19.28**	**76.03**	**602.47**	**1.24**
	0.35	**50.03**	**26.16**	**23.81**	**1012.18**	**0.86**
	0.45	**49.14**	**40.66**	**10.20**	**1455.93**	**0.51**
	0.55	4.11	77.54	18.35	1227.55	0.62
	0.65	1.34	79.99	18.67	1268.05	0.64
	0.75	12.72	67.97	19.31	1315.74	0.68
	0.85	3.33	76.98	19.69	1281.07	0.68
	0.95	1.38	82.94	15.68	1302.24	0.61
	1.05	7.17	63.77	29.06	1207.11	0.90
	1.15	8.78	62.39	28.83	1225.84	0.92
	1.25	14.35	52.99	32.66	1372.28	0.93
	1.37	22.43	43.49	34.07	1451.71	0.78
25	0.05				267.53	
	0.15				494.41	
	0.25				1140.78	
	0.35				1361.12	
	0.45				1257.07	
	0.55				1385.70	
	0.65				1351.58	
	0.75				995.80	
27	**0.05**	**35.10**	**35.64**	**29.26**	**554.72**	**0.79**
	0.15	**18.67**	**50.10**	**31.23**	**729.96**	**0.92**
	0.25	**75.36**	**15.85**	**8.79**	**1374.14**	**0.29**
	0.35	**34.43**	**26.17**	**39.40**	**755.00**	**0.82**
	0.45	**9.02**	**36.02**	**54.96**	**707.98**	**1.11**
	0.55	**10.60**	**43.61**	**45.78**	**863.96**	**1.09**
	0.65	**6.75**	**51.96**	**41.29**	**939.04**	**1.12**
	0.75	**11.81**	**47.16**	**41.03**	**754.51**	**1.72**
	0.85	48.89	34.50	16.61	976.14	1.73
	0.95	42.81	39.37	17.82	893.51	2.73
	1.05	45.36	42.50	12.14	1141.99	1.51
	1.15	28.76	53.64	17.60	1205.27	1.22
	1.25	9.20	61.40	29.40	1059.34	1.04

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
27	1.35	24.15	55.79	20.06	1217.34	0.98
	1.45	34.02	48.30	17.68	1318.03	0.75
	1.55	73.01	20.67	6.32	1306.12	0.48
	1.65	74.45	18.98	6.57	1241.11	1.14
	1.75	84.70	10.48	4.82	1612.18	0.35
	1.85	90.39	6.45	3.16	1458.39	0.37
	1.95	90.03	6.21	3.76	1228.54	0.75
	2.05	80.02	14.89	5.09	1546.10	0.39
	2.15	58.12	31.97	9.90	1471.77	0.76
	2.25	68.17	24.18	7.65	1404.89	0.88
28	0.05				962.52	
	0.15				932.51	
	0.25				894.52	
	0.35				1050.15	
	0.45				1089.74	
	0.55				1295.76	
	0.65				1436.18	
29	0.05				1165.04	
	0.15				1251.44	
	0.25				1230.56	
	0.35				1325.59	
	0.45				1368.26	
	0.55				1200.64	
30	0.05				858.28	
	0.15				1041.04	
	0.25				1113.20	
	0.35				954.21	
	0.45				943.70	
	0.55				982.96	
	0.65				852.65	
	0.75				1035.64	
	0.85				1211.17	
31	**0.05**	**2.73**	**52.12**	**45.15**	**508.49**	
	0.15	**17.50**	**47.80**	**34.70**	**714.30**	
	0.25	**0.88**	**48.71**	**50.41**	**579.19**	
	0.35	**2.77**	**52.25**	**44.99**	**625.89**	
	0.45	**4.73**	**47.71**	**47.56**	**659.12**	
	0.55	**3.26**	**53.02**	**43.71**	**701.36**	
	0.65	**1.01**	**44.57**	**54.42**	**645.20**	
	0.75	**1.60**	**39.94**	**58.46**	**657.57**	

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
31	**0.85**	**1.69**	**55.70**	**42.61**	**802.98**	
	0.95	**3.42**	**52.64**	**43.94**	**839.47**	
	1.05	**1.80**	**47.58**	**50.62**	**783.03**	
	1.15	**1.60**	**46.18**	**52.22**	**757.52**	
	1.25	**11.15**	**43.16**	**45.68**	**909.70**	
	1.35	53.73	33.38	12.89	1271.90	
	1.45	46.44	39.83	13.73	1227.90	
	1.55	73.65	19.46	6.89	1451.25	
	1.67	77.53	15.82	6.66	1012.25	
32A	0.05				748.95	
	0.15				716.43	
	0.25				653.09	
	0.35				668.14	
	0.45				585.18	
	0.55				593.40	
	0.65				500.49	
	0.75				543.11	
	0.85				419.93	
	0.95				538.34	
	1.05				720.16	
	1.15				976.06	
32B	0.05				785.02	
	0.15				733.42	
	0.25				716.01	
	0.35				590.37	
	0.45				616.63	
	0.55				539.33	
	0.65				0.00	
	0.75				488.95	
	0.85				609.12	
	0.95				840.94	
	1.05				1179.14	
	1.15				1189.72	
	1.25				1271.55	
	1.35				1231.35	
	1.45				1249.19	
	1.55				1292.48	
	1.65				1326.32	
	1.75				1213.01	

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
33	0.01				787.19	
	0.03				835.14	
	0.05				853.00	
	0.07				744.28	
	0.09				830.35	
	0.11				659.86	
	0.13				759.26	
	0.15				726.57	
	0.17				783.14	
	0.19				677.72	
	0.21				722.57	
	0.23				680.71	
	0.25				716.79	
	0.27				753.42	
	0.29				703.78	
	0.31				714.32	
	0.33				848.20	
	0.35				884.09	
	0.37				942.87	
	0.39				831.81	
	0.41				747.15	
	0.43				821.72	
	0.45				690.24	
	0.47				719.71	
	0.49				840.49	
	0.51				827.50	
	0.53				805.12	
	0.55				993.31	
	0.57				949.35	
	0.59				867.18	
	0.61				684.31	
	0.63				806.67	
	0.65				744.42	
	0.67				878.82	
	0.69				800.46	
	0.71				959.45	
	0.73				960.98	
	0.75				1027.58	
	0.77				988.86	
	0.79				1034.75	

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
33	0.81				1139.12	
	0.83				1126.10	
	0.85				1218.69	
	0.87				1224.31	
	0.89				1216.42	
	0.91				1173.59	
	0.93				1322.31	
	0.95				1351.31	
	0.97				1294.23	
	0.99				1385.60	
	1.01				1110.01	
	1.03				1437.07	
	1.05				1025.37	
	1.07				1307.51	
	1.09				1200.20	
	1.11				1280.46	
	1.13				1084.73	
	1.15				1225.15	
	1.17				1222.29	
	1.19				1451.18	
	1.21				1117.50	
	1.23				1353.39	
	1.25				1050.75	
	1.27				1361.71	
	1.29				1132.67	
	1.31				1450.52	
	1.33				1118.88	
	1.35				1386.74	
	1.37				1261.73	
34	**0.05**	**5.78**	**57.47**	**36.74**		**1.01**
	0.15	**2.38**	**57.41**	**40.20**		**1.16**
	0.25	**1.53**	**55.27**	**43.21**		**1.18**
	0.35	**0.85**	**39.48**	**59.68**		**1.34**
	0.45	**1.36**	**41.60**	**57.03**		**2.00**
	0.55	**1.75**	**62.34**	**35.91**		**1.57**
	0.65	**2.20**	**65.01**	**32.78**		**0.74**
	0.75	**6.40**	**65.32**	**28.28**		**0.64**
	0.85	7.42	71.77	20.82		0.52
	0.95	6.03	74.42	19.55		0.40
	1.05	4.76	77.39	17.85		0.32

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
34	1.15	3.96	79.27	16.77		0.34
	1.25	3.48	78.51	18.01		0.33
	1.35	3.76	78.40	17.85		0.33
	1.45	4.88	77.22	17.91		0.34
	1.55	5.52	76.08	18.40		0.31
	1.65	5.93	75.16	18.91		0.31
	1.75	6.51	74.82	18.68		0.26
	1.85	5.65	76.25	18.10		0.24
	1.95	5.23	72.49	22.28		0.27
35	0.05	15.96	58.07	25.96	703.16	1.07
	0.15	17.45	58.54	24.01	975.95	0.77
	0.25	12.92	60.01	27.07	840.23	0.89
	0.35	16.91	56.68	26.41	860.72	1.30
	0.45	27.80	43.76	28.45	830.98	1.66
	0.55	34.57	33.74	31.69	855.89	1.47
	0.65	39.44	34.10	26.46	1050.67	1.07
	0.75	32.69	38.31	29.01	942.01	1.64
	0.85	25.68	39.53	34.79	981.78	1.44
	0.95	27.49	47.75	24.76	1393.78	0.35
	1.05	21.86	51.96	26.18	1417.80	0.26
	1.15	19.89	54.84	25.27	1379.17	0.27
36	**0.05**	**0.75**	**61.55**	**37.70**		**1.07**
	0.15	**0.50**	**63.01**	**36.49**		**0.96**
	0.25	**0.65**	**57.42**	**41.93**		**1.16**
	0.35	**0.58**	**51.92**	**47.49**		**1.28**
	0.45	**0.98**	**52.34**	**46.67**		**1.32**
	0.55	**0.62**	**50.26**	**49.12**		**1.15**
	0.65	**1.00**	**37.19**	**61.81**		**1.41**
	0.75	**2.94**	**34.65**	**62.41**		**1.37**
	0.85	**1.54**	**54.86**	**43.60**		**1.37**
	0.95	**1.69**	**53.34**	**44.97**		**2.91**
	1.05	**0.55**	**52.73**	**46.73**		**1.04**
	1.15	**7.59**	**61.49**	**30.92**		**0.66**
	1.25	22.11	59.99	17.90		0.31
	1.35	21.16	60.15	18.69		0.31
	1.45	23.76	58.78	17.46		0.22
	1.55	25.87	56.70	17.42		0.26
	1.65	26.07	55.09	18.84		0.25

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
37	0.05	0.46	46.36	53.18	624.30	1.19
	0.15	1.56	37.18	61.26	777.09	1.86
	0.25	4.02	48.49	47.49	847.33	1.30
	0.35	3.47	53.08	43.45	1050.40	1.31
	0.45	6.23	51.01	42.75	970.55	1.45
	0.55	11.89	50.21	37.90	1266.39	1.10
	0.65	5.65	50.89	43.46	1169.96	0.98
	0.75	6.18	53.85	39.96	1257.03	0.77
	0.85	13.18	52.96	33.86	1259.18	0.72
	0.95	6.60	50.85	42.54	1048.60	0.65
38	0.05				639.30	
	0.15				706.43	
	0.25				658.68	
	0.35				552.38	
	0.45				580.02	
	0.55				504.53	
	0.65				502.84	
	0.75				1031.28	
	0.85				1234.69	
	0.95				1296.14	
	1.05				1358.17	
	1.15				1367.00	
39	0.05				746.04	
	0.15				831.39	
	0.25				969.66	
	0.35				753.06	
	0.45				1077.55	
	0.55				1035.88	
	0.65				891.40	
	0.75				1261.04	
	0.85				1399.44	
	0.95				1508.28	
	1.05				1383.96	
	1.15				1575.02	
	1.25				1543.29	
	1.35				1425.73	
	1.45				1526.19	
	1.55				1470.80	
	1.65				1465.99	
	1.75				1421.48	

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
39	1.85				1151.73	
	1.95				1300.70	
	2.05				1174.14	
	2.15				1369.45	
40	0.05				1455.79	
	0.15				1221.31	
	0.25				1356.64	
	0.35				1385.97	
	0.45				1217.79	
	0.55				1293.87	
	0.65				1314.99	
	0.75				1235.46	
	0.85				1264.11	
	0.95				1421.24	
	1.05				1187.42	
	1.15				1246.28	
	1.25				996.99	
	1.35				1225.81	
	1.45				1364.69	
	1.55				1458.86	
	1.65				1389.56	
	1.75				1421.62	
	1.85				1183.60	
	1.95				1201.41	
	2.05				1027.20	
41	0.05				1335.50	
	0.15				1383.32	
	0.25				1385.64	
	0.35				1206.67	
	0.45				1192.23	
	0.55				1226.14	
	0.65				1185.59	
	0.75				1315.79	
	0.85				972.82	
	0.95				1159.62	
	1.05				1020.88	
	1.15				1161.42	
	1.25				1387.69	
	1.35				1614.86	
	1.45				1742.50	

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
41	1.55				1500.63	
	1.65				1425.54	
	1.75				1545.05	
	1.85				1483.95	
	1.95				1734.99	
	2.05				1488.54	
42	0.05				993.99	
	0.15				1337.94	
	0.25				1247.33	
	0.35				1238.91	
	0.45				1314.61	
	0.55				1166.44	
	0.65				1293.63	
	0.75				1351.99	
	0.85				1480.87	
	0.95				1463.27	
	1.05				1617.54	
43	**0.05**	**6.39**	**67.51**	**26.10**	**857.68**	**0.52**
	0.15	**8.42**	**68.94**	**22.64**	**893.08**	**0.41**
	0.25	**6.30**	**64.32**	**29.38**	**885.96**	**0.52**
	0.35	**3.86**	**75.73**	**20.40**	**1024.08**	**0.43**
	0.45	**3.15**	**66.49**	**30.37**	**969.72**	**0.48**
	0.55	**2.25**	**52.28**	**45.47**	**712.70**	**0.76**
	0.65	**8.24**	**61.37**	**30.39**	**894.46**	**0.48**
	0.75	14.08	61.90	24.02	1006.79	0.45
	0.85	5.57	72.23	22.20	1095.21	0.69
	0.95	6.18	73.49	20.33	1096.71	1.20
	1.05	7.59	75.79	16.61	1362.39	1.12
	1.15	9.51	70.41	20.08	1395.53	0.99
	1.25	2.32	81.99	15.69	1489.74	0.54
	1.36	9.69	71.70	18.61	1467.59	0.40

Table 4-1 continued.

Core ID	Depth (m)	Parameter				
		Sand (%)	Silt (%)	Clay (%)	Bulk Density (kg/m^3)	Carbon (%)
44	**0.05**	**0.49**	**30.75**	**68.77**		**1.36**
	0.15	**0.30**	**30.44**	**69.26**		**1.29**
	0.25	**1.26**	**25.57**	**73.17**		**1.45**
	0.35	**0.74**	**22.42**	**76.84**		**1.22**
	0.45	**1.35**	**21.09**	**77.55**		**1.23**
	0.55	**1.47**	**26.30**	**72.23**		**1.65**
	0.65	**7.54**	**49.60**	**42.86**		**1.33**
	0.75	11.46	51.12	37.42		0.80
	0.85	17.27	50.28	32.45		0.55
	0.95	16.65	50.71	32.65		0.38
	1.05	16.60	49.01	34.39		0.33
	1.15	17.69	49.34	32.97		0.31

4.3 Particle Size, Bulk Density, and Total Carbon: Skuna River Arm

Particle size, bulk density, and total carbon results for select cores obtained in the Skuna River arm of Grenada Lake are shown in Figures 4-3, 4-5, and 4-6, respectively, and Table 4. The division between post-impoundment deposition and pre-impoundment material is also shown.

For the pre-impoundment materials, sand content ranges from 5 to 50% by mass, silt content ranges from 50 to 75% by mass, and clay content ranges from 5 to 35% by mass (Figure 4-3, Table 4-2). In general, there is more silt than clay in these deposits. The sediment with the highest sand content, up to 95%, occurs in Core 9 located in the middle portion of the river arm (Figure 3-2). The bulk density of the sediment ranges from 1500 to 1700 kg/m^3 (Figure 4-5, Table 4-2). Total organic content is generally 0.5 to 1.0 kg/m^2 (Figure 4-6, Table 4-2). For the post-impoundment material, sand content ranges from 5 to 10% by mass, silt content ranges from 50 to 75% by mass, and clay content ranges from 25 to 75% by mass (Figure 4-3, Table 4-2). In general, there is more clay than silt in these deposits. The bulk density of the sediment ranges from 1300 to 1400 kg/m^3 near the 1954 horizon, and decreases significantly toward the surface, attaining a value in the range of 100 to 500 kg/m^3 (Figure 4-5, Table 4-2). Total organic content is generally 0 to 1.5 kg/m^2, and near surface contents approach 0 kg/m^2 (Figure 4-6, Table 4-2).

Figure 4-7 shows the variation in total carbon as a function of sediment texture within the Skuna River arm of Grenada Lake. Although no distinction is made between the post-impoundment sediment versus the pre-impoundment sediment, there is no correlation between total carbon and sediment texture, especially clay content. Figure 4-8 shows that when the pre-impoundment sediment is discriminated from the post-impoundment sediment, no correlation is observed between total carbon and sediment texture.

4.4 Particle Size, Bulk Density, and Total Carbon: Yalobusha River Arm

Particle size, bulk density, and total carbon results for select cores obtained in the Yalobusha River arm of Grenada Lake are shown in Figures 4-4, 4-5, and 4-9, respectively, and Table 4-2. The division between post-impoundment deposition and pre-impoundment material is also shown.

For the pre-impoundment materials, sand content ranges from 5 to 75% by mass, silt content ranges from 25 to 50% by mass, and clay content ranges from 5 to 35% by mass (Figure 4-4, Table 4-2). In general, there is more silt than clay in these deposits. The sediment with the highest sand content, up to 95%, occurs in Core 27 located in the most upstream region of the river arm (Figure 3-2). The bulk density of the sediment ranges from 1400 to 2000 kg/m^3 (Figure 4-5, Table 4-2). Total organic content is generally 0.5 to 2.0 kg/m^2 (Figure 4-7, Table 4-2). For the post-impoundment material, sand content ranges from 0 to 25% by mass, silt content ranges from 25 to 75% by mass, and clay content ranges from 25 to 75% by mass (Figure 4-4, Table 4-2). In general, there is more clay than silt in these deposits. The bulk density of the sediment ranges from 1000 to 1500 kg/m^3 near the 1954 horizon, and decreases significantly toward the surface, attaining a value in the range of 100 to 300 kg/m^3 (Figure 4-5, Table 4-2). Total organic content is generally 0 to 2 kg/m^2, and near surface contents approach 0 kg/m^2 (Figure 4-7, Table 4-2).

Figure 4-10 shows the variation in total carbon as a function of sediment texture within the Yalobusha River arm of Grenada Lake. Although no distinction is made between the post-impoundment sediment versus the pre-impoundment sediment, there is little correlation between total carbon and sediment texture, especially clay content. There is a general decrease in total carbon with increased sand content. Figure 4-11 shows that when the pre-impoundment sediment is discriminated from the post-impoundment sediment, little correlation is observed between total carbon and sediment texture.

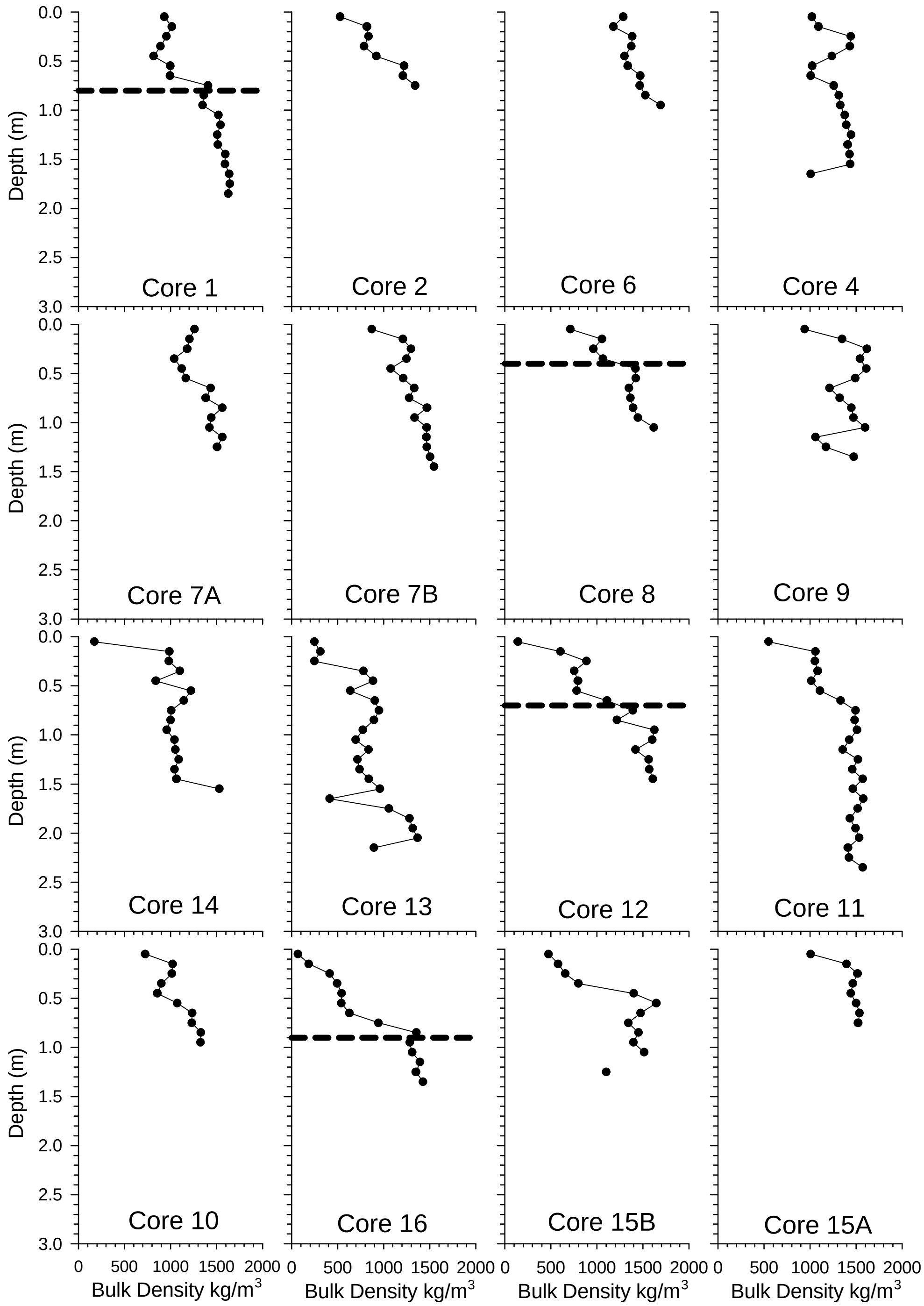


Figure 4-5. Variations in bulk density of the sediments as a function of depth for Cores 1 to 15. The dashed line demarcates the division between post-impoundment deposition and pre-impoundment sediment materials. Refer to Figure 3-2 for core locations.

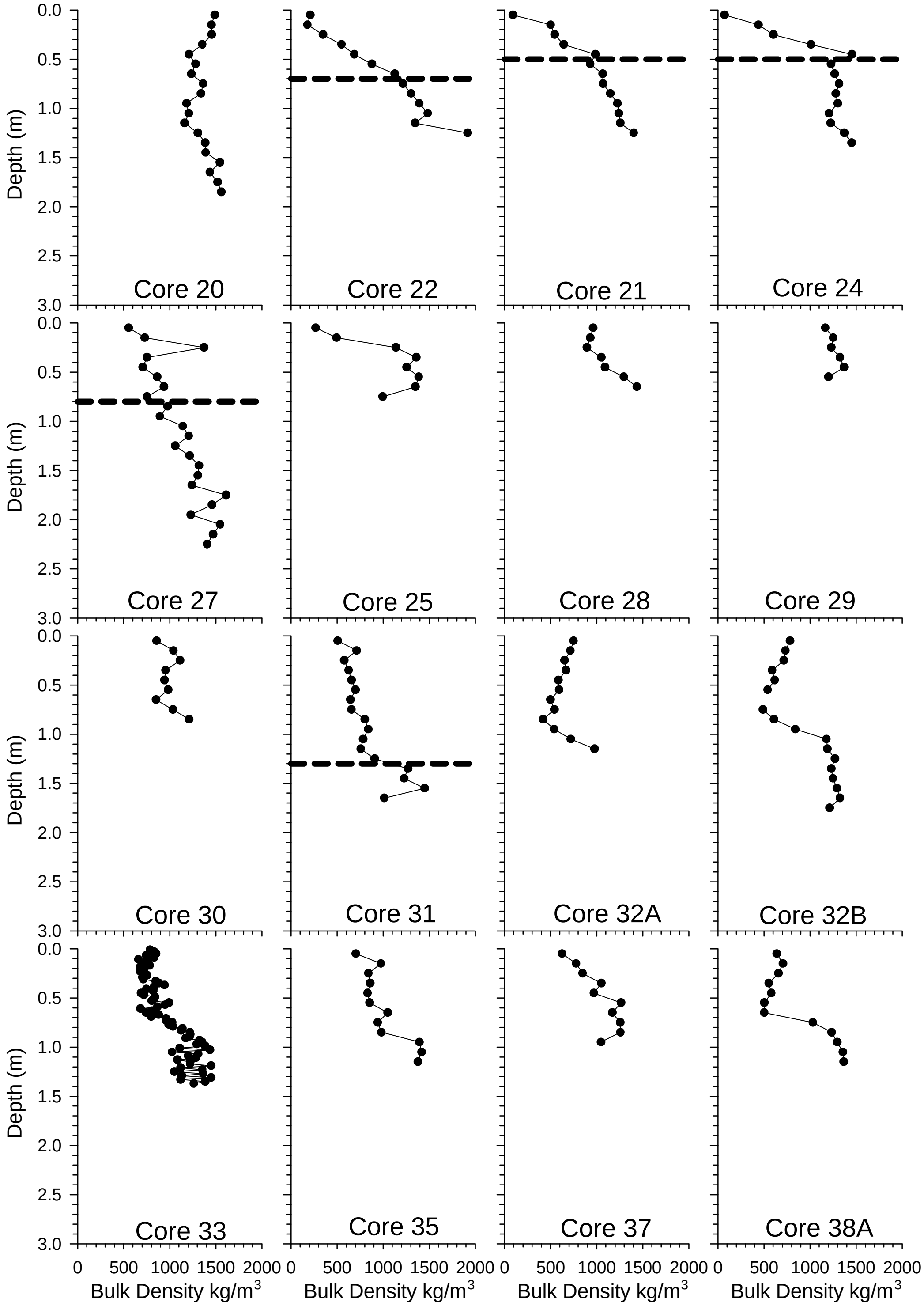


Figure 4-5 continued: Bulk density of the sediments as a function of depth for Cores 20 to 38.

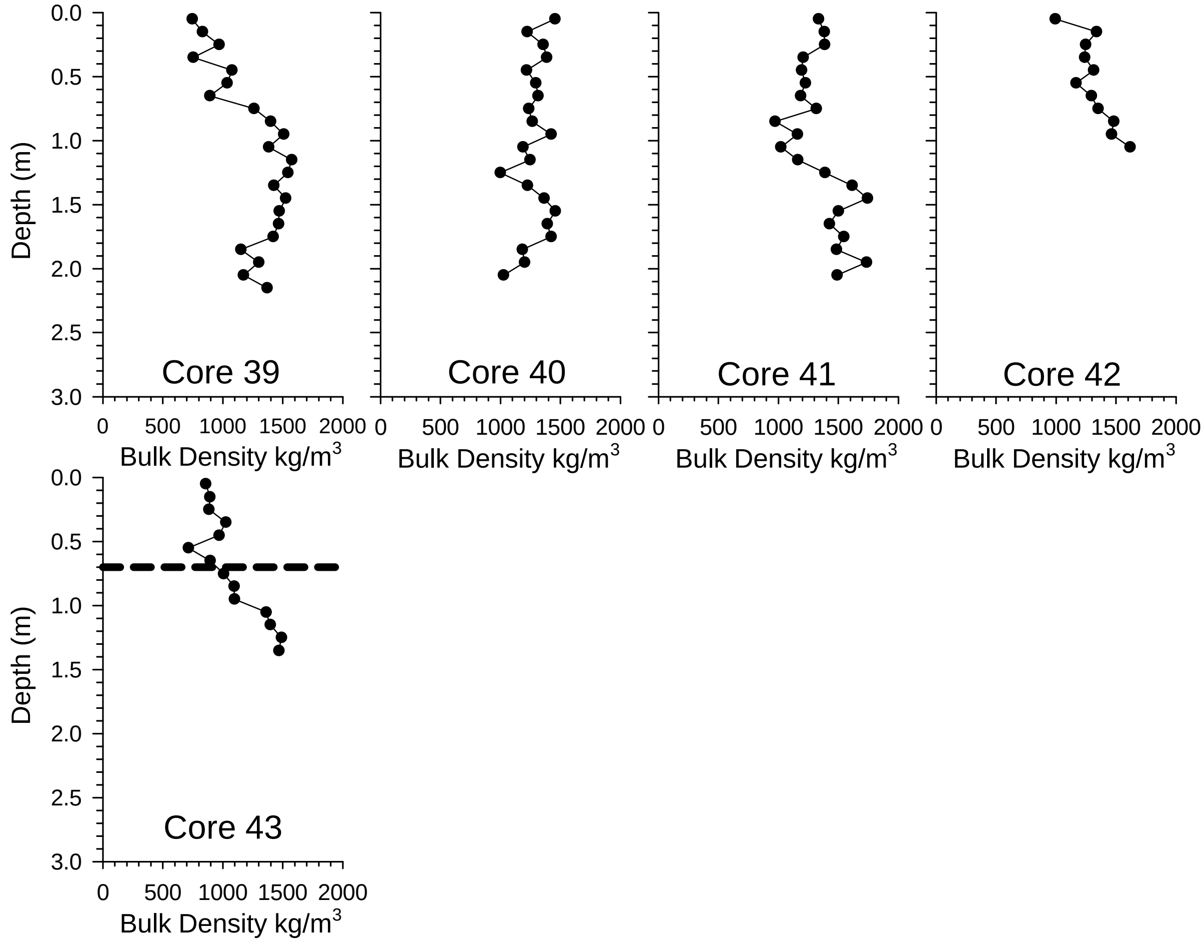


Figure 4-5 continued: Bulk density of the sediments as a function of depth for Cores 39 to 43.

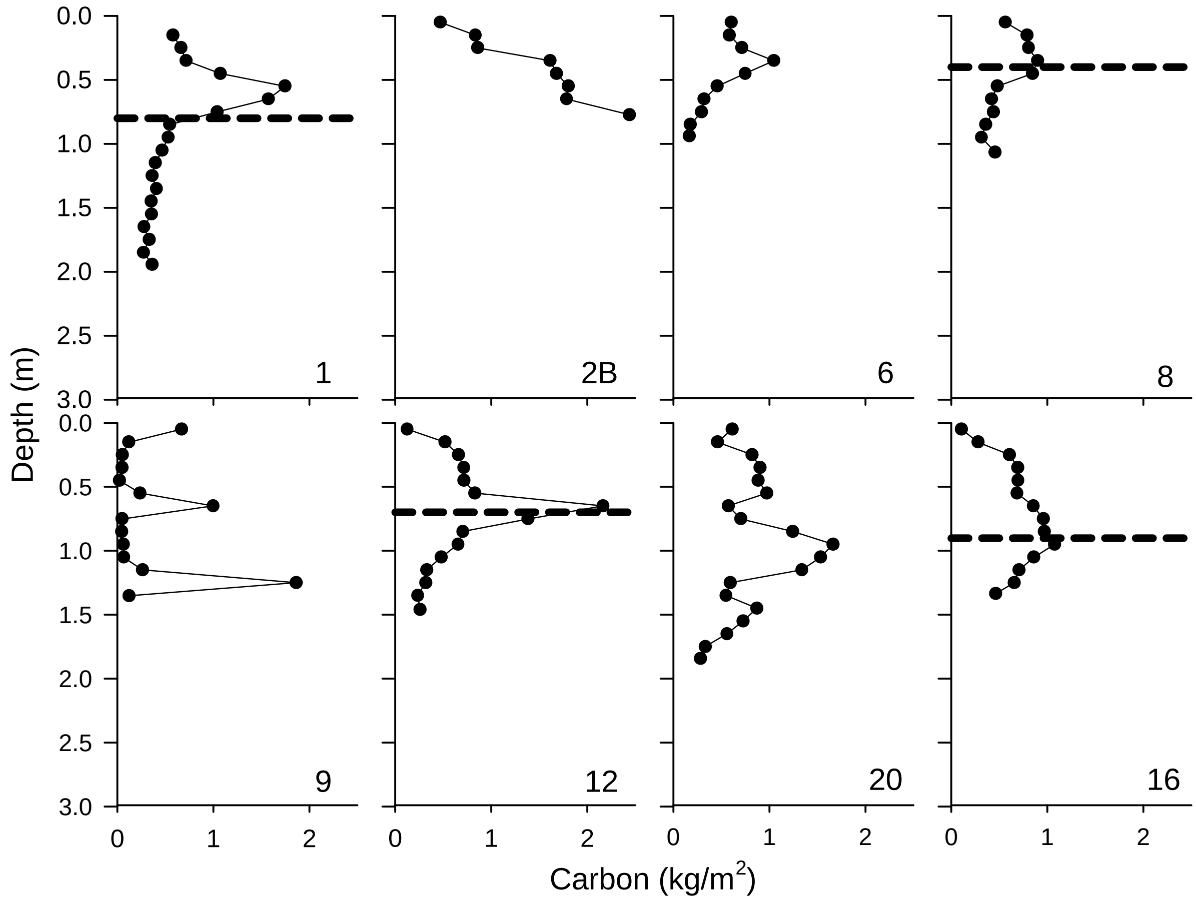


Figure 4-6. Variation in the concentration of total carbon within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

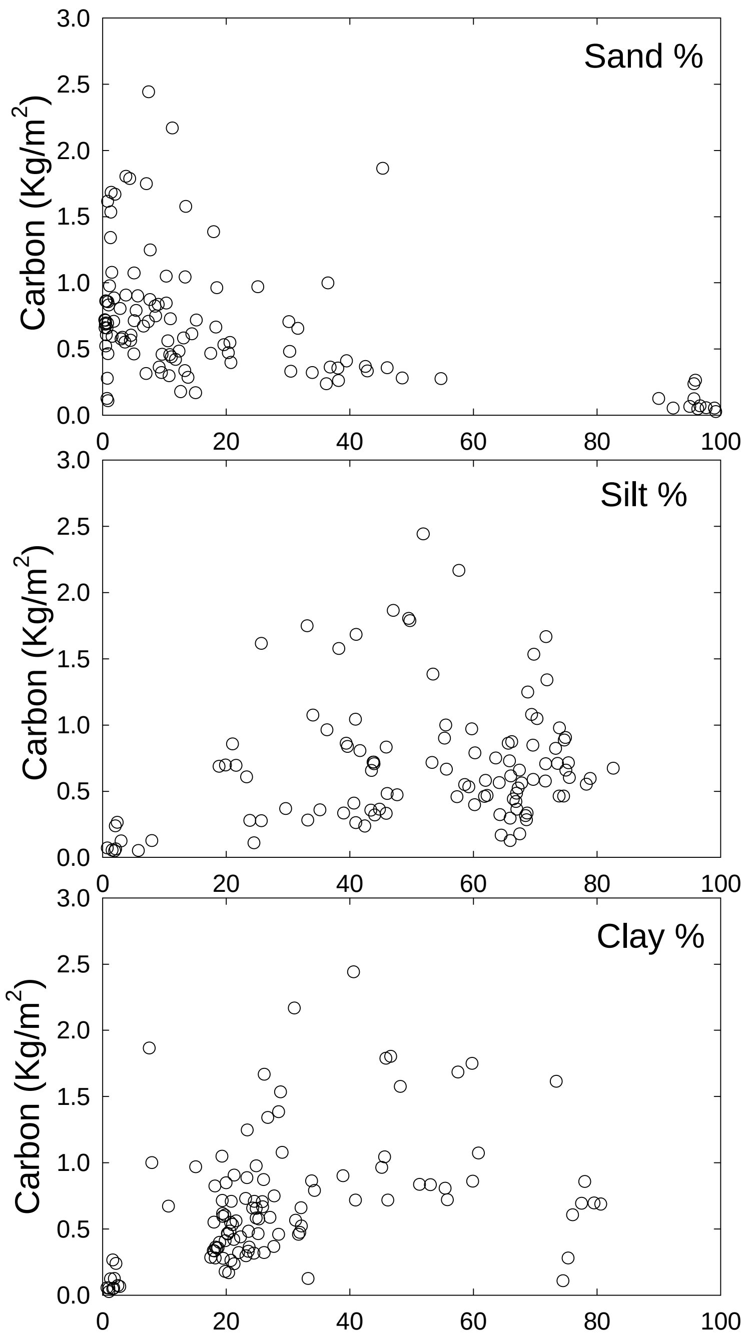


Figure 4-7. Variation in the concentration of total carbon with sediment texture for the Skuna River arm of Grenada Lake. No distinction is made between pre- and post-impoundment sediment.

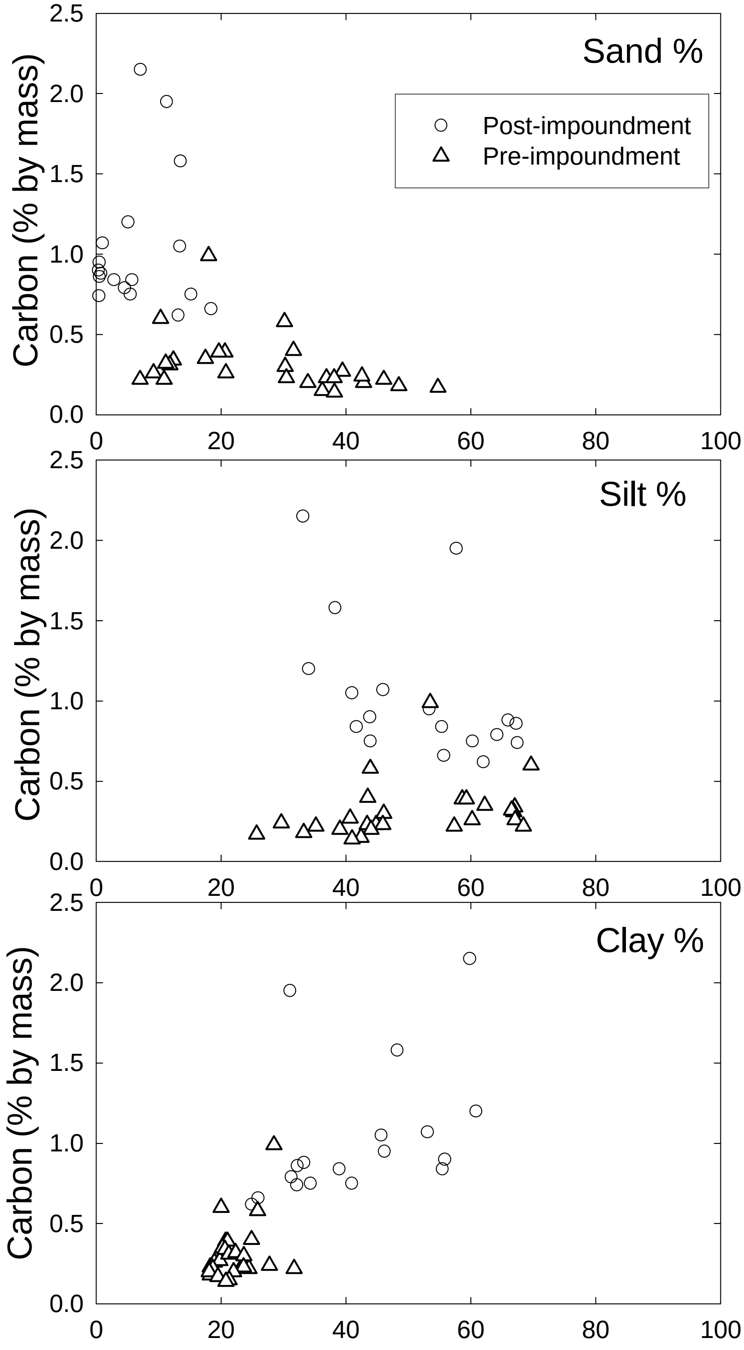


Figure 4-8. Variation in the concentration of total carbon with sediment texture for the pre- and post-impoundment sediment, Skuna River arm of Grenada Lake.

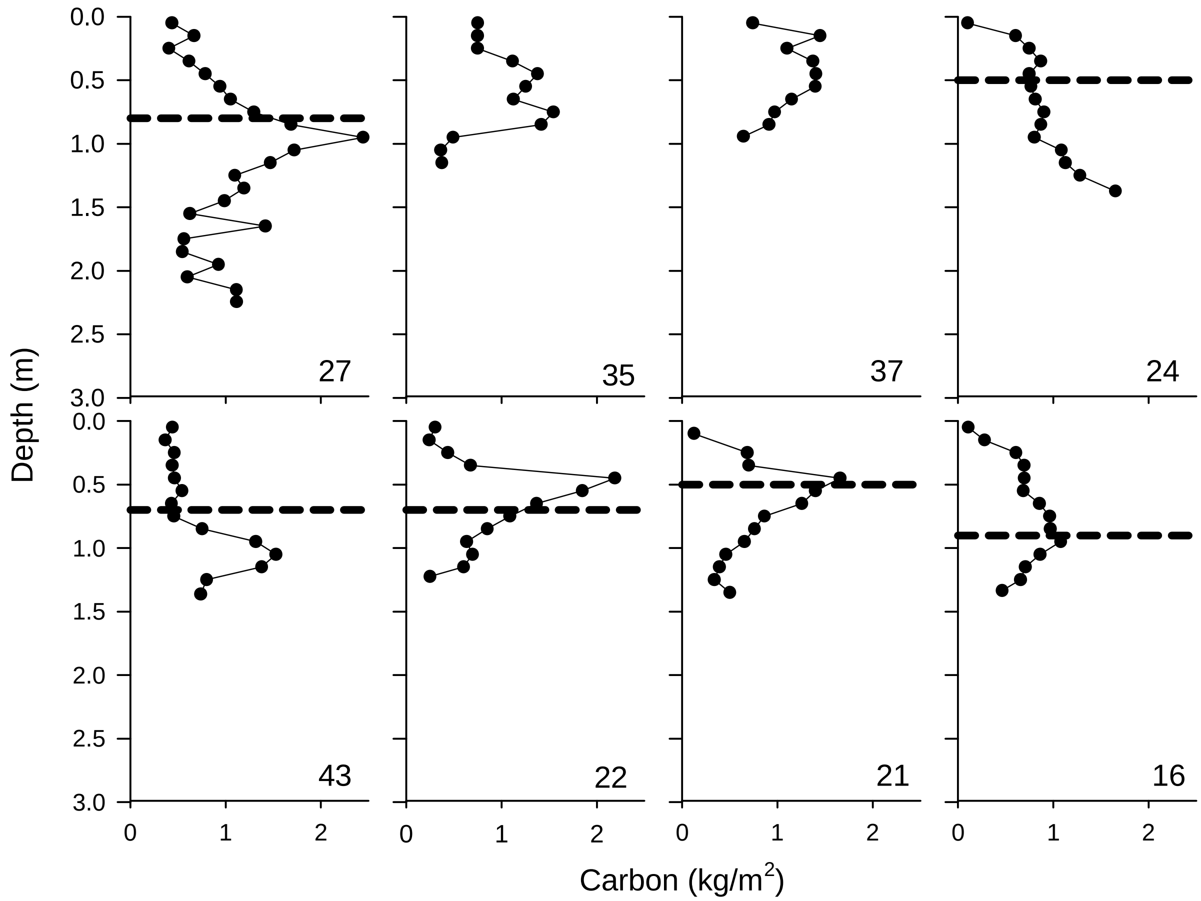


Figure 4-9. Variation in the concentration of total carbon within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

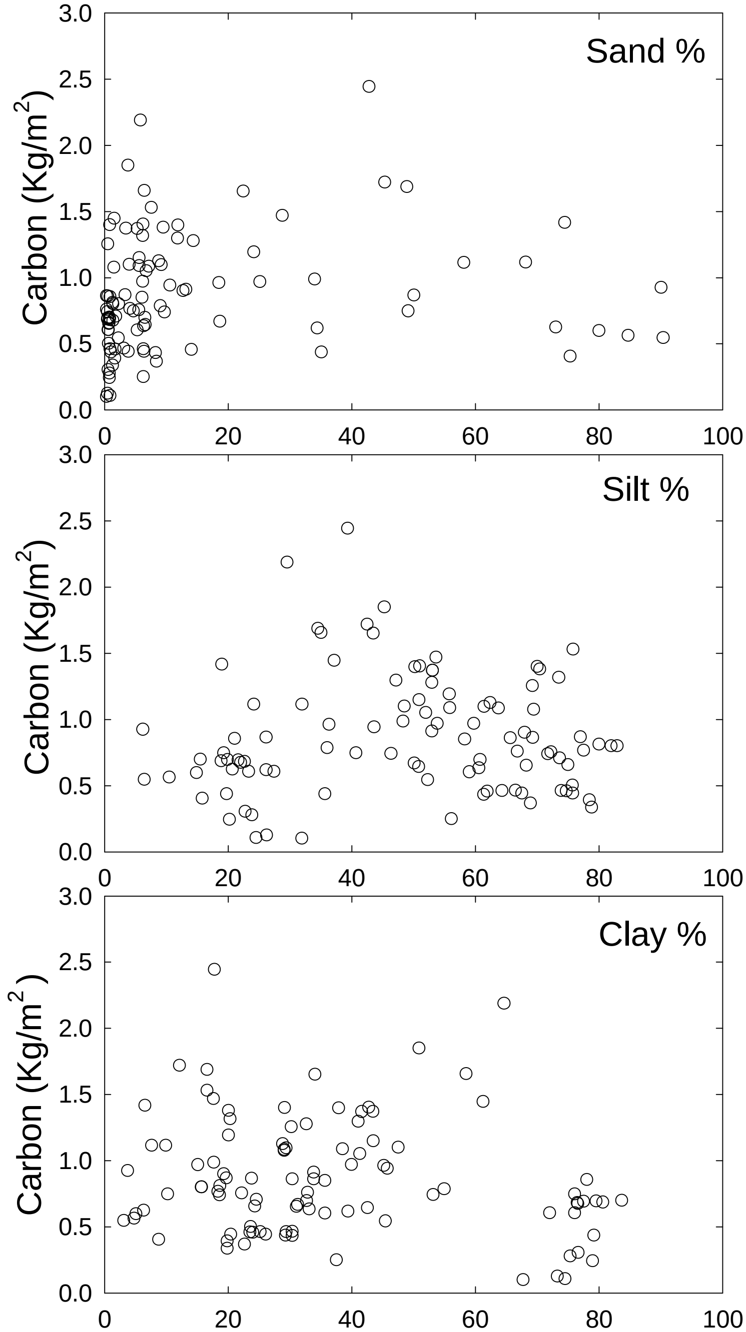


Figure 4-10. Variation in the concentration of total carbon with sediment texture for the Yalobusha River arm of Grenada Lake. No distinction is made between pre- and post-impoundment sediment.

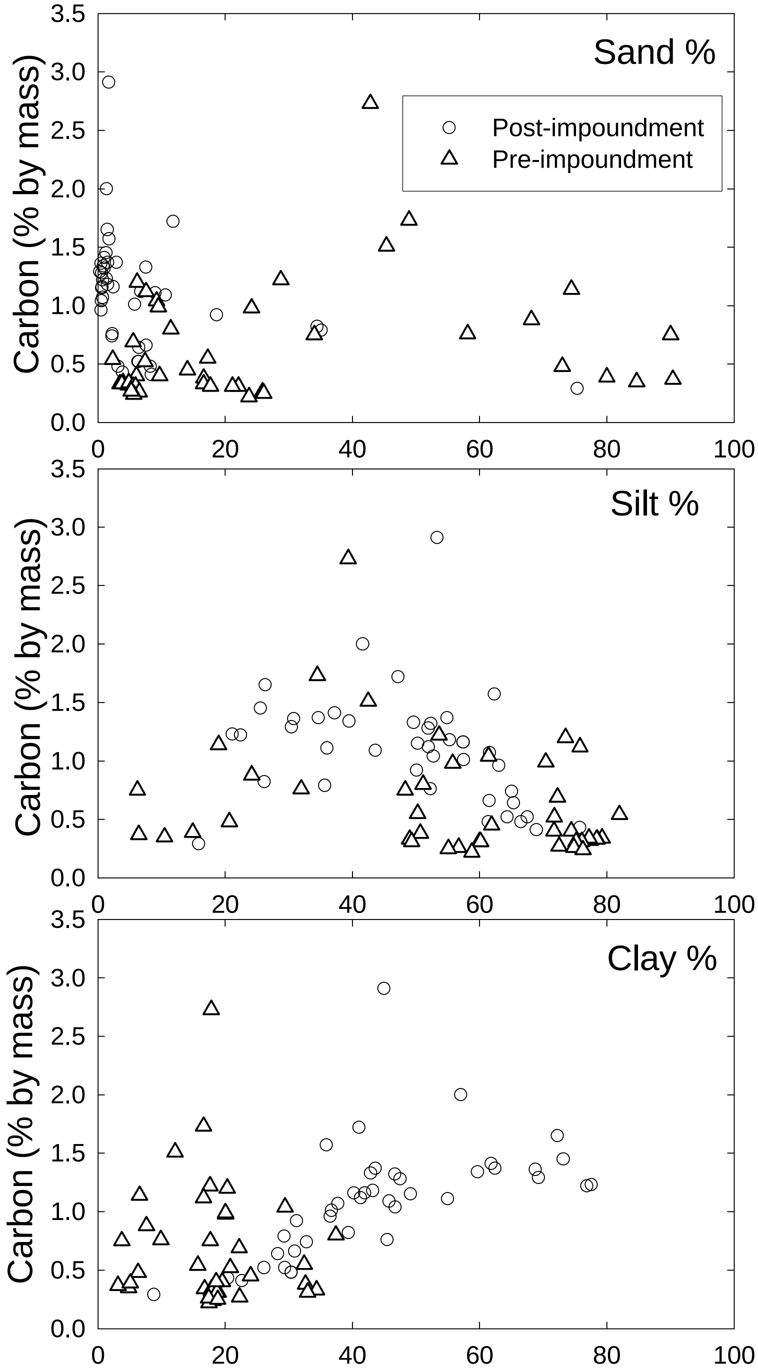


Figure 4-11. Variation in the concentration of total carbon with sediment texture for the pre- and post-impoundment sediment, Yalobusha River arm of Grenada Lake.

4.5 Bulk Chemical Analysis of Sediment: Skuna River Arm

Table 4-3 shows the results of the bulk chemical analysis performed on all sediment samples taken in Grenada Lake. This table lists the specific core and depth of sample, the equipment used, and the 49 elements analyzed. Figures 4-12 to 4-28 show the variation of concentration for select elements plotted with depth within individual cores, from the most upstream core within the Skuna River arm (Core 1) to the most downstream core within the pool region (Core 16).

The major elements further examined here are aluminum (Al), calcium (Ca), iron (Fe), potassium (K), magnesium (Mg), sodium (Na), phosphorus (P), and sulfur (S). For Al (Figure 4-12), Ca (Figure 4-13), Fe (Figure 4-14), K (Figure 4-15), Mg (Figure 4-16), and P (Figure 4-18), the concentrations of these elements are slightly higher in the post-impoundment sediment as compared to the pre-impoundment sediment. In the pool region for the post-impoundment sediment, these same elements are two to three times higher in concentration as compared to the post-impoundment sediments found upstream. The concentration of Na (Figure 4-18) is about the same for both the pre- and post-impoundment sediments, but in the pool region its concentration in the post-impoundment sediments is about two times lower than found upstream. The concentration of S (Figure 4-19) in the post-impoundment sediments is about three times higher than in the pre-impoundment materials, and in the pool region S concentrations in the post-impoundment sediments are eight to ten times higher than found upstream.

The concentrations of most major elements show very good correlation with sediment texture (Figures 4-29 to 4-34). As sand content decreases and silt and clay contents increase, the concentrations of Al, Ca, Fe, K, Mg, Mn, P, and S increase by as much as 5 to 10 times. The concentration of Na is positively correlated to silt content, and non-linearly related to clay content (Figure 4-30). The concentration of some elements, specifically Ca (Figure 4-32), K, and P (Figure 4-33), show more scatter when plotted against sediment texture compared to other elements. These variations are probably related to organic contributions to total element concentration in addition to mineralogical (inorganic).

The environmentally important elements further examined here are arsenic (As), cadmium (Cd), chromium, (Cr), copper (Cu), manganese (Mn), mercury (Hg), lead (Pb), selenium (Se), and zinc (Zn). For As (Figure 4-20), Cr (Figure 4-22), Cu (Figure 4-23), Pb (Figure 4-26), and Zn (Figure 4-28), the concentrations for these elements are about two times higher in the post-impoundment sediment as compared to the pre-impoundment materials. Moreover, the highest concentrations of these elements occur in the post-impoundment sediments located in the pool region. The concentration of Mn (Figure 4-24) is variable, yet the highest concentrations occur in the post-impoundment sediments of the most upstream core (Core 2). In the post-impoundment sediments, the concentration of Hg (Figure 4-25) is up to two times higher than the pre-impoundment sediments, and the highest Hg concentrations occur in the post-impoundment sediments of the pool region. Little to no Cd (Figure 4-21) and Se (Figure 4-27) were found in these sediments.

The concentrations of EIE show good correlations with sediment texture. Elements such as Zn (Figure 4-30) and Cu (Figure 4-31) show that as sand content decreases and silt and clay contents increase, the concentrations of these elements increase. EIE concentrations are typically 5 to 15 times higher in the silt and clay dominated horizons as compared to the sand dominated horizons (Table 4-3). Elements such as As, Cr, Mn, Pb, and Hg also show similar trends with sediment texture (Figures 4-29, 4-31, 4-32, and 4-34), but display more scatter. Very little Se and Cd were observed in the sediment (Figures 4-30 and 4-31).

The cause for the increase in element concentration for both major elements and EIE is the post-impoundment sediment is due to sediment texture. These more recent sediments are enriched in clay, hence controlling the bulk sediment chemistry.

Table 4-3. Summary of bulk chemical characteristics of sediment samples taken from Grenada Lake. **Bold** text signifies post-impoundment sediment.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
1	**0.15**	**ND**	**4.04**	**5.6**	**3**	**580**	**2**	**ND**	**ND**	**0.26**	**ND**	**74**	**9**	**69**	**3**	**13**	**1.6**	**2.3**	**13**	**36**
	0.25	**ND**	**3.64**	**5.6**	**8**	**570**	**2**	**ND**	**ND**	**0.22**	**ND**	**73**	**10**	**75**	**3**	**12**	**1.5**	**2.4**	**14**	**36**
	0.35	**ND**	**4.97**	**7.9**	**14**	**490**	**2**	**ND**	**1.9**	**0.23**	**ND**	**80**	**12**	**84**	**5**	**17**	**1.6**	**3.3**	**8**	**44**
	0.45	**ND**	**6.45**	**8**	**4**	**580**	**2**	**ND**	**ND**	**0.22**	**ND**	**85**	**14**	**96**	**7**	**23**	**1.8**	**3.8**	**6**	**63**
	0.55	**ND**	**6.08**	**9.1**	**5**	**560**	**2**	**2**	**2.7**	**0.22**	**ND**	**85**	**14**	**77**	**4**	**21**	**1.8**	**3.7**	**6**	**66**
	0.65	**ND**	**4.81**	**7.8**	**6**	**570**	**2**	**ND**	**ND**	**0.18**	**ND**	**80**	**13**	**82**	**5**	**16**	**1.7**	**3.7**	**8**	**59**
	0.75	**ND**	**4.78**	**8.7**	**ND**	**500**	**2**	**2**	**1.5**	**0.18**	**ND**	**73**	**12**	**79**	**5**	**16**	**1.6**	**3.5**	**7**	**40**
	0.85	ND	3.46	5.5	4	450	1	2	ND	0.16	ND	69	9	57	3	10	1.4	2	11	32
	0.95	ND	3.79	5.8	12	490	1	ND	1.1	0.16	ND	61	8	63	3	10	1.4	1.9	12	34
	1.05	ND	3.49	5.3	15	560	1	ND	ND	0.16	ND	66	8	65	3	10	1.3	2.2	12	30
	1.15	ND	3.54	5.3	ND	500	1	ND	ND	0.16	ND	59	7	60	3	11	1.3	2.2	12	27
	1.25	ND	2.91	5.3	ND	480	1	ND	1	0.13	ND	59	9	49	3	9	1.1	1.9	11	26
	1.35	ND	3.10	6	ND	490	1	ND	ND	0.12	ND	61	9	52	2	8	1.1	2.1	12	27
	1.45	ND	3.04	5.6	ND	460	1	ND	ND	0.13	ND	61	8	55	2	8	1.1	2	11	24
	1.55	ND	2.98	5.8	ND	510	1	ND	ND	0.11	ND	55	8	58	3	8	1.1	2.1	11	25
	1.65	ND	3.00	5.6	ND	350	1	ND	ND	0.10	ND	52	7	54	2	9	1	1.7	10	27
	1.75	ND	3.28	6.8	ND	400	1	ND	ND	0.11	ND	57	6	49	3	9	1.1	1.9	10	25
	1.85	ND	2.86	7.2	ND	370	1	ND	1.2	0.08	ND	51	7	49	2	10	0.9	1.9	9	28
	1.95	ND	3.83	12.3	ND	410	2	3	1.2	0.08	ND	53	10	62	3	77	1	3.4	8	34
2B	0.05	ND	4.64	8.6	ND	610	2	5	1.2	0.26	ND	75	13	76	4	17	1.6	2.8	11	51
	0.15	ND	5.70	9.8	13	610	2	ND	ND	0.25	ND	92	15	95	6	17	1.7	3.9	8	61
	0.25	ND	5.61	11.7	19	610	3	ND	1.9	0.23	ND	94	17	103	6	23	1.6	4.1	5	69
	0.35	ND	7.36	12	14	680	3	2	2.8	0.22	ND	106	19	110	8	31	1.9	4.8	6	88
	0.45	ND	7.15	14.9	17	830	3	2	1.6	0.20	ND	117	19	95	7	26	2.2	4.2	7	78
	0.55	ND	5.38	15.5	18	810	3	ND	1.2	0.20	ND	130	23	82	6	22	2.5	4.2	8	70
	0.65	ND	5.42	16.4	7	820	3	ND	1.3	0.16	ND	129	21	79	5	18	2.3	4.1	8	70
	0.78	ND	5.18	14.7	14	770	3	ND	1.4	0.16	ND	118	23	80	5	18	1.9	4.3	9	57

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
1	**0.15**	**ND**	**1.17**	**40.6**	**0.6**	**0.37**	**430**	**ND**	**0.4**	**28**	**18**	**0.028**	**17**	**55**	**0.018**	**0.9**	**9.3**	**ND**	**6.6**	**ND**
	0.25	**ND**	**1.03**	**38**	**0.56**	**0.34**	**400**	**2**	**0.4**	**28**	**17**	**0.027**	**18**	**35**	**0.018**	**0.8**	**9.3**	**ND**	**6.2**	**ND**
	0.35	**ND**	**1.12**	**43.2**	**0.53**	**0.45**	**510**	**1**	**0.3**	**35**	**24**	**0.035**	**19**	**84**	**0.015**	**0.9**	**12.7**	**ND**	**6.9**	**ND**
	0.45	**ND**	**1.23**	**46.7**	**0.52**	**0.54**	**601**	**2**	**0.3**	**29**	**32**	**0.048**	**27**	**84**	**0.016**	**0.9**	**15.8**	**ND**	**7.2**	**ND**
	0.55	**ND**	**1.17**	**46.3**	**0.54**	**0.50**	**668**	**1**	**0.3**	**33**	**31**	**0.046**	**28**	**86**	**0.029**	**0.9**	**14.4**	**4**	**7.4**	**ND**
	0.65	**ND**	**1.06**	**43.2**	**0.49**	**0.40**	**684**	**ND**	**0.3**	**32**	**24**	**0.040**	**14**	**58**	**0.018**	**0.8**	**13.1**	**ND**	**6.7**	**ND**
	0.75	**ND**	**1.10**	**41.1**	**0.48**	**0.39**	**741**	**ND**	**0.3**	**26**	**22**	**0.039**	**19**	**68**	**0.027**	**0.8**	**12.5**	**ND**	**6.4**	**ND**
	0.85	ND	1.06	35.3	0.53	0.23	1076	2	0.4	30	11	0.025	17	64	0.006	0.8	8.1	ND	5.5	ND
	0.95	ND	1.13	35.2	0.52	0.25	328	ND	0.4	29	13	0.023	12	57	0.007	0.8	8.5	ND	5.4	ND
	1.05	ND	1.13	34.3	0.55	0.25	328	ND	0.5	26	12	0.020	14	59	0.005	0.8	8.4	ND	5.2	ND
	1.15	ND	1.14	33.9	0.52	0.25	420	1	0.5	24	11	0.022	14	43	0.003	0.6	7.7	ND	5.1	ND
	1.25	ND	0.87	29.8	0.44	0.20	376	1	0.3	24	9	0.019	12	52	0.002	0.7	7	ND	4.6	ND
	1.35	ND	0.90	31.6	0.47	0.22	368	ND	0.3	29	10	0.022	15	54	0.003	0.7	7.6	ND	4.9	ND
	1.45	ND	0.89	29.7	0.44	0.21	470	1	0.3	23	10	0.018	13	58	ND	0.6	7	ND	4.7	ND
	1.55	ND	0.81	29.8	0.43	0.20	390	ND	0.3	24	10	0.021	16	53	0.002	0.7	7.3	ND	4.5	ND
	1.65	ND	0.81	26.1	0.42	0.20	187	ND	0.3	21	11	0.022	13	51	ND	0.7	6.7	ND	4.1	ND
	1.75	ND	0.86	30.1	0.47	0.20	213	ND	0.3	21	11	0.022	17	47	0.003	0.6	7.6	ND	4.7	ND
	1.85	ND	0.69	26.9	0.39	0.19	250	ND	0.2	20	10	0.021	11	29	0.002	0.6	6.3	ND	4	ND
	1.95	ND	0.77	28.8	0.37	0.26	446	2	0.2	24	14	0.045	21	69	0.003	0.8	9.1	ND	4.3	ND
2B	0.05	ND	1.20	41.1	0.59	0.44	602	ND	0.4	32	22	0.036	20	76	0.016	0.9	10.5	ND	6.5	ND
	0.15	ND	1.14	48.2	0.55	0.53	692	ND	0.3	40	26	0.043	22	70	0.013	0.9	14.1	ND	7.6	ND
	0.25	ND	1.20	49.2	0.54	0.51	792	1	0.3	39	31	0.050	24	88	0.025	0.9	15.5	ND	7.7	ND
	0.35	ND	1.15	52.7	0.57	0.55	899	2	0.2	37	41	0.055	33	120	0.020	1.2	18.9	ND	7.9	ND
	0.45	ND	1.32	53.5	0.61	0.53	1614	2	0.3	46	39	0.066	31	100	0.025	0.9	16.3	ND	8.5	ND
	0.55	ND	1.16	55.4	0.67	0.40	4745	1	0.4	45	34	0.065	34	110	0.014	1	14.3	3	9.4	ND
	0.65	ND	1.10	57.4	0.75	0.37	3515	1	0.4	45	33	0.062	24	92	0.013	0.8	14.4	ND	9.4	ND
	0.78	ND	1.13	48.3	0.64	0.34	5979	ND	0.4	35	27	0.070	28	68	0.010	0.9	13.5	ND	7.5	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
1	**0.15**	**108**	**ND**	**0.7**	**11.2**	**0.53**	**4.2**	**79**	**ND**	**23**	**4**	**63**
	0.25	**93**	**ND**	**0.9**	**10.8**	**0.44**	**4.3**	**69**	**ND**	**21**	**3.7**	**60**
	0.35	**93**	**2**	**ND**	**10.9**	**0.49**	**4.1**	**94**	**ND**	**25**	**3.5**	**78**
	0.45	**93**	**1.5**	**0.9**	**12.5**	**0.57**	**4.5**	**131**	**3**	**25**	**3.4**	**104**
	0.55	**90**	**ND**	**ND**	**11.5**	**0.54**	**4.4**	**124**	**ND**	**26**	**3.5**	**100**
	0.65	**79**	**1.6**	**1**	**11.4**	**0.48**	**4**	**97**	**ND**	**23**	**3.3**	**77**
	0.75	**82**	**1**	**ND**	**11.2**	**0.50**	**3.7**	**96**	**ND**	**22**	**3.2**	**75**
	0.85	78	1.4	ND	9.9	0.42	3.9	56	ND	18	3.5	43
	0.95	82	1.6	ND	9.7	0.45	3.6	59	ND	20	3.4	44
	1.05	83	1.2	ND	10	0.38	3.8	56	ND	18	3.7	42
	1.15	84	ND	ND	9.7	0.49	3.8	61	ND	19	3.4	41
	1.25	65	1.5	ND	7.8	0.34	3.4	46	ND	17	2.9	35
	1.35	67	0.7	ND	8.9	0.39	2.9	54	ND	16	3.2	38
	1.45	66	ND	ND	7.8	0.32	3.1	45	ND	16	2.9	35
	1.55	59	ND	ND	7.7	0.32	3.5	46	ND	15	2.8	37
	1.65	59	ND	ND	6.4	0.34	3.1	49	ND	16	2.8	36
	1.75	63	1.8	ND	7.8	0.33	2.7	48	ND	16	3.2	37
	1.85	50	ND	ND	7.7	0.30	2.6	46	ND	13	2.5	35
	1.95	52	1.3	ND	7.7	0.36	3.5	76	ND	15	2.4	76
2B	0.05	102	ND	0.9	9.4	0.53	3.9	96	ND	26	3.9	72
	0.15	100	ND	ND	10.4	0.54	3.3	119	ND	23	3.7	84
	0.25	98	1.4	ND	11	0.51	4.5	136	ND	18	3.6	101
	0.35	85	ND	1	13.2	0.58	4.4	166	3	18	3.8	130
	0.45	98	1.4	ND	12.6	0.59	4.8	130	3	38	4.1	112
	0.55	81	ND	0.9	12.6	0.54	3.1	108	3	37	4.4	90
	0.65	76	ND	1.4	12.6	0.50	5.5	104	4	36	4.8	87
	0.78	77	ND	0.8	12.5	0.53	5.4	107	ND	30	4	80

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
6	0.05	ND	4.27	9.3	3	480	2	ND	1.3	0.27	ND	77	8	73	3	14	1.4	2.3	14	36
	0.15	ND	3.89	8.7	5	670	1	2	1.3	0.23	ND	78	10	73	4	12	1.6	2.5	12	42
	0.25	ND	3.48	7	8	530	2	ND	1.7	0.19	ND	86	9	55	3	14	1.9	2	14	38
	0.35	ND	3.66	9.3	ND	590	2	2	2.5	0.17	ND	101	16	62	2	14	2.3	2.1	14	37
	0.45	ND	4.33	9.9	4	620	2	3	3.1	0.12	ND	103	19	65	4	17	2.1	2.5	12	49
	0.55	ND	4.29	9.5	5	620	2	ND	2	0.10	ND	95	22	64	3	16	1.7	2.7	13	54
	0.65	ND	4.25	9.9	ND	540	1	4	2.2	0.09	ND	79	16	70	5	15	1.5	2.5	14	50
	0.75	ND	4.10	9.4	ND	540	1	ND	2.2	0.08	ND	80	18	69	4	13	1.6	2.5	15	50
	0.85	ND	4.01	6.8	10	530	1	ND	1.9	0.09	ND	69	13	67	3	11	1.4	2.2	16	32
	0.94	ND	3.82	8.4	ND	520	1	ND	ND	0.10	ND	73	9	65	3	10	1.5	2.3	17	22
8	**0.05**	**ND**	**4.20**	**7.7**	**11**	**630**	**2**	**5**	**1.9**	**0.25**	**ND**	**86**	**12**	**84**	**4**	**15**	**1.6**	**3**	**12**	**46**
	0.15	**ND**	**4.56**	**10.1**	**41**	**640**	**2**	**ND**	**2.3**	**0.25**	**ND**	**84**	**13**	**74**	**4**	**15**	**1.8**	**2.9**	**12**	**47**
	0.25	**ND**	**6.25**	**15**	**15**	**670**	**2**	**ND**	**2.3**	**0.25**	**ND**	**94**	**16**	**110**	**5**	**21**	**1.9**	**4.4**	**8**	**67**
	0.35	**ND**	**5.56**	**8.2**	**38**	**590**	**2**	**ND**	**2**	**0.20**	**ND**	**84**	**13**	**74**	**4**	**21**	**1.7**	**2.6**	**11**	**58**
	0.45	ND	3.64	5.8	18	540	2	ND	1.4	0.15	ND	73	10	63	3	11	1.6	1.9	14	48
	0.55	ND	3.67	5.8	7	430	2	3	1.7	0.14	ND	73	8	67	3	9	1.7	1.6	14	42
	0.65	ND	3.64	4.9	6	500	2	ND	1	0.13	ND	70	9	62	3	11	1.6	1.7	14	43
	0.75	ND	4.06	4.8	28	570	2	3	1	0.13	ND	73	8	68	3	9	1.7	1.8	14	49
	0.85	ND	3.82	5	13	530	2	ND	ND	0.12	ND	71	10	63	3	9	1.6	1.9	13	48
	0.95	ND	4.09	8.2	5	540	2	4	ND	0.11	ND	71	13	71	3	10	1.4	2.3	13	52
	1.07	ND	4.80	8.6	14	520	2	ND	ND	0.10	ND	73	12	68	4	15	1.5	2.6	12	91

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
6	0.05	ND	1.41	38.2	0.62	0.33	894	ND	0.6	33	20	0.036	23	81	0.007	0.7	9	4	5.8	ND
	0.15	ND	1.21	41.3	0.6	0.30	541	ND	0.6	27	17	0.027	21	70	0.005	0.8	10.7	ND	6.2	ND
	0.25	ND	1.24	40.7	0.64	0.24	531	ND	0.5	32	17	0.028	17	41	0.005	0.7	8.4	ND	6.3	ND
	0.35	ND	1.16	49.8	0.74	0.23	1692	ND	0.5	43	22	0.033	19	62	0.010	0.9	9.1	ND	8.1	ND
	0.45	ND	1.19	47.2	0.69	0.26	2106	1	0.4	38	27	0.037	20	66	0.008	0.9	10.5	ND	7.4	ND
	0.55	ND	1.12	41.3	0.61	0.25	2103	ND	0.4	31	26	0.036	21	62	0.008	0.9	10.8	4	6	ND
	0.65	ND	1.10	40.6	0.59	0.24	1291	ND	0.4	31	20	0.030	20	77	0.007	0.7	10.2	ND	5.7	ND
	0.75	ND	1.15	40.6	0.67	0.23	1201	2	0.4	28	18	0.023	20	74	0.004	1	10	ND	5.7	ND
	0.85	ND	1.13	36.6	0.63	0.22	929	ND	0.5	21	14	0.020	20	47	0.002	0.6	8.7	6	5.3	ND
	0.94	ND	1.02	38.6	0.64	0.22	439	ND	0.5	31	12	0.016	14	49	ND	0.7	9.2	ND	5.7	ND
8	**0.05**	**ND**	**1.20**	**42.4**	**0.6**	**0.38**	**642**	**2**	**0.5**	**34**	**21**	**0.034**	**17**	**73**	**0.015**	**0.8**	**11.4**	**ND**	**6.5**	**ND**
	0.15	**ND**	**1.26**	**42.2**	**0.6**	**0.42**	**711**	**ND**	**0.5**	**30**	**24**	**0.038**	**24**	**64**	**0.015**	**1**	**11.5**	**ND**	**6.2**	**ND**
	0.25	**ND**	**1.27**	**47.4**	**0.59**	**0.54**	**1026**	**3**	**0.4**	**42**	**32**	**0.052**	**26**	**100**	**0.013**	**0.9**	**15.6**	**ND**	**7.3**	**ND**
	0.35	**ND**	**1.29**	**42.6**	**0.58**	**0.40**	**781**	**ND**	**0.4**	**34**	**28**	**0.042**	**29**	**98**	**0.014**	**0.8**	**11.2**	**4**	**6.5**	**ND**
	0.45	ND	1.12	39.5	0.61	0.23	1304	ND	0.4	28	17	0.039	17	68	0.006	0.6	8.2	ND	5.9	ND
	0.55	ND	1.11	39.4	0.61	0.22	454	ND	0.5	26	14	0.029	14	49	0.005	0.8	8.1	ND	5.9	ND
	0.65	ND	1.12	37.4	0.61	0.22	428	1	0.5	27	14	0.035	14	56	0.009	0.8	8	ND	5.5	ND
	0.75	ND	1.14	40	0.61	0.22	510	ND	0.5	31	15	0.035	12	54	0.005	0.6	8.8	ND	6.1	ND
	0.85	ND	1.13	38.2	0.61	0.23	615	1	0.5	30	15	0.030	15	68	0.003	0.5	9	ND	5.6	ND
	0.95	ND	1.12	37.6	0.61	0.24	660	2	0.5	26	16	0.028	14	74	0.003	0.8	9.6	ND	5.4	ND
	1.07	ND	1.10	38.7	0.55	0.29	744	ND	0.4	29	17	0.025	18	64	ND	0.8	11	ND	5.5	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
6	0.05	113	1	0.9	9.6	0.63	3.1	80	3	28	4	62
	0.15	95	3.3	ND	11.1	0.53	3.2	70	4	25	4.1	53
	0.25	91	1.7	0.8	10.4	0.49	4	59	4	26	4.3	50
	0.35	80	2	ND	10.8	0.55	3.3	60	ND	35	4.9	58
	0.45	72	2.7	0.9	11.9	0.58	3.4	74	ND	28	4.6	72
	0.55	65	1.5	1.1	11.9	0.56	3.6	73	ND	22	4	68
	0.65	65	1.7	ND	11.2	0.52	4.5	67	3	20	4.1	60
	0.75	68	ND	ND	12.1	0.49	5	58	ND	21	4.5	54
	0.85	74	ND	0.7	10.3	0.55	3.5	60	ND	20	4.1	44
	0.94	70	1.9	0.7	10.9	0.49	3.7	56	ND	19	4.3	38
8	**0.05**	**99**	**ND**	**0.8**	**10.6**	**0.53**	**3.3**	**87**	**ND**	**24**	**4.1**	**68**
	0.15	**104**	**ND**	**0.8**	**11.6**	**0.59**	**3.8**	**98**	**ND**	**27**	**4**	**74**
	0.25	**101**	**2**	**0.7**	**12**	**0.61**	**3.3**	**132**	**ND**	**26**	**3.9**	**96**
	0.35	**92**	**ND**	**0.9**	**10.7**	**0.59**	**3**	**107**	**3**	**27**	**3.8**	**88**
	0.45	79	1.2	0.9	10.5	0.49	3.1	61	ND	27	4.2	57
	0.55	78	1.5	0.8	9.9	0.47	3.5	55	ND	26	4.1	53
	0.65	78	0.7	0.7	10	0.44	4.4	57	ND	25	4	56
	0.75	80	ND	0.6	9.9	0.56	3.4	64	2	25	4.1	55
	0.85	78	ND	0.9	9.8	0.54	3.2	62	2	24	4.1	55
	0.95	75	1.5	0.7	10.3	0.55	3.9	67	2	22	3.9	56
	1.07	73	1.4	0.8	10.5	0.51	3.3	75	ND	22	3.6	60

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
9	0.05	ND	3.34	7.2	2	480	1	ND	1.4	0.21	ND	73	8	65	2	10	1.4	1.9	13	33
	0.15	ND	0.33	1.2	ND	65	ND	ND	ND	0.02	ND	12	2	6	ND	ND	ND	0.2	4	6
	0.25	ND	0.17	1.4	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	ND	ND	ND	0.1	2	ND
	0.35	ND	0.15	0.5	ND	59	ND	ND	ND	ND	ND	9	ND	ND	ND	ND	ND	0.1	5	ND
	0.45	ND	0.15	0.7	ND	53	ND	ND	ND	ND	ND	9	ND	6	ND	5	0.2	0.1	6	ND
	0.55	ND	0.55	1.4	ND	75	ND	ND	ND	0.03	ND	29	2	12	ND	ND	0.5	0.3	16	5
	0.65	ND	2.12	5.8	ND	450	ND	ND	1.1	0.15	ND	68	6	50	2	8	1.6	1.3	17	25
	0.75	ND	0.41	0.9	ND	71	ND	ND	ND	0.02	ND	33	2	10	ND	ND	0.3	0.2	11	5
	0.85	ND	0.32	0.8	ND	ND	ND	ND	ND	0.01	ND	18	1	6	ND	ND	0.3	0.1	8	ND
	0.95	ND	0.40	0.6	ND	60	ND	ND	ND	0.02	ND	11	1	5	ND	ND	ND	0.2	3	6
	1.05	ND	0.29	0.9	ND	71	ND	ND	ND	0.01	ND	8	2	ND	ND	ND	ND	0.1	2	ND
	1.15	ND	0.29	1.1	ND	ND	ND	ND	ND	0.01	ND	9	1	ND	ND	ND	ND	0.2	2	6
	1.25	ND	1.85	5.5	4	370	ND	2	ND	0.12	ND	61	6	38	1	9	1.2	1.1	13	23
	1.35	ND	0.59	0.8	ND	100	ND	ND	ND	0.03	ND	17	1	12	ND	ND	0.4	0.2	7	8

Table 4-3 continued.

Core ID	Depth (m)	Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		Element Concentrations, Units, and Methods																		
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
9	0.05	ND	1.09	37	0.59	0.23	484	ND	0.6	25	16	0.026	10	48	0.012	0.6	8.1	ND	5.5	ND
	0.15	ND	0.09	6.4	0.1	0.02	56	ND	0	ND	1	0.004	5	ND	ND	ND	0.9	ND	0.9	ND
	0.25	ND	0.04	3.5	ND	ND	44	ND	0	ND	ND	ND	5	ND	ND	ND	0.5	ND	0.5	ND
	0.35	ND	0.04	4.7	0.14	ND	29	ND	0	ND	1	0.002	3	ND	ND	ND	0.6	ND	0.6	ND
	0.45	ND	0.03	4.7	0.09	ND	30	ND	0	ND	2	0.002	5	ND	ND	ND	0.8	ND	0.7	ND
	0.55	ND	0.20	15.4	0.22	0.03	101	ND	0	11	2	0.003	13	ND	ND	0.2	1.5	ND	2.3	ND
	0.65	ND	0.85	34.5	0.63	0.13	320	1	0.4	28	9	0.018	16	ND	0.007	0.7	6.1	ND	5.7	ND
	0.75	ND	0.15	17.6	0.19	0.02	52	ND	0	12	ND	0.003	7	ND	ND	ND	1.2	ND	2.5	ND
	0.85	ND	0.11	9.8	0.16	0.02	45	ND	0	6	ND	0.001	6	ND	ND	ND	0.9	ND	1.4	ND
	0.95	ND	0.13	6	0.07	0.02	139	ND	0	ND	2	0.006	3	ND	ND	ND	0.8	ND	0.9	ND
	1.05	ND	0.08	4	ND	0.02	47	ND	0	ND	2	0.004	5	ND	ND	ND	0.5	ND	0.6	ND
	1.15	ND	0.09	4.8	0.08	0.02	47	ND	0	ND	3	0.004	3	ND	ND	ND	0.6	ND	0.8	ND
	1.25	ND	0.72	32	0.45	0.11	247	ND	0.3	27	7	0.017	12	27	0.007	0.7	4.7	ND	5.2	ND
	1.35	ND	0.24	9.8	0.15	0.03	68	ND	0	10	4	0.004	10	ND	ND	0.1	1	ND	1.5	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
9	0.05	88	2	0.7	9.6	0.50	3	56	ND	22	3.9	45
	0.15	8	ND	ND	1.7	0.17	0.5	6	ND	3	0.6	8
	0.25	5	ND	ND	0.9	0.12	ND	2	ND	3	0.3	6
	0.35	5	ND	ND	1.5	0.15	0.6	2	ND	2	0.9	6
	0.45	4	ND	ND	1.5	0.18	0.7	4	ND	2	0.5	12
	0.55	16	0.8	ND	5.3	0.15	2	3	1	16	1.4	14
	0.65	63	ND	0.8	9.3	0.47	3.5	36	ND	19	4.2	28
	0.75	12	0.8	ND	4.5	0.18	1.2	4	ND	11	1.2	8
	0.85	9	ND	ND	3.1	0.14	1	4	ND	5	1	8
	0.95	10	ND	ND	1.4	0.21	0.7	7	ND	5	0.4	9
	1.05	7	ND	ND	0.9	0.15	ND	6	ND	5	0.3	6
	1.15	8	ND	ND	1.2	0.17	ND	7	ND	3	0.4	6
	1.25	54	1.3	0.9	7.2	0.41	3.5	32	ND	18	2.9	25
	1.35	19	ND	ND	2.6	0.26	0.7	6	ND	11	0.9	12

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
12	**0.05**	**ND**	**5.27**	**9.1**	**ND**	**470**	**2**	**ND**	**ND**	**0.26**	**ND**	**78**	**13**	**72**	**3**	**16**	**1.5**	**2.9**	**7**	**51**
	0.15	**ND**	**5.28**	**7.9**	**ND**	**620**	**2**	**2**	**ND**	**0.27**	**ND**	**79**	**12**	**76**	**4**	**17**	**1.5**	**2.8**	**8**	**47**
	0.25	**ND**	**8.44**	**8.2**	**2**	**570**	**2**	**3**	**1.6**	**0.29**	**ND**	**77**	**13**	**76**	**4**	**15**	**1.4**	**2.8**	**7**	**48**
	0.35	**ND**	**8.25**	**9.9**	**6**	**550**	**2**	**ND**	**2.5**	**0.28**	**ND**	**90**	**16**	**81**	**5**	**21**	**1.7**	**3.8**	**6**	**62**
	0.45	**ND**	**7.55**	**9.6**	**ND**	**740**	**2**	**2**	**2.5**	**0.25**	**ND**	**96**	**20**	**112**	**6**	**21**	**1.8**	**4.4**	**5**	**67**
	0.55	**ND**	**8.98**	**10.6**	**4**	**720**	**3**	**ND**	**2.7**	**0.23**	**ND**	**105**	**19**	**102**	**6**	**23**	**1.9**	**4.2**	**7**	**76**
	0.65	**ND**	**6.07**	**9.3**	**ND**	**640**	**2**	**4**	**2.3**	**0.16**	**ND**	**90**	**13**	**72**	**4**	**16**	**1.7**	**2.7**	**10**	**54**
	0.75	ND	4.56	8.4	2	560	2	ND	1.7	0.12	0.3	84	14	62	4	13	1.5	2.7	10	52
	0.85	ND	3.87	7.3	42	480	1	ND	1.3	0.10	ND	71	15	65	3	12	1.4	2.4	11	43
	0.95	ND	3.54	8.9	ND	440	1	ND	ND	0.07	ND	67	15	69	4	10	1.2	2.5	12	39
	1.05	ND	3.67	7.7	3	390	1	ND	1.1	0.06	ND	59	9	77	3	13	1.1	2.4	12	36
	1.15	ND	3.54	7.7	2	420	1	ND	1.2	0.05	ND	60	6	74	3	10	1	2.4	13	45
	1.25	ND	3.51	6.9	ND	440	ND	ND	ND	0.05	ND	60	5	71	3	10	1	2.3	12	43
	1.35	ND	3.57	7.8	ND	450	ND	ND	1.3	0.05	ND	60	4	67	3	8	1	2.4	13	39
	1.46	ND	4.06	6.3	8	430	1	ND	1.2	0.06	ND	50	6	75	3	10	0.9	2.2	13	35

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
12	**0.05**	**ND**	**1.24**	**40.7**	**0.48**	**0.43**	**751**	**2**	**0.4**	**31**	**24**	**0.041**	**22**	**52**	**0.019**	**0.7**	**10.9**	**ND**	**6.5**	**ND**
	0.15	**ND**	**1.34**	**41.7**	**0.48**	**0.43**	**730**	**ND**	**0.5**	**35**	**23**	**0.036**	**27**	**76**	**0.020**	**0.8**	**10.9**	**ND**	**6.6**	**ND**
	0.25	**ND**	**1.31**	**40.4**	**0.48**	**0.49**	**715**	**1**	**0.5**	**32**	**22**	**0.036**	**28**	**60**	**0.030**	**0.9**	**10.7**	**ND**	**6.4**	**ND**
	0.35	**ND**	**1.45**	**47.7**	**0.51**	**0.56**	**946**	**2**	**0.4**	**36**	**32**	**0.047**	**25**	**69**	**0.042**	**0.8**	**13.6**	**ND**	**7.4**	**ND**
	0.45	**ND**	**1.38**	**49.2**	**0.57**	**0.57**	**970**	**1**	**0.3**	**40**	**31**	**0.043**	**27**	**96**	**0.031**	**1.3**	**15.8**	**ND**	**7.1**	**ND**
	0.55	**ND**	**1.47**	**51.8**	**0.64**	**0.57**	**808**	**3**	**0.4**	**48**	**34**	**0.044**	**35**	**109**	**0.028**	**1.3**	**15.2**	**ND**	**7.5**	**ND**
	0.65	**ND**	**1.09**	**44.7**	**0.64**	**0.32**	**731**	**1**	**0.4**	**42**	**25**	**0.034**	**21**	**79**	**0.032**	**1.2**	**10.9**	**ND**	**6.4**	**ND**
	0.75	ND	1.05	41.5	0.6	0.27	992	2	0.4	37	19	0.033	19	76	0.012	1	9.6	4	6.1	ND
	0.85	ND	0.91	35	0.62	0.24	968	ND	0.3	27	16	0.033	18	62	0.008	0.9	8.8	ND	5.3	ND
	0.95	ND	0.84	34.9	0.57	0.21	609	1	0.3	24	15	0.023	16	73	0.005	0.9	8.6	ND	4.8	ND
	1.05	ND	0.85	33	0.54	0.22	170	ND	0.2	23	14	0.019	14	70	0.005	1.1	8.5	ND	4.3	ND
	1.15	ND	0.85	32.2	0.53	0.21	151	1	0.2	28	14	0.016	18	58	0.002	0.9	8.5	ND	4.1	ND
	1.25	ND	0.85	30.9	0.54	0.20	130	ND	0.2	25	13	0.013	16	58	0.006	1	8.6	ND	4	ND
	1.35	ND	0.81	32	0.53	0.19	123	ND	0.3	25	12	0.013	14	59	ND	0.9	8.4	ND	4.1	ND
	1.46	ND	0.83	28.7	0.53	0.21	133	2	0.2	22	12	0.021	13	60	0.002	1	7.9	ND	3.8	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
12	**0.05**	**109**	**1.5**	**0.9**	**8.8**	**0.54**	**3.4**	**99**	**4**	**26**	**3.1**	**72**
	0.15	**114**	**1.2**	**0.8**	**9.7**	**0.54**	**3.7**	**96**	**3**	**27**	**3.2**	**72**
	0.25	**135**	**1.8**	**1**	**9.2**	**0.59**	**3.4**	**93**	**ND**	**38**	**3.2**	**70**
	0.35	**125**	**ND**	**1**	**10.6**	**0.61**	**4.8**	**123**	**ND**	**32**	**3.3**	**92**
	0.45	**112**	**1.3**	**1.1**	**11.8**	**0.57**	**4.1**	**128**	**3**	**31**	**3.8**	**96**
	0.55	**112**	**1.3**	**1.1**	**12.4**	**0.60**	**3.8**	**124**	**4**	**41**	**4.2**	**99**
	0.65	**82**	**1.8**	**1**	**10.9**	**0.54**	**3.5**	**79**	**5**	**31**	**4.2**	**68**
	0.75	69	1.9	1	9.7	0.51	4.2	72	ND	25	4.1	58
	0.85	61	1.3	0.8	9.2	0.54	4	78	ND	24	3.8	58
	0.95	51	1	ND	9.8	0.51	3.5	70	3	16	3.5	47
	1.05	50	0.9	0.8	9.6	0.52	3.7	70	ND	14	3.5	52
	1.15	48	1.2	0.8	9.7	0.43	3.8	63	3	14	3.5	46
	1.25	47	1	0.6	9.6	0.48	3.8	65	ND	13	3.6	43
	1.35	47	0.9	0.8	9.8	0.44	3.4	59	ND	13	3.5	38
	1.46	50	1.1	0.7	9.1	0.49	3	75	5	15	3.3	39

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
16	**0.05**	**ND**	**12.48**	**16.9**	**10**	**700**	**3**	**ND**	**4**	**0.35**	**ND**	**96**	**22**	**94**	**8**	**35**	**1.9**	**5.5**	**4**	**104**
	0.15	**ND**	**16.56**	**18.2**	**ND**	**700**	**3**	**ND**	**4.8**	**0.50**	**ND**	**100**	**21**	**101**	**8**	**37**	**1.9**	**5.6**	**4**	**100**
	0.25	**ND**	**13.38**	**15.6**	**ND**	**760**	**3**	**ND**	**4**	**0.38**	**ND**	**96**	**22**	**100**	**8**	**31**	**1.9**	**5.5**	**4**	**97**
	0.35	**ND**	**15.83**	**16**	**ND**	**610**	**3**	**3**	**3.6**	**0.41**	**ND**	**104**	**23**	**98**	**9**	**32**	**1.9**	**5.8**	**5**	**95**
	0.45	**ND**	**17.28**	**15.4**	**ND**	**730**	**3**	**3**	**4.2**	**0.57**	**ND**	**100**	**22**	**103**	**8**	**32**	**2**	**5.8**	**4**	**99**
	0.55	**ND**	**16.63**	**16.3**	**ND**	**760**	**3**	**ND**	**4.5**	**0.45**	**ND**	**105**	**23**	**106**	**8**	**31**	**1.9**	**5.8**	**5**	**89**
	0.65	**ND**	**13.57**	**18.6**	**ND**	**790**	**3**	**3**	**4.6**	**0.31**	**ND**	**108**	**21**	**96**	**8**	**30**	**1.9**	**5.9**	**5**	**89**
	0.75	**ND**	**4.47**	**14.6**	**3**	**680**	**2**	**ND**	**3.5**	**0.15**	**ND**	**92**	**18**	**83**	**7**	**13**	**1.8**	**4.6**	**7**	**61**
	0.85	**ND**	**2.88**	**5.9**	**ND**	**470**	**2**	**ND**	**1.5**	**0.15**	**ND**	**66**	**8**	**44**	**3**	**9**	**1.1**	**1.5**	**12**	**31**
	0.95	ND	4.99	9	4	690	2	ND	ND	0.18	ND	84	12	69	5	14	1.5	2.8	9	49
	1.05	ND	6.27	10.2	4	670	2	ND	1.2	0.20	ND	81	12	66	5	16	1.5	3	8	54
	1.15	ND	4.65	7.7	4	610	2	ND	ND	0.18	ND	78	9	60	4	13	1.5	2.4	10	48
	1.25	ND	4.14	8.4	4	630	2	ND	ND	0.17	ND	78	11	58	5	13	1.4	2.4	11	45
	1.34	ND	4.68	8.8	ND	640	2	ND	1.3	0.18	ND	77	11	61	4	14	1.5	2.5	11	50

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
16	**0.05**	**ND**	**1.49**	**46.9**	**0.45**	**0.82**	**2392**	**2**	**0.2**	**40**	**45**	**0.078**	**38**	**126**	**0.061**	**1.1**	**17.6**	**ND**	**8.8**	**ND**
	0.15	**ND**	**1.71**	**48.9**	**0.53**	**1.25**	**2638**	**2**	**0.2**	**43**	**43**	**0.087**	**41**	**145**	**0.108**	**1.2**	**18.2**	**ND**	**8.9**	**ND**
	0.25	**ND**	**1.62**	**47.5**	**0.48**	**1.03**	**2185**	**4**	**0.2**	**39**	**43**	**0.077**	**36**	**130**	**0.091**	**1.1**	**17.9**	**ND**	**8.8**	**ND**
	0.35	**ND**	**1.66**	**49.8**	**0.5**	**1.19**	**2254**	**2**	**0.2**	**47**	**43**	**0.092**	**37**	**132**	**0.114**	**1.2**	**18.1**	**ND**	**9**	**ND**
	0.45	**ND**	**1.81**	**48.8**	**0.51**	**1.42**	**3054**	**2**	**0.2**	**44**	**43**	**0.087**	**44**	**122**	**0.156**	**1.2**	**18.6**	**ND**	**9.2**	**ND**
	0.55	**ND**	**1.71**	**50.1**	**0.48**	**1.29**	**2944**	**1**	**0.2**	**46**	**41**	**0.084**	**49**	**127**	**0.110**	**1**	**19**	**ND**	**9.4**	**ND**
	0.65	**ND**	**1.55**	**50.4**	**0.53**	**0.91**	**2762**	**2**	**0.2**	**39**	**42**	**0.069**	**39**	**130**	**0.084**	**1.2**	**18.9**	**ND**	**9.4**	**ND**
	0.75	**ND**	**0.97**	**44.4**	**0.49**	**0.29**	**956**	**2**	**0.3**	**43**	**19**	**0.032**	**15**	**114**	**0.028**	**1.1**	**15**	**ND**	**8.2**	**ND**
	0.85	**ND**	**0.99**	**32**	**0.44**	**0.18**	**661**	**1**	**0.5**	**30**	**12**	**0.016**	**14**	**64**	**0.008**	**0.7**	**6.7**	**ND**	**6**	**ND**
	0.95	ND	1.20	41.1	0.56	0.32	1285	1	0.6	34	20	0.032	21	93	0.008	0.9	11.5	ND	7.1	ND
	1.05	ND	1.46	41.8	0.55	0.32	1250	2	0.5	37	22	0.036	9	98	0.011	1	11.9	ND	7	ND
	1.15	ND	1.48	38.9	0.58	0.25	681	1	0.6	37	17	0.033	13	64	0.009	1	9.7	ND	7.2	ND
	1.25	ND	1.39	37.3	0.58	0.23	591	2	0.6	34	16	0.031	12	71	0.007	0.8	9.8	ND	7	ND
	1.34	ND	1.49	39.5	0.6	0.25	621	ND	0.6	34	17	0.033	13	112	0.010	1	10.1	ND	7.2	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
16	**0.05**	**140**	**ND**	**0.9**	**12.1**	**0.57**	**4.1**	**166**	**ND**	**49**	**3.1**	**131**
	0.15	**171**	**1**	**1.1**	**13.3**	**0.62**	**4.8**	**171**	**ND**	**105**	**3.5**	**140**
	0.25	**150**	**1.2**	**1.1**	**12.7**	**0.59**	**4.4**	**164**	**ND**	**77**	**3.1**	**131**
	0.35	**150**	**1.2**	**ND**	**13.4**	**0.64**	**4.8**	**169**	**ND**	**97**	**3.3**	**130**
	0.45	**180**	**ND**	**1.1**	**12.8**	**0.65**	**4.8**	**174**	**ND**	**123**	**3.3**	**134**
	0.55	**167**	**1**	**1**	**13.6**	**0.63**	**5.4**	**171**	**ND**	**105**	**3.2**	**130**
	0.65	**137**	**ND**	**1.1**	**13.1**	**0.60**	**4.9**	**161**	**ND**	**70**	**3.5**	**127**
	0.75	**72**	**1.2**	**1.1**	**11.6**	**0.44**	**4**	**75**	**ND**	**20**	**3.3**	**58**
	0.85	**72**	**1.1**	**0.7**	**8.5**	**0.27**	**3.1**	**31**	**2**	**19**	**3**	**38**
	0.95	87	1.2	0.8	10.7	0.52	4.5	78	ND	23	3.8	61
	1.05	85	1.1	0.9	10.7	0.61	4	79	ND	30	3.7	72
	1.15	76	1.4	1	10.5	0.58	4.1	68	2	27	3.9	57
	1.25	70	ND	0.9	10	0.51	3.8	57	2	23	3.9	54
	1.34	76	1.4	1	9.9	0.57	4.1	66	ND	25	4	56

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
20	0.05	ND	4.12	6.2	3	480	1	ND	1.5	0.17	ND	71	9	66	3	10	1.3	2	12	57
	0.15	ND	4.22	6.6	4	620	2	ND	1.6	0.19	ND	78	9	65	4	12	1.7	2.2	11	44
	0.25	ND	3.66	6	2	530	1	ND	1	0.17	ND	74	8	66	3	11	1.5	1.9	12	47
	0.35	ND	4.21	7.6	3	590	2	ND	1	0.19	ND	79	9	69	4	13	1.6	2.2	10	42
	0.45	ND	3.77	8.2	ND	590	2	ND	2	0.17	ND	86	10	67	4	14	1.7	2.3	10	41
	0.55	ND	3.75	9.4	ND	670	2	ND	2.3	0.15	ND	97	12	72	4	16	1.8	2.7	9	46
	0.65	ND	3.82	8.6	2	640	2	ND	2	0.15	ND	92	10	65	4	16	1.8	2.5	9	50
	0.75	ND	3.90	6.9	3	540	2	ND	1.5	0.15	ND	80	10	66	3	12	1.5	2.2	11	49
	0.85	ND	4.37	7.9	3	630	2	ND	1.6	0.15	ND	84	12	66	3	15	1.6	2.3	11	48
	0.95	ND	4.94	9.3	3	720	2	ND	2.6	0.18	ND	95	14	68	4	17	1.9	2.5	9	51
	1.05	ND	4.54	8.9	ND	790	2	ND	3.2	0.19	ND	101	13	69	4	17	2	2.7	9	55
	1.15	ND	4.10	9.1	ND	630	2	ND	4.1	0.17	ND	94	12	59	5	16	1.8	2.4	10	59
	1.25	ND	3.40	7.3	ND	580	1	3	1.2	0.21	ND	80	11	58	3	8	1.9	1.8	14	36
	1.35	ND	3.37	5.8	2	590	1	ND	1.8	0.18	ND	75	9	53	3	14	1.4	1.7	14	35
	1.45	ND	3.41	6.8	ND	500	2	3	2.5	0.15	ND	83	14	55	4	19	1.5	2.3	12	44
	1.55	ND	3.60	6.3	ND	550	1	2	ND	0.13	ND	78	12	58	4	16	1.3	2.1	14	46
	1.65	ND	3.70	6.4	24	540	1	ND	2.1	0.13	ND	74	11	56	4	16	1.3	2.1	14	48
	1.75	ND	3.72	6	5	370	1	ND	1.5	0.11	ND	75	9	59	3	11	1.1	1.8	15	44
	1.84	ND	3.96	7.1	ND	450	1	ND	1.5	0.11	ND	62	7	50	3	11	1	1.9	15	44

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
20	0.05	ND	1.10	36.2	0.59	0.24	589	ND	0.5	25	13	0.037	19	68	0.008	0.8	8.4	ND	5.1	ND
	0.15	ND	1.27	41.4	0.66	0.27	589	ND	0.6	36	17	0.031	16	77	0.009	1.1	8.8	ND	6.1	ND
	0.25	ND	1.13	38.8	0.62	0.22	407	1	0.6	27	14	0.029	16	62	0.006	1.1	8	ND	5.5	ND
	0.35	ND	1.31	42	0.66	0.27	353	ND	0.6	39	18	0.035	19	71	0.011	0.9	8.8	ND	6.2	ND
	0.45	ND	1.29	45.2	0.68	0.27	372	ND	0.7	34	21	0.038	18	84	0.010	1	9.5	ND	6.8	ND
	0.55	ND	1.34	49.4	0.71	0.29	416	ND	0.7	40	23	0.041	18	83	0.011	1.2	10.5	ND	7.5	ND
	0.65	ND	1.27	45.8	0.67	0.27	733	1	0.6	46	24	0.043	17	97	0.007	1.2	9.8	ND	6.8	ND
	0.75	ND	1.16	39.8	0.66	0.23	894	ND	0.6	28	16	0.037	16	78	0.003	1.1	8.7	ND	5.8	ND
	0.85	ND	1.10	42.1	0.65	0.24	1213	ND	0.5	38	18	0.038	21	78	0.007	1	9.2	ND	6.3	ND
	0.95	ND	1.29	49.8	0.7	0.31	896	1	0.6	44	25	0.048	24	88	0.014	1.1	10.1	ND	7.4	ND
	1.05	ND	1.24	55	0.74	0.31	1505	2	0.6	50	29	0.053	19	75	0.012	1.2	10.4	ND	7.9	ND
	1.15	ND	1.16	49.7	0.6	0.27	840	2	0.6	39	26	0.054	16	69	0.015	0.9	9.6	ND	9.7	ND
	1.25	ND	1.67	43	0.72	0.18	407	1	0.7	34	16	0.033	15	78	0.015	0.8	8.8	ND	7.5	ND
	1.35	ND	1.19	38.1	0.55	0.21	826	ND	0.6	38	15	0.029	17	82	0.004	0.7	7.8	ND	7.6	ND
	1.45	ND	1.17	40.4	0.57	0.24	1972	ND	0.5	31	20	0.046	22	79	0.003	0.7	8.9	ND	8	ND
	1.55	ND	1.07	36.6	0.54	0.22	1951	ND	0.4	32	17	0.039	20	84	0.001	0.8	8.4	ND	6.7	ND
	1.65	ND	1.16	35.9	0.54	0.24	1209	1	0.4	30	17	0.038	16	87	0.003	0.8	8.5	ND	7.4	ND
	1.75	ND	1.07	34.1	0.51	0.21	433	ND	0.4	33	14	0.032	17	60	0.002	0.8	7.9	ND	6.3	ND
	1.84	ND	1.07	31.7	0.53	0.22	443	ND	0.5	24	13	0.034	19	68	ND	0.8	7.7	ND	5.9	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
20	0.05	84	1.1	0.9	10.3	0.51	3.7	68	ND	21	3.7	45
	0.15	93	1.2	0.9	11.4	0.48	4.6	60	ND	27	4.3	50
	0.25	84	0.7	1	10.5	0.50	3.8	60	4	20	4.1	45
	0.35	97	0.9	0.8	10.9	0.57	4.4	70	4	26	4.4	54
	0.45	89	1.4	1.2	11.3	0.54	4.2	69	ND	25	4.4	55
	0.55	85	ND	1.3	11.3	0.52	4.4	76	ND	25	4.6	62
	0.65	82	1.4	1.2	11.3	0.54	3.6	75	4	27	4.3	66
	0.75	82	1.5	0.8	11.1	0.56	4.3	69	ND	22	4.3	51
	0.85	82	ND	0.8	11.2	0.50	4	67	4	23	4.3	57
	0.95	95	0.7	1.3	12.2	0.54	4.5	73	ND	34	4.7	70
	1.05	89	1.2	1.2	11.3	0.51	4	75	6	38	4.9	81
	1.15	84	1.7	1.2	10.1	0.50	4	72	ND	33	4.2	74
	1.25	92	2.1	0.8	10	0.50	3.3	59	4	27	4.8	57
	1.35	88	0.9	0.9	9.4	0.51	4.4	58	2	23	3.7	47
	1.45	73	ND	ND	10.5	0.50	4.1	78	ND	22	3.6	68
	1.55	69	0.9	0.7	9.6	0.53	4.4	68	2	18	3.5	63
	1.65	74	1	1	10.2	0.55	4.3	70	1	19	3.6	62
	1.75	72	1.2	0.8	10.3	0.52	4.3	60	ND	16	3.4	48
	1.84	72	ND	0.7	9.8	0.54	4.2	63	ND	15	3.5	46

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
21	**0.10**	**ND**	**6.75**	**13.3**	**ND**	**780**	**3**	**3**	**4.7**	**0.25**	**ND**	**99**	**21**	**100**	**8**	**25**	**2**	**5.3**	**5**	**90**
	0.25	**ND**	**7.44**	**14.3**	**ND**	**710**	**3**	**ND**	**4.4**	**0.25**	**ND**	**101**	**21**	**101**	**8**	**26**	**1.9**	**5.7**	**4**	**92**
	0.35	**ND**	**5.67**	**14.6**	**3**	**720**	**3**	**ND**	**2.5**	**0.17**	**ND**	**107**	**23**	**110**	**8**	**24**	**2.2**	**6**	**5**	**92**
	0.55	ND	5.89	8.8	3	710	3	ND	4.1	0.17	ND	106	14	62	5	12	2.3	2.7	9	70
	0.65	ND	6.82	6.6	6	620	3	ND	4.7	0.17	ND	102	16	65	5	17	2.3	2.4	9	66
	0.75	ND	5.57	7.8	ND	590	2	ND	3	0.14	ND	98	15	69	5	15	2.1	2.2	10	52
	0.85	ND	6.82	6	ND	650	2	2	3	0.14	ND	101	15	65	5	14	2.1	2.3	10	55
	0.95	ND	6.05	5.2	4	520	2	ND	2.8	0.13	ND	93	15	70	4	13	1.9	2.2	10	49
	1.05	ND	4.81	4.5	ND	610	2	ND	ND	0.14	ND	77	11	63	4	12	1.6	1.8	13	42
	1.15	0.3	4.79	4.3	ND	560	2	ND	1.9	0.15	ND	81	9	60	3	7	1.7	1.6	13	42
	1.25	ND	3.42	5.2	ND	540	1	ND	2.3	0.14	ND	83	8	62	3	9	1.5	1.6	13	41
	1.35	ND	4.82	6	ND	600	2	ND	0.5	0.13	ND	88	10	76	4	6	1.6	2.1	12	41
22	**0.05**	**ND**	**6.65**	**15.1**	**4**	**730**	**3**	**2**	**4.4**	**0.22**	**ND**	**101**	**21**	**101**	**9**	**30**	**1.9**	**5.6**	**4**	**122**
	0.15	**ND**	**5.19**	**14.8**	**ND**	**760**	**3**	**ND**	**4.6**	**0.18**	**ND**	**98**	**22**	**95**	**8**	**33**	**1.9**	**5.7**	**4**	**126**
	0.25	**ND**	**4.56**	**16.7**	**ND**	**740**	**3**	**ND**	**4.2**	**0.21**	**ND**	**102**	**20**	**96**	**9**	**29**	**1.8**	**5.7**	**4**	**112**
	0.35	**ND**	**5.68**	**15.3**	**7**	**740**	**3**	**ND**	**4**	**0.25**	**ND**	**99**	**21**	**110**	**7**	**25**	**2**	**5.6**	**5**	**87**
	0.45	**ND**	**4.97**	**15.3**	**ND**	**690**	**3**	**ND**	**3.8**	**0.11**	**ND**	**101**	**19**	**90**	**8**	**31**	**2**	**4.4**	**5**	**109**
	0.55	**ND**	**5.29**	**14.7**	**ND**	**660**	**3**	**ND**	**2.7**	**0.11**	**ND**	**114**	**19**	**86**	**7**	**24**	**2.1**	**4**	**7**	**107**
	0.65	**ND**	**3.99**	**12.1**	**ND**	**580**	**2**	**ND**	**2.3**	**0.07**	**ND**	**96**	**18**	**75**	**5**	**18**	**1.9**	**3.4**	**8**	**104**
	0.75	ND	4.65	11.5	2	480	2	3	1.5	0.07	ND	86	16	80	5	17	1.6	3.6	9	88
	0.85	ND	4.23	11.9	4	430	2	ND	ND	0.07	ND	73	14	77	5	15	1.3	3.3	10	79
	0.95	ND	5.06	13.2	7	360	2	ND	ND	0.08	ND	66	13	76	4	16	1.2	3.6	9	67
	1.05	ND	5.08	12.5	4	400	2	2	1.2	0.07	ND	66	14	70	4	15	1.1	3.5	9	75
	1.15	ND	5.64	8.6	9	400	2	ND	1.2	0.07	ND	74	17	83	5	16	1.3	3.3	9	65
	1.23	ND	6.70	12.7	9	430	2	ND	1.6	0.08	ND	77	16	78	5	18	1.5	3.3	9	42

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
21	**0.10**	**ND**	**1.33**	**50.7**	**0.56**	**0.40**	**1441**	**1**	**0.2**	**46**	**39**	**0.058**	**31**	**132**	**0.037**	**1.1**	**18.2**	**ND**	**10.1**	**ND**
	0.25	**ND**	**1.30**	**52.3**	**0.54**	**0.42**	**1609**	**3**	**0.2**	**46**	**40**	**0.062**	**38**	**129**	**0.058**	**1**	**18.4**	**ND**	**9.7**	**ND**
	0.35	**ND**	**1.07**	**53.4**	**0.57**	**0.32**	**1619**	**1**	**0.2**	**44**	**43**	**0.055**	**33**	**110**	**0.040**	**1**	**20.1**	**ND**	**8.9**	**ND**
	0.55	ND	1.64	53.3	0.75	0.26	1471	1	0.6	54	21	0.055	20	95	0.037	0.9	11.4	ND	11.8	ND
	0.65	ND	1.71	55.7	0.72	0.27	1738	2	0.5	55	20	0.056	18	94	0.036	0.6	11.1	ND	11.6	ND
	0.75	ND	1.72	52.8	0.7	0.25	757	ND	0.6	55	20	0.039	17	82	0.022	1	11.2	ND	11.1	ND
	0.85	ND	1.73	51.4	0.66	0.28	698	3	0.6	48	23	0.043	18	82	0.023	0.7	11.8	ND	10.2	ND
	0.95	ND	1.77	49.2	0.67	0.25	779	1	0.6	44	20	0.042	23	75	0.015	0.7	11.1	ND	10.4	ND
	1.05	ND	1.70	44	0.64	0.21	798	1	0.6	41	15	0.030	16	96	0.014	0.9	9.4	ND	8.4	ND
	1.15	ND	1.68	40.9	0.6	0.19	439	1	0.6	36	13	0.025	17	80	0.013	0.8	9.1	ND	7.4	ND
	1.25	ND	1.74	39.4	0.56	0.19	366	ND	0.7	32	15	0.024	15	85	0.008	0.9	9.1	ND	7.4	ND
	1.35	ND	1.66	39.9	0.61	0.21	514	ND	0.5	33	15	0.025	14	80	0.010	0.8	10.4	ND	7.1	ND
22	**0.05**	**ND**	**1.05**	**49.9**	**0.46**	**0.52**	**1607**	**2**	**0.2**	**45**	**44**	**0.064**	**30**	**114**	**0.048**	**1.3**	**18.4**	**ND**	**9.5**	**ND**
	0.15	**ND**	**0.89**	**50.1**	**0.5**	**0.42**	**1591**	**ND**	**0.2**	**47**	**45**	**0.067**	**30**	**108**	**0.052**	**1.1**	**18.4**	**ND**	**9.9**	**ND**
	0.25	**ND**	**0.95**	**50.4**	**0.46**	**0.45**	**1338**	**2**	**0.3**	**42**	**42**	**0.060**	**32**	**119**	**0.042**	**1.4**	**18.3**	**ND**	**9.3**	**ND**
	0.35	**ND**	**1.28**	**49.7**	**0.56**	**0.39**	**1438**	**2**	**0.3**	**38**	**46**	**0.061**	**38**	**120**	**0.043**	**1.2**	**18.8**	**ND**	**8.4**	**ND**
	0.45	**ND**	**1.01**	**55.1**	**0.55**	**0.39**	**1066**	**2**	**0.2**	**48**	**45**	**0.065**	**38**	**106**	**0.054**	**1.2**	**16.1**	**ND**	**9.7**	**ND**
	0.55	**ND**	**1.12**	**59**	**0.63**	**0.37**	**2652**	**1**	**0.3**	**49**	**40**	**0.068**	**35**	**101**	**0.033**	**1.1**	**13.4**	**ND**	**10.7**	**ND**
	0.65	**ND**	**0.90**	**46.3**	**0.6**	**0.27**	**2244**	**1**	**0.3**	**43**	**24**	**0.061**	**20**	**88**	**0.018**	**1**	**11.7**	**ND**	**9.2**	**ND**
	0.75	ND	0.92	44.3	0.56	0.27	1860	2	0.3	36	20	0.046	24	74	0.010	1.1	11.2	ND	8.5	ND
	0.85	ND	0.90	37.7	0.52	0.26	1612	2	0.4	30	16	0.042	20	83	0.004	1.1	10.8	ND	6.7	ND
	0.95	ND	1.00	37	0.52	0.29	1614	2	0.4	28	17	0.035	23	65	0.002	0.8	9.9	ND	6.3	ND
	1.05	ND	0.97	36.1	0.48	0.27	2063	1	0.4	27	14	0.036	23	64	ND	1	9.9	ND	5.9	ND
	1.15	ND	0.98	42.1	0.53	0.30	1847	1	0.4	35	16	0.037	24	81	0.002	0.8	11.3	ND	7.1	ND
	1.23	ND	1.00	41.2	0.55	0.33	912	2	0.4	36	19	0.027	23	84	ND	0.9	11.7	ND	7.2	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
21	**0.10**	**79**	**ND**	**0.8**	**15.1**	**0.50**	**4.2**	**151**	**ND**	**15**	**3.7**	**123**
	0.25	**76**	**ND**	**1**	**13.7**	**0.49**	**5**	**156**	**ND**	**12**	**3.6**	**134**
	0.35	**56**	**1.5**	**1.3**	**13.6**	**0.50**	**3.8**	**167**	**ND**	**11**	**3.6**	**131**
	0.55	84	1.3	1.4	12.2	0.51	4.4	80	3	42	5	78
	0.65	89	1.1	1.3	11.1	0.53	4.1	88	3	49	4.8	79
	0.75	81	ND	1.2	12.6	0.50	3.6	82	ND	30	4.7	73
	0.85	85	ND	0.9	10.7	0.53	4.2	87	2	33	4.4	80
	0.95	83	1.5	1.1	12.8	0.54	4.2	83	ND	29	4.5	72
	1.05	83	1.2	1	11.1	0.53	4.3	71	ND	25	4.3	58
	1.15	85	0.9	0.9	11.5	0.55	4.6	65	2	24	4	54
	1.25	83	1.2	1.1	11.5	0.39	4	64	ND	19	3.8	52
	1.35	81	ND	ND	10.8	0.52	4.2	68	ND	21	4.1	53
22	**0.05**	**80**	**ND**	**0.9**	**13.6**	**0.50**	**4.4**	**161**	**ND**	**18**	**3.1**	**126**
	0.15	**59**	**ND**	**1**	**13.4**	**0.50**	**4.1**	**164**	**ND**	**10**	**3.2**	**125**
	0.25	**65**	**ND**	**1.1**	**13.6**	**0.47**	**5**	**150**	**3**	**12**	**3.1**	**117**
	0.35	**70**	**ND**	**0.9**	**13.6**	**0.50**	**4.8**	**167**	**ND**	**13**	**3.8**	**134**
	0.45	**50**	**1.5**	**1**	**12.2**	**0.51**	**3.8**	**149**	**ND**	**15**	**3.7**	**129**
	0.55	**64**	**1**	**1.2**	**11.3**	**0.59**	**3.8**	**132**	**3**	**29**	**4.2**	**108**
	0.65	**49**	**1.1**	**1**	**11.4**	**0.50**	**4.8**	**105**	**ND**	**23**	**4**	**72**
	0.75	56	ND	0.9	10.5	0.50	4.7	98	ND	20	3.8	64
	0.85	54	ND	0.8	10.7	0.40	4.4	100	ND	14	3.4	56
	0.95	64	0.8	0.6	10	0.55	3.9	95	ND	20	3.4	56
	1.05	63	1.1	0.7	10.2	0.55	4.3	96	ND	20	3.2	51
	1.15	65	1.5	0.7	10.5	0.56	4	104	ND	24	3.5	56
	1.23	70	1.3	0.8	10.3	0.58	4	102	ND	25	3.6	62

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
24	**0.05**	**ND**	**12.69**	**13.6**	**ND**	**680**	**3**	**3**	**3.9**	**0.31**	**ND**	**91**	**18**	**105**	**8**	**37**	**1.8**	**5.2**	**4**	**107**
	0.15	**ND**	**15.58**	**12.9**	**ND**	**760**	**3**	**3**	**3.9**	**0.44**	**ND**	**97**	**21**	**111**	**9**	**28**	**1.8**	**5.4**	**4**	**98**
	0.25	**ND**	**16.19**	**12.7**	**ND**	**670**	**3**	**6**	**4.3**	**0.48**	**ND**	**101**	**20**	**117**	**7**	**29**	**2**	**5.2**	**5**	**98**
	0.35	**ND**	**3.07**	**8.4**	**ND**	**460**	**1**	**ND**	**2.1**	**0.10**	**ND**	**63**	**12**	**67**	**4**	**9**	**1.2**	**2.5**	**6**	**53**
	0.45	**ND**	**1.93**	**5**	**ND**	**260**	**ND**	**ND**	**ND**	**0.10**	**ND**	**46**	**6**	**41**	**2**	**6**	**0.9**	**1.3**	**9**	**21**
	0.55	ND	4.10	7.7	ND	530	1	ND	ND	0.18	ND	68	8	60	3	11	1.3	2.1	11	37
	0.65	ND	4.11	8.5	ND	660	1	3	ND	0.18	ND	79	9	65	3	12	1.5	2.2	11	39
	0.75	ND	3.77	7.3	ND	540	1	ND	ND	0.16	ND	71	9	61	3	12	1.3	2	10	36
	0.85	ND	4.36	8.1	ND	610	2	ND	1.4	0.19	ND	74	9	62	4	13	1.4	2.2	10	41
	0.95	ND	4.06	8	ND	530	1	ND	ND	0.21	ND	66	8	54	3	11	1.4	2	10	36
	1.05	ND	5.22	8.9	ND	570	2	ND	ND	0.18	ND	82	10	69	5	15	1.6	2.6	9	48
	1.15	ND	5.27	7.6	ND	650	2	ND	2	0.18	ND	75	8	67	4	15	1.5	2.2	9	48
	1.25	ND	5.36	7.3	ND	550	2	3	1.6	0.16	ND	78	7	61	5	14	1.6	2.1	9	50
	1.35	ND	4.07	8.3	3	490	2	ND	ND	0.16	ND	74	11	67	4	12	1.4	3.2	10	37

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
24	**0.05**	**ND**	**1.44**	**53.5**	**0.53**	**0.82**	**1433**	**2**	**0.2**	**39**	**37**	**0.064**	**32**	**115**	**0.048**	**1.2**	**17.2**	**ND**	**9.5**	**ND**
	0.15	**ND**	**1.64**	**50.7**	**0.55**	**1.10**	**1638**	**3**	**0.2**	**44**	**40**	**0.074**	**40**	**133**	**0.116**	**1.1**	**17.7**	**ND**	**9.2**	**ND**
	0.25	**ND**	**1.66**	**52.2**	**0.59**	**1.20**	**1410**	**4**	**0.2**	**53**	**42**	**0.069**	**43**	**120**	**0.129**	**1.3**	**18**	**ND**	**9.3**	**ND**
	0.35	**ND**	**0.60**	**31.7**	**0.4**	**0.19**	**268**	**ND**	**0.2**	**29**	**14**	**0.022**	**13**	**86**	**0.019**	**0.7**	**9**	**ND**	**5.7**	**ND**
	0.45	**ND**	**0.69**	**23.2**	**0.37**	**0.13**	**323**	**ND**	**0.3**	**22**	**9**	**0.012**	**13**	**41**	**0.004**	**0.5**	**4.6**	**ND**	**4.2**	**ND**
	0.55	ND	1.25	36.3	0.6	0.24	459	1	0.6	30	17	0.020	17	87	0.005	0.7	8.1	ND	6.4	ND
	0.65	ND	1.26	39.8	0.58	0.23	508	1	0.6	35	17	0.023	15	82	0.005	0.9	8.6	ND	6.9	ND
	0.75	ND	1.14	36.6	0.55	0.23	553	ND	0.5	30	17	0.024	15	74	0.005	0.8	7.7	ND	6.5	ND
	0.85	ND	1.27	38.5	0.6	0.25	771	ND	0.6	37	19	0.027	14	72	0.005	0.8	8.4	ND	7	ND
	0.95	ND	1.31	36.8	0.56	0.23	947	ND	0.6	27	16	0.024	15	66	0.002	0.7	7.4	ND	6.5	ND
	1.05	ND	1.22	44.2	0.62	0.31	509	2	0.5	40	22	0.029	20	83	0.009	0.8	10.1	ND	7.7	ND
	1.15	ND	1.25	42.2	0.62	0.32	366	ND	0.5	34	23	0.032	17	88	0.007	0.8	9.8	ND	7.3	ND
	1.25	ND	1.14	40.9	0.5	0.32	149	ND	0.4	37	22	0.030	23	73	0.008	0.8	10.7	ND	7.3	ND
	1.35	ND	0.85	38.3	0.46	0.26	459	ND	0.4	30	16	0.021	20	92	0.003	0.7	11	ND	6.9	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
24	**0.05**	**126**	**1**	**0.9**	**11.9**	**0.55**	**4.9**	**144**	**2**	**53**	**3.5**	**118**
	0.15	**160**	**1.7**	**0.9**	**13.1**	**0.59**	**4.6**	**155**	**4**	**90**	**3.7**	**122**
	0.25	**163**	**1.4**	**ND**	**13.2**	**0.59**	**4.9**	**164**	**ND**	**104**	**3.9**	**129**
	0.35	**43**	**1**	**0.7**	**7.9**	**0.27**	**3**	**45**	**ND**	**16**	**2.6**	**43**
	0.45	**49**	**0.9**	**0.6**	**6**	**0.17**	**2.5**	**21**	**1**	**15**	**2.5**	**28**
	0.55	89	1.3	1	9.2	0.43	3.4	50	ND	24	4	44
	0.65	90	1.9	0.9	9.7	0.46	3.4	52	ND	26	4.1	45
	0.75	82	1.2	0.8	8.1	0.45	3.8	56	3	24	3.7	46
	0.85	92	1.8	1	9.2	0.51	3.6	59	ND	29	4	50
	0.95	95	1	0.7	8.1	0.48	3.2	49	ND	28	3.8	45
	1.05	90	1.9	0.8	10	0.54	3.9	77	2	31	4.1	63
	1.15	92	1.5	0.9	9.8	0.56	3.7	81	ND	31	4	65
	1.25	87	ND	0.9	9.8	0.53	3.2	76	ND	30	3.3	66
	1.35	68	ND	0.8	10.4	0.34	3.7	62	ND	22	3.2	55

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
27	**0.05**	**ND**	**3.97**	**10.9**	**3**	**610**	**2**	**ND**	**1.7**	**0.17**	**ND**	**74**	**12**	**62**	**5**	**14**	**1.3**	**2.6**	**10**	**46**
	0.15	**ND**	**4.64**	**11.1**	**4**	**490**	**2**	**ND**	**2.2**	**0.21**	**ND**	**81**	**12**	**73**	**5**	**13**	**1.4**	**2.9**	**11**	**48**
	0.25	**ND**	**1.65**	**5**	**ND**	**390**	**ND**	**ND**	**ND**	**0.10**	**ND**	**41**	**6**	**38**	**1**	**5**	**0.7**	**1.2**	**11**	**24**
	0.35	**ND**	**4.43**	**11.9**	**5**	**540**	**2**	**ND**	**2.8**	**0.17**	**ND**	**78**	**14**	**76**	**6**	**12**	**1.4**	**3.6**	**7**	**49**
	0.45	**ND**	**6.67**	**12.5**	**3**	**690**	**2**	**ND**	**3**	**0.23**	**ND**	**89**	**15**	**90**	**7**	**19**	**1.6**	**4.3**	**7**	**63**
	0.55	**ND**	**6.23**	**10.1**	**ND**	**600**	**2**	**ND**	**2.7**	**0.21**	**ND**	**79**	**13**	**77**	**6**	**18**	**1.5**	**3.6**	**9**	**61**
	0.65	**ND**	**5.40**	**9.4**	**3**	**560**	**2**	**ND**	**2.1**	**0.18**	**ND**	**82**	**12**	**70**	**5**	**16**	**1.5**	**3.4**	**9**	**58**
	0.75	**ND**	**8.22**	**10.6**	**ND**	**600**	**2**	**ND**	**2.5**	**0.23**	**ND**	**79**	**13**	**62**	**4**	**17**	**1.4**	**3.2**	**8**	**60**
	0.85	ND	3.25	6.3	ND	490	1	2	2.2	0.16	ND	69	11	44	3	9	1.3	1.8	10	38
	0.95	ND	2.98	6.3	ND	530	1	ND	1.7	0.14	ND	59	9	41	3	8	1.2	1.6	9	36
	1.05	ND	2.43	5	3	480	1	ND	1.2	0.14	ND	63	10	42	2	7	1	1.4	12	35
	1.15	ND	3.29	4.5	ND	450	1	ND	1.7	0.16	ND	80	11	51	3	9	1.4	1.8	13	38
	1.25	ND	4.79	6.6	4	620	2	ND	2	0.17	ND	100	12	68	5	14	1.6	2.8	12	45
	1.35	ND	3.37	5.4	2	500	1	ND	1.6	0.13	ND	81	10	61	3	9	1.3	1.7	15	38
	1.45	ND	3.25	4	15	530	1	ND	1.7	0.13	ND	71	8	56	3	8	1.2	1.5	14	31
	1.55	ND	1.74	2.3	ND	340	ND	ND	0.8	0.08	ND	45	7	31	1	4	0.8	0.7	10	20
	1.65	ND	1.65	2.3	ND	340	1	ND	0.6	0.10	ND	44	4	31	1	5	0.7	0.7	8	23
	1.75	ND	1.16	1.2	ND	280	ND	ND	ND	0.07	ND	30	3	20	1	1	0.5	0.4	7	13
	1.85	ND	0.72	0.8	ND	210	ND	ND	ND	0.04	ND	26	2	20	ND	9	0.4	0.4	8	12
	1.95	ND	1.20	1	2	150	ND	ND	ND	0.07	ND	25	2	17	ND	4	0.4	0.4	5	13
	2.05	ND	1.39	1.9	ND	290	ND	ND	ND	0.07	ND	37	2	30	1	3	0.6	0.5	11	14
	2.15	ND	2.13	1.7	ND	450	1	ND	ND	0.12	ND	56	3	45	2	5	1	0.8	12	18
	2.25	ND	2.07	2.6	8	450	ND	ND	0.8	0.11	ND	44	4	48	1	5	0.8	0.7	10	18

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
27	**0.05**	**ND**	**1.06**	**35.7**	**0.47**	**0.23**	**582**	**2**	**0.4**	**30**	**17**	**0.033**	**12**	**78**	**0.020**	**0.8**	**10.3**	**ND**	**6.4**	**ND**
	0.15	**ND**	**1.26**	**39.9**	**0.55**	**0.28**	**677**	**1**	**0.4**	**36**	**19**	**0.040**	**14**	**90**	**0.021**	**0.7**	**11.2**	**ND**	**8**	**ND**
	0.25	**ND**	**0.75**	**21.2**	**0.3**	**0.09**	**215**	**ND**	**0.3**	**15**	**6**	**0.012**	**9**	**39**	**0.008**	**0.5**	**4.3**	**ND**	**3.6**	**ND**
	0.35	**ND**	**1.06**	**38.3**	**0.52**	**0.26**	**539**	**2**	**0.3**	**33**	**21**	**0.037**	**13**	**84**	**0.028**	**0.9**	**12.3**	**ND**	**7.3**	**ND**
	0.45	**ND**	**1.35**	**45.7**	**0.48**	**0.40**	**606**	**1**	**0.3**	**34**	**29**	**0.050**	**20**	**114**	**0.053**	**1**	**15.1**	**ND**	**8**	**ND**
	0.55	**ND**	**1.33**	**39.8**	**0.45**	**0.35**	**664**	**2**	**0.4**	**34**	**25**	**0.050**	**12**	**111**	**0.043**	**1.1**	**12.7**	**ND**	**7.8**	**ND**
	0.65	**ND**	**1.29**	**40.1**	**0.49**	**0.30**	**590**	**2**	**0.4**	**35**	**24**	**0.045**	**13**	**76**	**0.028**	**1**	**12.2**	**ND**	**7.2**	**ND**
	0.75	**ND**	**1.40**	**40.2**	**0.46**	**0.35**	**637**	**2**	**0.4**	**39**	**24**	**0.045**	**13**	**87**	**0.048**	**0.9**	**11.6**	**ND**	**7.3**	**ND**
	0.85	ND	1.08	33.6	0.46	0.18	335	2	0.4	26	16	0.021	9	70	0.035	0.8	7.3	ND	6	ND
	0.95	ND	1.04	31.2	0.4	0.17	312	2	0.4	29	12	0.020	9	65	0.028	0.7	6.9	ND	6	ND
	1.05	ND	1.01	30.8	0.44	0.13	403	1	0.4	30	12	0.016	8	64	0.018	0.6	5.8	ND	5.5	ND
	1.15	ND	1.22	36.4	0.55	0.18	600	ND	0.5	29	15	0.020	8	72	0.017	0.8	7.2	ND	5.7	ND
	1.25	ND	1.40	43.6	0.61	0.26	963	2	0.5	38	19	0.031	14	112	0.014	0.9	10.6	ND	7	ND
	1.35	ND	1.23	36.4	0.59	0.19	255	1	0.4	30	14	0.022	9	80	0.013	0.8	8	ND	5.6	ND
	1.45	ND	1.19	32.2	0.5	0.18	264	ND	0.4	26	14	0.021	8	86	0.014	0.7	6.7	3	5.1	ND
	1.55	ND	0.72	21.3	0.32	0.09	154	ND	0.2	20	7	0.007	6	37	0.015	0.5	3.6	ND	3.3	ND
	1.65	ND	0.65	19.3	0.26	0.09	178	ND	0.2	17	14	0.008	7	49	0.063	0.4	3.3	ND	3.1	ND
	1.75	ND	0.49	15.6	0.2	0.06	77	1	0.2	11	4	0.005	5	31	0.009	0.3	2.3	ND	2	ND
	1.85	ND	0.27	12.1	0.18	0.04	55	ND	0.1	9	3	0.004	5	25	0.012	0.3	1.8	ND	1.8	ND
	1.95	ND	0.38	11.9	0.15	0.07	93	1	0.1	8	7	0.007	6	18	0.030	0.2	1.7	ND	1.7	ND
	2.05	ND	0.60	17.6	0.25	0.07	72	1	0.2	15	5	0.005	6	29	0.010	0.4	2.8	ND	2.7	ND
	2.15	ND	0.92	26.5	0.38	0.12	99	ND	0.4	17	7	0.007	5	44	0.017	0.7	5	ND	4.1	ND
	2.25	ND	0.86	23.3	0.36	0.11	108	ND	0.3	17	8	0.007	7	30	0.026	0.5	4.1	ND	3	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
27	**0.05**	**59**	**ND**	**0.8**	**8.9**	**0.44**	**4**	**65**	**2**	**21**	**3.1**	**54**
	0.15	**70**	**1.6**	**1**	**10.9**	**0.52**	**3.6**	**78**	**ND**	**25**	**3.8**	**67**
	0.25	**44**	**ND**	**ND**	**5.2**	**0.30**	**2.2**	**22**	**ND**	**11**	**2**	**25**
	0.35	**60**	**ND**	**1**	**10.1**	**0.47**	**3.6**	**77**	**ND**	**23**	**3.4**	**61**
	0.45	**79**	**ND**	**1.1**	**11.1**	**0.56**	**3.4**	**116**	**ND**	**31**	**3.1**	**88**
	0.55	**74**	**ND**	**0.9**	**10.6**	**0.54**	**3.8**	**101**	**ND**	**28**	**3.1**	**80**
	0.65	**67**	**1.1**	**0.7**	**10.9**	**0.51**	**3.8**	**88**	**ND**	**23**	**3.2**	**71**
	0.75	**87**	**1.9**	**0.9**	**10.7**	**0.58**	**4.4**	**95**	**ND**	**33**	**3**	**74**
	0.85	60	1.6	0.8	8	0.44	3	52	ND	23	3	43
	0.95	58	1	0.7	7.5	0.41	2.8	47	ND	19	2.6	38
	1.05	58	1.2	0.7	7.1	0.39	3.3	39	1	18	2.9	32
	1.15	66	0.7	ND	8.4	0.45	3	53	ND	22	3.7	41
	1.25	70	1.2	0.9	11.5	0.58	4.5	77	ND	26	4.2	59
	1.35	61	1.6	0.9	8.9	0.40	3.6	50	ND	20	3.9	44
	1.45	60	0.8	0.7	8.1	0.48	3.4	55	ND	20	3.4	42
	1.55	41	0.6	0.5	5.3	0.28	2	28	ND	12	2.2	22
	1.65	41	0.8	ND	4.4	0.26	1.9	33	ND	17	1.8	26
	1.75	32	ND	ND	3.4	0.17	1.4	17	ND	7	1.3	15
	1.85	18	ND	ND	3.1	0.10	1.2	14	ND	7	1.2	12
	1.95	24	ND	ND	2.5	0.16	1.1	23	ND	12	1	20
	2.05	35	0.5	ND	4.4	0.22	1.7	21	ND	9	1.8	19
	2.15	51	1	0.6	6.9	0.24	2.5	27	ND	13	2.6	32
	2.25	51	0.7	0.5	5.7	0.26	2.5	28	ND	14	2.3	29

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																	
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
31	0.05	ND	7.78	12.2	11	560	2	ND	3.6	0.28	0.4	91	15	80	6	20	1.7	3.6	9	63
	0.15	ND	5.60	11.2	11	660	2	ND	2.9	0.23	ND	87	13	73	5	16	1.5	3.4	9	52
	0.25	ND	10.59	15.4	15	730	2	ND	3.2	0.32	ND	93	16	88	7	19	1.7	4	8	61
	0.35	ND	11.46	13.9	15	620	2	ND	3.5	0.53	ND	92	15	75	7	18	1.6	3.7	8	62
	0.45	ND	7.82	13.7	15	600	3	ND	3.1	0.30	ND	85	16	78	6	21	1.5	3.8	8	60
	0.55	ND	7.12	12.6	15	650	3	ND	3.6	0.29	ND	87	14	77	7	22	1.6	3.9	8	59
	0.65	ND	10.98	15.5	30	750	3	ND	4.1	0.38	ND	96	16	87	7	22	1.7	4.3	7	62
	0.75	ND	10.19	14.8	12	710	3	ND	4	0.30	ND	88	18	76	8	25	1.7	4.7	7	64
	0.85	ND	5.99	12.8	7	670	2	ND	3.5	0.24	ND	85	14	75	5	20	1.6	4	9	55
	0.95	ND	6.86	12.5	12	580	2	ND	3	0.24	ND	76	12	76	5	21	1.6	3.8	9	55
	1.05	ND	8.50	15	17	640	2	ND	3.6	0.26	ND	85	14	73	6	21	1.6	4.4	8	60
	1.15	ND	8.79	12.5	16	610	2	ND	3.4	0.26	ND	85	14	77	6	20	1.5	4.5	7	62
	1.25	ND	5.65	11.4	ND	590	2	ND	3	0.19	ND	80	13	69	5	18	1.5	3.6	8	53
	1.35	ND	2.31	3.7	9	440	ND	ND	ND	0.10	ND	52	6	41	2	7	0.8	1.2	11	32
	1.45	ND	2.69	4	14	490	1	ND	ND	0.11	ND	61	7	43	2	10	1.1	1.2	13	30
	1.55	ND	1.45	2	5	330	ND	ND	ND	0.07	ND	37	4	25	1	6	0.6	0.6	9	18
	1.67	ND	1.28	2	ND	280	ND	ND	ND	0.06	ND	34	4	23	1	6	0.6	0.6	6	37

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
31	**0.05**	**ND**	**1.35**	**47.3**	**0.58**	**0.38**	**1023**	**ND**	**0.4**	**45**	**27**	**0.051**	**15**	**115**	**0.026**	**0.9**	**14.1**	**ND**	**8.9**	**ND**
	0.15	**ND**	**1.31**	**41.7**	**0.55**	**0.31**	**684**	**2**	**0.4**	**35**	**22**	**0.047**	**17**	**104**	**0.018**	**1**	**12.3**	**ND**	**7.9**	**ND**
	0.25	**ND**	**1.35**	**45.8**	**0.55**	**0.43**	**1266**	**2**	**0.4**	**46**	**29**	**0.060**	**18**	**74**	**0.027**	**0.8**	**14.6**	**ND**	**8.6**	**ND**
	0.35	**ND**	**1.38**	**45**	**0.56**	**0.43**	**1309**	**3**	**0.4**	**35**	**25**	**0.054**	**18**	**125**	**0.028**	**1**	**13.8**	**ND**	**8.4**	**ND**
	0.45	**ND**	**1.45**	**44.4**	**0.54**	**0.42**	**1098**	**2**	**0.4**	**40**	**29**	**0.063**	**15**	**104**	**0.028**	**1**	**13.5**	**ND**	**8.5**	**ND**
	0.55	**ND**	**1.52**	**45.6**	**0.56**	**0.41**	**907**	**2**	**0.4**	**44**	**30**	**0.061**	**19**	**115**	**0.024**	**0.9**	**13.3**	**ND**	**8.3**	**ND**
	0.65	**ND**	**1.52**	**46.4**	**0.45**	**0.51**	**866**	**2**	**0.3**	**41**	**30**	**0.066**	**22**	**113**	**0.053**	**1**	**15.2**	**ND**	**8.1**	**ND**
	0.75	**ND**	**1.39**	**46.4**	**0.5**	**0.46**	**1261**	**3**	**0.3**	**42**	**31**	**0.062**	**16**	**109**	**0.044**	**1.1**	**15.4**	**ND**	**7.9**	**ND**
	0.85	**ND**	**1.43**	**42.3**	**0.49**	**0.35**	**849**	**3**	**0.4**	**38**	**26**	**0.055**	**17**	**100**	**0.031**	**1**	**12.8**	**ND**	**7.2**	**ND**
	0.95	**ND**	**1.39**	**40.2**	**0.49**	**0.35**	**652**	**3**	**0.4**	**36**	**28**	**0.057**	**16**	**81**	**0.038**	**1**	**12.2**	**ND**	**6.8**	**ND**
	1.05	**ND**	**1.38**	**42.3**	**0.51**	**0.39**	**710**	**3**	**0.4**	**33**	**29**	**0.062**	**22**	**114**	**0.065**	**1**	**14**	**ND**	**7.2**	**ND**
	1.15	**ND**	**1.38**	**42.1**	**0.46**	**0.40**	**690**	**2**	**0.3**	**39**	**29**	**0.058**	**20**	**109**	**0.044**	**1.1**	**14.4**	**ND**	**7.4**	**ND**
	1.25	**ND**	**1.29**	**39**	**0.43**	**0.32**	**448**	**2**	**0.3**	**35**	**25**	**0.046**	**13**	**88**	**0.031**	**0.9**	**12.8**	**ND**	**6.7**	**ND**
	1.35	ND	0.88	25.4	0.35	0.13	160	ND	0.3	24	10	0.014	8	56	0.011	0.4	5.4	ND	4.3	ND
	1.45	ND	0.97	30.3	0.4	0.13	182	ND	0.3	29	11	0.014	9	64	0.011	0.6	5.7	ND	5.1	ND
	1.55	ND	0.63	18.6	0.26	0.07	106	ND	0.2	14	5	0.007	7	31	0.007	0.4	3.3	ND	3.1	ND
	1.67	ND	0.53	16.1	0.21	0.07	87	ND	0.2	14	5	0.008	6	21	0.010	0.3	3	ND	2.8	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
31	**0.05**	**95**	**1.2**	**1.2**	**11.9**	**0.61**	**4.3**	**100**	**3**	**31**	**3.9**	**85**
	0.15	**80**	**1**	**1.1**	**10.8**	**0.57**	**4.1**	**85**	**ND**	**25**	**3.7**	**71**
	0.25	**122**	**1.2**	**1.3**	**12**	**0.64**	**4.2**	**108**	**ND**	**37**	**3.7**	**90**
	0.35	**141**	**1.2**	**1**	**11.3**	**0.57**	**3.9**	**101**	**3**	**39**	**3.8**	**83**
	0.45	**91**	**1.1**	**1.1**	**11.5**	**0.62**	**4.2**	**114**	**ND**	**32**	**3.6**	**93**
	0.55	**87**	**1**	**0.8**	**11.8**	**0.63**	**4.7**	**114**	**ND**	**33**	**3.8**	**91**
	0.65	**122**	**1.2**	**1**	**12.7**	**0.64**	**4.3**	**124**	**ND**	**48**	**3.5**	**99**
	0.75	**102**	**1.5**	**1.1**	**12.1**	**0.59**	**5**	**124**	**ND**	**36**	**3.3**	**99**
	0.85	**78**	**1.1**	**0.8**	**10.8**	**0.57**	**4**	**97**	**ND**	**31**	**3.3**	**81**
	0.95	**82**	**1.6**	**1**	**10.8**	**0.57**	**4.1**	**99**	**ND**	**31**	**3.3**	**82**
	1.05	**92**	**ND**	**0.9**	**11.3**	**0.57**	**4.7**	**107**	**ND**	**34**	**3.3**	**89**
	1.15	**91**	**0.9**	**0.7**	**11.5**	**0.60**	**3.6**	**108**	**ND**	**35**	**3.1**	**86**
	1.25	**67**	**ND**	**0.8**	**10.7**	**0.54**	**3.4**	**93**	**ND**	**26**	**2.9**	**75**
	1.35	45	ND	0.6	6.8	0.24	2.6	27	ND	16	2.4	31
	1.45	50	ND	0.8	7.5	0.24	2.5	25	ND	17	2.6	33
	1.55	35	0.8	ND	4.7	0.25	2.2	17	ND	11	1.8	20
	1.67	29	ND	ND	3.9	0.27	1.5	21	ND	10	1.4	20

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
34	**0.05**	**ND**	**5.46**	**8.1**	**6**	**600**	**ND**	**ND**	**2.9**	**0.27**	**ND**	**99**	**13**	**79**	**5**	**19**	**1.6**	**3.2**	**9**	**67**
	0.15	**ND**	**6.11**	**8.4**	**3**	**680**	**ND**	**ND**	**3.6**	**0.27**	**ND**	**98**	**14**	**87**	**4**	**21**	**1.7**	**3.5**	**8**	**69**
	0.25	**ND**	**5.61**	**11.8**	**8**	**590**	**ND**	**ND**	**3.3**	**0.22**	**ND**	**102**	**17**	**92**	**5**	**22**	**1.8**	**4.3**	**8**	**77**
	0.35	**ND**	**7.24**	**11.5**	**ND**	**550**	**ND**	**2**	**3.3**	**0.21**	**ND**	**104**	**19**	**90**	**6**	**25**	**1.9**	**4.6**	**6**	**81**
	0.45	**ND**	**7.04**	**12.2**	**ND**	**550**	**ND**	**ND**	**4**	**0.19**	**ND**	**108**	**19**	**95**	**7**	**24**	**2**	**4.4**	**7**	**90**
	0.55	**ND**	**5.89**	**7.6**	**ND**	**650**	**ND**	**2**	**2.1**	**0.17**	**ND**	**88**	**11**	**83**	**5**	**19**	**1.7**	**2.7**	**9**	**66**
	0.65	**ND**	**5.65**	**5.6**	**ND**	**700**	**ND**	**ND**	**ND**	**0.15**	**ND**	**85**	**10**	**78**	**4**	**17**	**1.6**	**2.3**	**10**	**57**
	0.75	**ND**	**4.02**	**8.5**	**ND**	**650**	**ND**	**ND**	**1**	**0.13**	**ND**	**79**	**12**	**68**	**3**	**13**	**1.6**	**2**	**11**	**46**
	0.85	ND	4.88	7.3	3	560	ND	ND	ND	0.15	ND	75	11	72	3	12	1.4	1.7	13	39
	0.95	ND	4.50	4.3	ND	630	ND	ND	1.3	0.15	ND	80	9	70	2	11	1.4	1.6	12	32
	1.05	ND	3.78	3	ND	580	ND	ND	3	0.15	ND	70	7	66	3	11	1.4	1.4	13	35
	1.15	ND	3.10	6.2	ND	600	ND	ND	1.9	0.15	ND	73	6	65	2	10	1.4	1.6	12	35
	1.25	ND	3.43	4.1	ND	550	ND	2	2.5	0.15	ND	71	7	68	3	11	1.4	1.7	13	39
	1.35	ND	3.81	6.3	ND	640	ND	ND	2.3	0.15	ND	74	7	70	3	12	1.6	1.9	14	35
	1.45	ND	3.68	4.5	5	540	ND	ND	ND	0.15	ND	71	7	66	2	11	1.4	1.8	13	40
	1.55	ND	4.03	4.7	4	550	ND	ND	1.3	0.15	ND	75	8	64	2	11	1.4	2	13	36
	1.65	ND	3.95	5.3	ND	540	ND	ND	2.9	0.15	ND	85	10	74	2	11	1.5	1.9	14	36
	1.75	ND	4.03	4.6	ND	590	ND	ND	1.5	0.14	ND	84	9	66	3	12	1.4	1.9	13	35
	1.85	ND	2.95	6	ND	620	ND	ND	1.9	0.13	ND	86	10	70	3	13	1.4	2.1	13	36
	1.95	ND	4.71	6.3	ND	620	ND	ND	2.7	0.14	ND	80	10	70	3	13	1.5	2.4	12	35

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
34	**0.05**	**ND**	**1.57**	**45.1**	**0.6**	**0.46**	**918**	**2**	**0.4**	**43**	**25**	**0.041**	**19**	**91**	**0.033**	**0.9**	**11.8**	**ND**	**7.8**	**ND**
	0.15	**ND**	**1.70**	**45.2**	**0.61**	**0.51**	**983**	**ND**	**0.4**	**41**	**29**	**0.048**	**26**	**92**	**0.047**	**1**	**12.2**	**ND**	**7.9**	**ND**
	0.25	**ND**	**1.60**	**50.9**	**0.62**	**0.50**	**963**	**2**	**0.4**	**37**	**30**	**0.049**	**26**	**116**	**0.045**	**1.2**	**14.3**	**ND**	**8.6**	**ND**
	0.35	**ND**	**1.59**	**50.4**	**0.57**	**0.61**	**1135**	**2**	**0.3**	**43**	**35**	**0.062**	**33**	**101**	**0.043**	**1.2**	**15.7**	**ND**	**8.9**	**ND**
	0.45	**ND**	**1.48**	**50.3**	**0.61**	**0.55**	**1078**	**1**	**0.3**	**43**	**34**	**0.054**	**26**	**110**	**0.059**	**1.1**	**15.3**	**ND**	**8.3**	**ND**
	0.55	**ND**	**1.67**	**45.4**	**0.62**	**0.43**	**758**	**1**	**0.5**	**36**	**24**	**0.034**	**22**	**78**	**0.028**	**1**	**12.8**	**ND**	**7.5**	**ND**
	0.65	**ND**	**1.67**	**41.7**	**0.56**	**0.38**	**635**	**ND**	**0.5**	**33**	**23**	**0.031**	**16**	**101**	**0.018**	**0.8**	**11**	**ND**	**6.7**	**ND**
	0.75	**ND**	**1.51**	**40.8**	**0.54**	**0.31**	**465**	**ND**	**0.5**	**30**	**19**	**0.026**	**18**	**89**	**0.017**	**0.8**	**10.1**	**ND**	**6.5**	**ND**
	0.85	ND	1.49	39.5	0.55	0.28	435	2	0.5	25	15	0.022	16	64	0.021	0.8	9.1	ND	6.2	ND
	0.95	ND	1.51	36.6	0.59	0.27	404	ND	0.6	28	12	0.019	15	65	0.016	0.9	8.9	ND	5.9	ND
	1.05	ND	1.49	37	0.63	0.24	350	ND	0.5	36	11	0.018	16	70	0.011	0.8	8.4	ND	6	ND
	1.15	ND	1.51	37	0.58	0.25	517	ND	0.5	32	12	0.016	16	61	0.008	0.8	8.4	ND	5.8	ND
	1.25	ND	1.53	38.3	0.6	0.26	680	ND	0.6	35	13	0.018	16	66	0.008	0.9	8.4	ND	6.1	ND
	1.35	ND	1.56	38.3	0.7	0.26	563	ND	0.6	37	11	0.020	18	90	0.010	0.9	8.9	ND	6.3	ND
	1.45	ND	1.52	36.2	0.61	0.26	599	ND	0.5	30	11	0.019	13	64	0.008	0.9	8.1	ND	5.9	ND
	1.55	ND	1.47	37.2	0.61	0.26	1033	ND	0.5	30	11	0.019	17	59	0.008	0.8	8.5	ND	5.9	ND
	1.65	ND	1.52	38.5	0.62	0.27	626	ND	0.6	34	12	0.020	13	63	0.010	0.9	9.2	ND	6.3	ND
	1.75	ND	1.45	37.8	0.64	0.26	801	ND	0.5	31	11	0.021	14	76	0.008	0.6	8.3	ND	5.9	ND
	1.85	ND	1.39	39.5	0.65	0.23	653	ND	0.5	32	11	0.019	12	72	0.007	0.9	8.7	ND	6	ND
	1.95	ND	1.45	39	0.63	0.29	882	1	0.5	33	13	0.024	14	78	0.008	0.9	9.4	ND	6.1	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
34	**0.05**	**103**	**0.9**	**0.8**	**11.9**	**0.49**	**3.9**	**98**	**ND**	**24**	**4**	**77**
	0.15	**110**	**1.4**	**0.8**	**12.7**	**0.53**	**3.8**	**111**	**ND**	**27**	**3.9**	**87**
	0.25	**95**	**1**	**0.8**	**13**	**0.53**	**4.8**	**116**	**2**	**26**	**4.3**	**92**
	0.35	**94**	**1.1**	**ND**	**13.1**	**0.52**	**3.8**	**141**	**ND**	**21**	**3.8**	**109**
	0.45	**87**	**ND**	**0.9**	**12.7**	**0.49**	**4.5**	**129**	**ND**	**18**	**3.8**	**102**
	0.55	**96**	**ND**	**1**	**11.5**	**0.53**	**4.9**	**96**	**ND**	**24**	**3.9**	**75**
	0.65	**95**	**ND**	**1**	**11.1**	**0.55**	**3.9**	**91**	**ND**	**23**	**3.8**	**66**
	0.75	**82**	**ND**	**0.7**	**10.4**	**0.50**	**3.7**	**74**	**2**	**20**	**3.5**	**55**
	0.85	92	1.5	0.9	9.7	0.47	3.1	64	ND	19	3.7	48
	0.95	93	ND	0.6	9.9	0.53	4	66	3	19	3.9	44
	1.05	87	ND	0.9	10.3	0.47	3.6	55	ND	18	4.2	40
	1.15	85	ND	0.8	9.9	0.32	2.5	43	ND	18	3.8	40
	1.25	86	ND	ND	9.9	0.46	3.9	58	ND	18	4	42
	1.35	88	ND	0.9	10.7	0.52	4.7	63	ND	19	4.6	47
	1.45	86	1.2	0.5	9.9	0.52	4.2	62	ND	18	4.1	46
	1.55	86	1.2	0.7	10.8	0.48	4.3	62	2	17	4.2	44
	1.65	87	1.1	ND	10.7	0.48	4.1	63	ND	18	4.1	47
	1.75	85	1.1	0.7	10.4	0.47	3.6	61	ND	17	4.2	46
	1.85	77	ND	0.6	11.5	0.39	4.1	56	ND	14	4.3	44
	1.95	87	ND	0.7	10.4	0.50	4.7	72	ND	19	4.1	48

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
35	0.05	ND	4.67	9.4	ND	620	2	ND	2.4	0.23	ND	79	12	73	4	13	1.5	2.6	9	54
	0.15	ND	3.94	8.3	ND	680	2	ND	1.5	0.19	ND	74	10	72	3	11	1.3	2.4	9	48
	0.25	ND	4.35	9.1	ND	580	2	ND	2.2	0.19	0.4	81	11	73	3	15	1.5	2.6	9	53
	0.35	ND	4.13	8.7	3	620	2	ND	2.4	0.18	ND	78	11	75	4	12	1.6	2.5	10	55
	0.45	ND	4.29	10.1	ND	530	2	ND	2.1	0.16	0.5	79	14	65	4	14	1.4	2.6	9	65
	0.55	ND	4.41	9.8	ND	600	2	ND	2.4	0.14	ND	79	16	75	4	14	1.5	2.8	9	64
	0.65	ND	3.86	8.7	ND	510	2	ND	1.6	0.12	0.4	67	12	65	3	12	1.4	2.4	10	48
	0.75	ND	4.24	8.7	ND	480	2	ND	1.8	0.11	ND	77	12	70	4	12	1.4	2.5	11	50
	0.85	ND	5.26	8.8	3	550	2	ND	1.9	0.11	ND	68	13	65	4	17	1.3	2.4	10	55
	0.95	ND	4.33	6.4	7	540	1	ND	1.4	0.08	ND	64	8	63	4	11	1	2.1	13	42
	1.05	ND	4.13	6.9	ND	600	1	ND	2.1	0.07	ND	69	8	65	4	11	1.1	2.3	14	49
	1.15	ND	4.24	7.3	ND	530	1	ND	2.5	0.07	ND	72	7	70	3	12	1.1	2.4	14	50

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
35	0.05	ND	1.34	39.5	0.59	0.27	654	2	0.4	35	20	0.039	14	95	0.016	1.1	9.6	ND	5.8	ND
	0.15	ND	1.23	35.7	0.56	0.22	539	ND	0.5	37	17	0.034	9	82	0.017	1	8.7	ND	5.2	ND
	0.25	ND	1.35	39.8	0.58	0.25	598	ND	0.5	30	19	0.038	13	81	0.018	0.9	9.6	ND	5.6	ND
	0.35	ND	1.30	39.5	0.62	0.24	516	ND	0.4	39	18	0.037	17	82	0.031	1.1	9.1	ND	5.7	ND
	0.45	ND	1.23	38.6	0.58	0.25	589	ND	0.4	38	22	0.043	13	84	0.036	0.9	8.9	ND	5.6	ND
	0.55	ND	1.16	39.2	0.57	0.25	548	3	0.3	36	22	0.039	16	72	0.035	1.1	9.7	ND	5.8	ND
	0.65	ND	1.10	33.9	0.56	0.22	459	2	0.3	30	19	0.039	15	59	0.039	0.9	8.2	ND	4.9	ND
	0.75	ND	1.17	36.5	0.59	0.23	364	2	0.3	34	20	0.034	14	87	0.043	1	9	ND	5.2	ND
	0.85	ND	1.22	34	0.45	0.28	356	2	0.3	31	22	0.033	14	75	0.027	0.8	9.8	ND	6.9	ND
	0.95	ND	1.21	30.4	0.5	0.23	211	ND	0.3	27	16	0.025	9	75	0.009	0.9	9.3	ND	5.7	ND
	1.05	ND	1.27	32.7	0.53	0.24	192	1	0.3	28	16	0.024	11	70	0.004	0.7	9.8	ND	6.2	ND
	1.15	ND	1.29	32.3	0.54	0.25	189	2	0.3	30	15	0.023	11	69	0.006	0.9	9.7	ND	5.6	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
35	0.05	77	1	1	9.6	0.54	3.9	75	ND	26	3.8	61
	0.15	69	1.2	0.9	8.8	0.49	3.9	64	ND	23	3.7	51
	0.25	73	1.4	0.9	10	0.53	3.8	74	ND	26	3.9	60
	0.35	70	1.4	0.9	9.4	0.53	4.1	72	ND	27	4.2	59
	0.45	66	0.7	0.9	9.4	0.50	3.5	77	ND	28	3.7	69
	0.55	61	ND	0.9	9.4	0.51	3.9	82	ND	26	3.8	70
	0.65	56	1.2	0.9	8.6	0.48	2.9	73	ND	25	3.4	61
	0.75	57	1.4	0.9	9.7	0.50	3.9	77	ND	24	3.7	61
	0.85	60	ND	0.8	9.3	0.53	3.5	88	2	26	3	69
	0.95	53	0.6	0.7	9.9	0.48	4	67	2	19	3.2	54
	1.05	52	1.4	0.7	10	0.43	4.5	63	ND	19	3.5	53
	1.15	54	1.1	0.6	9.9	0.53	4.8	73	ND	20	3.5	51

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
36	**0.05**	**ND**	**5.05**	**9.9**	**3**	**680**	**ND**	**3**	**2.1**	**0.24**	**ND**	**95**	**13**	**84**	**5**	**20**	**1.8**	**3.5**	**9**	**39**
	0.15	**ND**	**5.25**	**8.3**	**8**	**650**	**ND**	**ND**	**2.1**	**0.24**	**ND**	**98**	**12**	**79**	**4**	**19**	**1.5**	**3.4**	**8**	**58**
	0.25	**ND**	**4.96**	**10.9**	**6**	**720**	**ND**	**3**	**2.6**	**0.22**	**ND**	**108**	**15**	**83**	**5**	**19**	**1.8**	**4**	**8**	**67**
	0.35	**ND**	**7.71**	**11.2**	**ND**	**660**	**ND**	**ND**	**3.7**	**0.29**	**ND**	**109**	**17**	**84**	**6**	**24**	**1.6**	**4.4**	**6**	**72**
	0.45	**ND**	**6.04**	**12.4**	**4**	**790**	**ND**	**ND**	**3.3**	**0.23**	**ND**	**110**	**19**	**91**	**7**	**26**	**1.6**	**4.9**	**6**	**71**
	0.55	**ND**	**5.99**	**12.4**	**ND**	**750**	**ND**	**ND**	**3.4**	**0.19**	**ND**	**111**	**18**	**94**	**6**	**25**	**2**	**4.6**	**6**	**72**
	0.65	**ND**	**6.57**	**13.8**	**8**	**690**	**ND**	**5**	**4.1**	**0.19**	**ND**	**105**	**21**	**106**	**8**	**28**	**2**	**5.6**	**5**	**85**
	0.75	**ND**	**6.89**	**12.8**	**6**	**660**	**ND**	**2**	**4.2**	**0.18**	**ND**	**115**	**21**	**101**	**8**	**28**	**1.9**	**5.6**	**5**	**82**
	0.85	**ND**	**5.97**	**11.4**	**4**	**620**	**ND**	**ND**	**3.7**	**0.19**	**ND**	**109**	**17**	**86**	**5**	**22**	**1.9**	**3.9**	**8**	**68**
	0.95	**ND**	**5.74**	**11.1**	**ND**	**620**	**ND**	**3**	**3.3**	**0.17**	**ND**	**105**	**16**	**83**	**5**	**23**	**1.8**	**3.5**	**7**	**65**
	1.05	**ND**	**6.01**	**9.6**	**ND**	**730**	**ND**	**ND**	**2.7**	**0.14**	**ND**	**114**	**9**	**90**	**6**	**22**	**1.6**	**3.5**	**7**	**62**
	1.15	**ND**	**5.04**	**9.6**	**ND**	**580**	**ND**	**ND**	**ND**	**0.15**	**ND**	**85**	**8**	**64**	**4**	**17**	**1.4**	**2.2**	**8**	**52**
	1.25	ND	3.28	4.2	6	530	ND	ND	1.4	0.15	ND	71	4	65	3	9	1.3	1.4	12	26
	1.35	ND	3.29	3.5	ND	550	ND	ND	ND	0.14	ND	68	5	60	2	10	1.2	1.4	11	28
	1.45	ND	2.96	3.4	8	510	ND	ND	1.2	0.13	ND	68	4	60	2	9	1.2	1.4	12	31
	1.55	ND	3.10	3.7	ND	540	ND	ND	1.1	0.13	ND	66	4	59	2	10	1.1	1.3	12	22
	1.65	ND	3.01	4.1	6	500	ND	ND	ND	0.13	ND	70	5	61	3	11	1.1	1.6	12	28
37	0.05	ND	8.47	14	ND	620	3	ND	3	0.26	0.6	97	18	94	6	47	1.8	4.6	7	76
	0.15	ND	9.93	13.7	ND	690	3	ND	3.1	0.23	0.5	108	22	101	7	25	2.2	4.3	6	87
	0.25	ND	7.27	11.1	5	780	3	2	ND	0.14	ND	103	14	85	6	20	2	3.4	6	67
	0.35	ND	7.34	10.1	3	660	3	ND	2.1	0.14	ND	102	17	81	6	18	1.9	3.3	7	63
	0.45	ND	6.30	11.1	2	660	3	ND	2.8	0.11	ND	108	19	79	6	17	2.2	3.3	7	66
	0.55	ND	5.43	8.6	4	650	3	ND	2.9	0.10	ND	98	16	83	4	16	1.9	2.9	8	59
	0.65	ND	5.56	8	ND	660	3	ND	2.3	0.09	ND	102	19	87	5	18	1.9	3.1	8	69
	0.75	ND	5.60	9.7	3	690	2	ND	2.7	0.09	0.5	96	19	82	5	16	1.8	2.9	8	63
	0.85	ND	5.56	10.6	ND	650	2	ND	2.8	0.09	ND	84	17	73	4	13	1.7	2.4	11	48
	0.94	ND	6.10	11.5	2	580	2	ND	2.5	0.08	ND	91	15	86	5	19	1.6	3	8	58

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
36	**0.05**	**ND**	**1.57**	**46.4**	**0.62**	**0.42**	**826**	**2**	**0.5**	**40**	**24**	**0.045**	**23**	**93**	**0.028**	**0.9**	**12.5**	**4**	**8.6**	**ND**
	0.15	**ND**	**1.55**	**46.6**	**0.6**	**0.42**	**742**	**1**	**0.4**	**41**	**23**	**0.041**	**20**	**116**	**0.030**	**1.1**	**12**	**ND**	**7.9**	**ND**
	0.25	**ND**	**1.49**	**47.7**	**0.61**	**0.43**	**893**	**2**	**0.4**	**41**	**27**	**0.047**	**25**	**92**	**0.062**	**1**	**13.4**	**ND**	**8.6**	**ND**
	0.35	**ND**	**1.61**	**49.6**	**0.58**	**0.58**	**1238**	**2**	**0.3**	**42**	**31**	**0.055**	**30**	**123**	**0.056**	**1**	**14**	**ND**	**8.6**	**ND**
	0.45	**ND**	**1.54**	**49.1**	**0.62**	**0.51**	**1326**	**1**	**0.4**	**40**	**32**	**0.058**	**25**	**105**	**0.067**	**1.2**	**15.3**	**ND**	**9**	**ND**
	0.55	**ND**	**1.50**	**48.7**	**0.58**	**0.52**	**1205**	**1**	**0.3**	**39**	**33**	**0.052**	**33**	**104**	**0.056**	**0.9**	**15.3**	**ND**	**8.8**	**ND**
	0.65	**ND**	**1.42**	**50.7**	**0.54**	**0.55**	**1385**	**ND**	**0.2**	**44**	**39**	**0.068**	**34**	**114**	**0.074**	**1.4**	**17.4**	**ND**	**9.1**	**ND**
	0.75	**ND**	**1.41**	**53.1**	**0.61**	**0.56**	**1265**	**1**	**0.2**	**41**	**40**	**0.061**	**37**	**117**	**0.052**	**1.3**	**17.9**	**ND**	**9.5**	**ND**
	0.85	**ND**	**1.56**	**47.6**	**0.63**	**0.44**	**814**	**2**	**0.4**	**47**	**29**	**0.049**	**29**	**104**	**0.048**	**1**	**13.9**	**ND**	**8.7**	**ND**
	0.95	**ND**	**1.57**	**46.9**	**0.6**	**0.44**	**609**	**1**	**0.4**	**35**	**28**	**0.046**	**26**	**86**	**0.054**	**1**	**13**	**ND**	**8.1**	**ND**
	1.05	**ND**	**1.70**	**49.2**	**0.59**	**0.47**	**492**	**ND**	**0.4**	**40**	**27**	**0.040**	**23**	**110**	**0.022**	**1**	**14.6**	**ND**	**8.5**	**ND**
	1.15	**ND**	**1.62**	**39.5**	**0.55**	**0.37**	**390**	**2**	**0.4**	**32**	**20**	**0.031**	**17**	**78**	**0.019**	**0.9**	**9.7**	**ND**	**6.5**	**ND**
	1.25	ND	1.50	35.2	0.58	0.25	180	1	0.5	27	12	0.018	15	74	0.013	0.9	7.9	ND	5.6	ND
	1.35	ND	1.44	33.7	0.51	0.25	186	ND	0.4	26	12	0.018	13	73	0.010	0.6	7.6	ND	5.4	ND
	1.45	ND	1.35	33.9	0.53	0.23	129	ND	0.4	26	11	0.015	12	70	0.007	0.6	7.6	ND	5.4	ND
	1.55	ND	1.36	32.5	0.51	0.23	142	2	0.4	29	10	0.014	13	63	0.007	0.7	7.1	ND	5.1	ND
	1.65	ND	1.32	35.1	0.51	0.24	147	ND	0.4	26	12	0.014	11	61	0.008	0.7	7.7	ND	5.4	ND
37	0.05	ND	1.69	50.7	0.64	0.46	1108	3	0.4	39	38	0.060	23	119	0.036	1.4	14.8	ND	7.1	ND
	0.15	ND	1.73	55.8	0.69	0.54	1176	3	0.3	38	39	0.062	26	112	0.042	1.5	16.3	ND	8	ND
	0.25	ND	1.63	53.4	0.68	0.38	1160	3	0.4	47	31	0.057	20	110	0.019	1.3	13.5	ND	7.7	ND
	0.35	ND	1.59	51.8	0.65	0.35	2304	ND	0.4	48	29	0.056	17	113	0.022	1.4	13.2	ND	7.3	ND
	0.45	ND	1.42	53.4	0.68	0.31	2334	1	0.4	43	28	0.062	17	103	0.025	1.3	12.7	ND	7.8	ND
	0.55	ND	1.37	47.8	0.66	0.29	2016	2	0.4	40	22	0.065	14	95	0.022	1.2	11.8	ND	7.2	ND
	0.65	ND	1.46	48.2	0.62	0.31	2620	2	0.4	48	24	0.065	16	103	0.024	1.2	13	4	7.3	ND
	0.75	ND	1.41	47.7	0.64	0.30	1734	2	0.4	48	24	0.056	18	101	0.019	1.1	12.7	ND	7.1	ND
	0.85	ND	1.46	42.2	0.6	0.25	905	ND	0.4	31	21	0.044	22	83	0.030	1	11.8	ND	7.5	ND
	0.94	ND	1.35	44.4	0.6	0.32	1354	1	0.4	43	24	0.057	15	102	0.022	1.2	13.1	ND	6.3	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
36	**0.05**	**105**	**ND**	**0.9**	**12.7**	**0.49**	**4.1**	**97**	**ND**	**19**	**4.2**	**78**
	0.15	**106**	**ND**	**0.9**	**11.2**	**0.46**	**4.1**	**91**	**2**	**20**	**3.9**	**75**
	0.25	**93**	**ND**	**1.1**	**13.4**	**0.42**	**4.4**	**99**	**ND**	**15**	**3.9**	**88**
	0.35	**116**	**1.2**	**0.9**	**12.2**	**0.50**	**4.2**	**120**	**ND**	**26**	**3.8**	**98**
	0.45	**99**	**0.9**	**0.9**	**13.6**	**0.48**	**5**	**122**	**ND**	**19**	**4.1**	**98**
	0.55	**84**	**1.5**	**0.9**	**12.9**	**0.43**	**3.7**	**128**	**ND**	**11**	**3.9**	**102**
	0.65	**81**	**1.8**	**0.8**	**13.5**	**0.50**	**4.4**	**156**	**ND**	**12**	**3.6**	**120**
	0.75	**82**	**1**	**1**	**14.2**	**0.49**	**4.9**	**162**	**ND**	**13**	**4**	**121**
	0.85	**99**	**0.9**	**1**	**12.2**	**0.49**	**5.4**	**112**	**ND**	**21**	**4.2**	**91**
	0.95	**92**	**ND**	**0.9**	**12.1**	**0.47**	**4.9**	**105**	**ND**	**18**	**4.1**	**87**
	1.05	**88**	**ND**	**ND**	**12.7**	**0.44**	**4.7**	**108**	**ND**	**16**	**3.9**	**80**
	1.15	**90**	**1.1**	**0.7**	**9.9**	**0.49**	**3.5**	**85**	**ND**	**23**	**3.7**	**60**
	1.25	85	1.8	0.6	9.6	0.47	3.6	59	ND	16	3.7	38
	1.35	84	0.7	0.6	8.9	0.48	3.2	61	3	17	3.3	39
	1.45	79	1.1	0.5	8.8	0.46	3.8	54	ND	15	3.3	35
	1.55	81	1	ND	8.6	0.45	3.3	54	ND	16	3.3	36
	1.65	79	1.2	0.6	9.3	0.42	3.9	54	ND	16	3.3	38
37	0.05	91	ND	1.2	12.5	0.68	3.8	132	ND	36	4.2	109
	0.15	88	ND	1.5	12.8	0.66	4.7	144	5	49	4.6	120
	0.25	73	1.5	1.3	12.3	0.67	4.2	120	ND	36	4.4	93
	0.35	75	1.7	1.1	11.1	0.65	4.1	104	ND	42	4.5	86
	0.45	66	1.4	1.3	11.5	0.62	4.5	101	ND	38	4.4	83
	0.55	63	ND	1.2	10.7	0.61	4.3	103	ND	33	4.4	74
	0.65	60	1.2	1.3	11.5	0.62	4.3	113	3	31	4.1	82
	0.75	61	1.4	1.1	12.2	0.62	4.1	107	3	30	4.2	75
	0.85	70	ND	ND	11.7	0.50	4.5	99	ND	19	4	72
	0.94	59	ND	1	11.4	0.64	3.9	112	ND	24	4.1	82

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ag (ppm)	Al (%)	As (ppm)	Au (ppb)	Ba (ppm)	Be (ppm)	Bi (ppm)	Br (ppm)	Ca (%)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Eu (ppm)	Fe (%)	Hf (ppm)	Hg (ppb)
		ICP	ICP	NA	NA	NA	ICP	ICP	NA	ICP	ICP	NA	NA	NA	NA	ICP	NA	NA	NA	AA
43	**0.05**	**ND**	**4.71**	**11.6**	**2**	**580**	**2**	**ND**	**1.3**	**0.27**	**ND**	**74**	**11**	**81**	**4**	**14**	**1.4**	**2.8**	**11**	**45**
	0.15	**ND**	**4.08**	**11.2**	**ND**	**550**	**2**	**ND**	**1.3**	**0.30**	**ND**	**71**	**10**	**72**	**3**	**12**	**1.3**	**2.6**	**10**	**46**
	0.25	**ND**	**4.67**	**13.5**	**3**	**620**	**2**	**ND**	**2.1**	**0.25**	**ND**	**81**	**13**	**82**	**4**	**15**	**1.4**	**3.2**	**11**	**53**
	0.35	**ND**	**3.95**	**11.1**	**12**	**520**	**1**	**ND**	**1.4**	**0.22**	**ND**	**69**	**10**	**73**	**3**	**12**	**1.2**	**2.4**	**11**	**43**
	0.45	**ND**	**5.10**	**12.9**	**3**	**630**	**2**	**ND**	**1.4**	**0.25**	**ND**	**78**	**12**	**89**	**4**	**25**	**1.3**	**3**	**10**	**52**
	0.55	**ND**	**5.26**	**14.9**	**ND**	**680**	**3**	**ND**	**2.6**	**0.22**	**ND**	**80**	**15**	**97**	**5**	**20**	**1.5**	**3.8**	**9**	**67**
	0.65	**ND**	**4.81**	**12.3**	**2**	**540**	**2**	**ND**	**2**	**0.22**	**ND**	**75**	**12**	**84**	**4**	**15**	**1.4**	**2.9**	**11**	**52**
	0.75	ND	4.07	9.3	ND	550	2	ND	1.6	0.19	ND	72	10	67	3	12	1.3	2.5	11	42
	0.85	ND	3.79	8.3	ND	480	1	ND	ND	0.21	ND	71	11	74	3	12	1.3	2.4	13	42
	0.95	0.4	3.55	9.7	4	570	1	ND	1.8	0.20	ND	79	10	78	2	11	1.3	2.1	15	39
	1.05	0.4	3.09	8.9	ND	550	1	ND	1.1	0.21	ND	72	9	77	3	10	1.3	2	14	34
	1.15	0.3	3.54	11.1	ND	560	2	ND	ND	0.26	ND	76	11	75	3	12	1.3	2.8	12	48
	1.25	ND	3.27	7.1	ND	500	1	ND	ND	0.26	ND	66	7	56	2	7	1.3	1.8	13	29
	1.36	ND	3.43	12.8	ND	500	2	ND	1	0.27	ND	77	14	69	3	11	1.3	2.7	11	36
44	**0.05**	**ND**	**8.80**	**16.9**	**4**	**750**	**ND**	**ND**	**4.9**	**0.33**	**ND**	**125**	**21**	**115**	**7**	**27**	**2**	**5.8**	**5**	**85**
	0.15	**ND**	**7.11**	**12.9**	**ND**	**790**	**ND**	**ND**	**3.7**	**0.25**	**ND**	**109**	**20**	**100**	**6**	**27**	**1.8**	**5.5**	**4**	**84**
	0.25	**ND**	**8.90**	**16.9**	**ND**	**830**	**3**	**ND**	**4.3**	**0.33**	**ND**	**120**	**21**	**119**	**7**	**34**	**2**	**6.1**	**4**	**91**
	0.35	**ND**	**9.11**	**14.6**	**4**	**740**	**3**	**ND**	**4.2**	**0.30**	**ND**	**115**	**21**	**119**	**8**	**32**	**1.9**	**5.9**	**4**	**87**
	0.45	**ND**	**9.53**	**16.5**	**ND**	**720**	**3**	**ND**	**4.5**	**0.25**	**ND**	**134**	**24**	**110**	**8**	**35**	**2.2**	**6.3**	**5**	**91**
	0.55	**ND**	**8.40**	**15.3**	**ND**	**650**	**3**	**ND**	**4.7**	**0.18**	**ND**	**121**	**21**	**113**	**7**	**32**	**1.9**	**5.1**	**5**	**88**
	0.65	**ND**	**5.50**	**9.7**	**25**	**620**	**2**	**ND**	**1.5**	**0.14**	**ND**	**97**	**16**	**92**	**6**	**25**	**1.8**	**3.2**	**7**	**67**
	0.75	ND	4.88	8.8	19	570	2	ND	1.6	0.12	ND	85	14	81	4	19	1.6	2.7	7	60
	0.85	ND	4.19	6.6	15	590	2	ND	1.4	0.10	ND	80	9	78	5	16	1.5	2.3	8	50
	0.95	ND	4.65	6	14	560	2	ND	ND	0.10	ND	75	6	80	4	16	1.4	2.3	8	46
	1.05	ND	4.75	5.5	15	470	2	2	ND	0.10	ND	71	7	95	4	16	1.3	2.5	8	48
	1.15	ND	4.62	6.1	15	510	2	ND	1.5	0.10	ND	68	7	85	4	16	1.3	2.3	8	40

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods																		
		Ir (ppb)	K (%)	La (ppm)	Lu (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Nd (ppm)	Ni (ppm)	P (%)	Pb (ppm)	Rb (ppm)	S (%)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn (%)
		NA	ICP	NA	NA	ICP	ICP	ICP	NA	NA	ICP	ICP	ICP	NA	ICP	NA	NA	NA	NA	NA
43	0.05	ND	1.50	36.9	0.61	0.31	885	2	0.6	28	20	0.036	15	77	0.012	1.2	9.5	ND	5.2	ND
	0.15	ND	1.42	33.6	0.59	0.27	799	1	0.6	29	17	0.032	14	88	0.047	1	8.9	ND	4.8	ND
	0.25	ND	1.47	37.4	0.59	0.31	1111	2	0.5	29	22	0.040	12	76	0.021	1.2	10.1	ND	5.4	ND
	0.35	ND	1.42	34	0.61	0.24	789	1	0.6	25	16	0.029	12	58	0.016	1.1	8.4	ND	4.9	ND
	0.45	ND	1.48	38	0.59	0.32	1102	1	0.5	28	23	0.035	15	96	0.020	1.1	10.3	4	5.4	ND
	0.55	ND	1.45	42.2	0.59	0.36	1282	2	0.4	31	30	0.048	22	83	0.021	1.1	12.3	ND	6.1	ND
	0.65	ND	1.42	37.9	0.63	0.31	880	2	0.5	28	22	0.034	17	78	0.014	1.2	9.7	4	5.3	ND
	0.75	ND	1.29	35.1	0.56	0.24	943	1	0.5	28	17	0.029	16	90	0.011	1	8.5	ND	4.8	ND
	0.85	ND	1.32	36.8	0.62	0.22	789	2	0.5	33	16	0.026	16	85	0.014	1	8.4	4	5.2	ND
	0.95	ND	1.28	38.4	0.69	0.20	382	1	0.5	34	15	0.027	29	59	0.025	5.2	8	ND	5.3	ND
	1.05	ND	1.24	36	0.64	0.17	808	1	0.5	31	13	0.027	15	71	0.012	1.1	7.3	ND	5	ND
	1.15	ND	1.27	36.1	0.67	0.20	889	2	0.5	28	14	0.032	15	73	0.012	1.2	8.3	ND	5.1	ND
	1.25	ND	1.60	33.5	0.57	0.18	275	ND	0.7	25	14	0.019	17	61	0.010	0.6	7.8	ND	5.8	ND
	1.36	ND	1.31	33.8	0.61	0.22	663	2	0.6	27	15	0.027	18	70	0.006	1.1	7.9	ND	4.9	ND
44	0.05	ND	1.49	57.4	0.56	0.75	1960	1	0.3	50	34	0.067	28	136	0.052	1.4	19.4	ND	9.2	ND
	0.15	ND	1.47	50.9	0.53	0.71	1866	2	0.2	44	39	0.069	30	126	0.051	1.1	17.5	ND	8.3	ND
	0.25	ND	1.28	55.1	0.6	0.62	1996	4	0.2	45	40	0.081	22	127	0.149	1.3	19	ND	8.6	ND
	0.35	ND	1.30	54.1	0.55	0.64	1651	2	0.2	45	41	0.068	30	108	0.063	1.2	18.9	ND	8.8	ND
	0.45	ND	1.34	61.4	0.63	0.61	1444	3	0.2	51	44	0.075	33	133	0.075	1.2	20.7	ND	9.7	ND
	0.55	ND	1.25	54.1	0.61	0.51	985	3	0.2	40	39	0.065	29	132	0.063	1.1	17.5	ND	8.7	ND
	0.65	ND	1.33	48.9	0.61	0.33	648	2	0.4	41	28	0.045	21	98	0.025	1.4	12.4	ND	7	ND
	0.75	ND	1.24	44.2	0.59	0.28	507	2	0.4	37	22	0.037	19	90	0.017	0.9	11.3	ND	6.2	ND
	0.85	ND	1.08	42	0.5	0.23	240	ND	0.4	34	17	0.030	17	71	0.013	1.1	10.2	ND	5.7	ND
	0.95	ND	1.09	39.5	0.53	0.24	237	1	0.4	26	18	0.031	15	82	0.010	0.9	9.9	ND	5.4	ND
	1.05	ND	1.15	38.3	0.52	0.25	220	ND	0.4	31	27	0.029	16	81	0.010	0.9	10.1	4	5.3	ND
	1.15	ND	1.13	39.4	0.53	0.24	159	1	0.4	33	19	0.024	17	77	0.011	1.1	10.2	ND	5.4	ND

Table 4-3 continued.

Core ID	Depth (m)	Element Concentrations, Units, and Methods										
		Sr (ppm)	Ta (ppm)	Tb (ppm)	Th (ppm)	Ti (%)	U (ppm)	V (ppm)	W (ppm)	Y (ppm)	Yb (ppm)	Zn (ppm)
		ICP	NA	NA	NA	ICP	NA	ICP	NA	ICP	NA	ICP
43	**0.05**	**87**	**1.6**	**0.8**	**10.5**	**0.55**	**4.1**	**79**	**ND**	**25**	**4**	**59**
	0.15	**83**	**0.9**	**0.8**	**9.5**	**0.52**	**3.8**	**70**	**ND**	**22**	**3.8**	**52**
	0.25	**85**	**1.5**	**0.9**	**10.1**	**0.55**	**3.5**	**85**	**ND**	**24**	**3.9**	**65**
	0.35	**82**	**1.1**	**0.9**	**9.3**	**0.53**	**3.5**	**65**	**ND**	**22**	**4.1**	**47**
	0.45	**84**	**1.3**	**1**	**10.4**	**0.57**	**4**	**87**	**ND**	**25**	**3.9**	**68**
	0.55	**76**	**ND**	**1.1**	**11.3**	**0.54**	**3.8**	**107**	**ND**	**24**	**3.9**	**86**
	0.65	**78**	**0.7**	**0.9**	**10.2**	**0.56**	**4.2**	**87**	**ND**	**26**	**4.1**	**66**
	0.75	71	0.8	0.8	9.6	0.51	3.3	69	ND	23	3.6	52
	0.85	75	0.9	ND	10.1	0.48	3.7	58	3	23	4.2	47
	0.95	71	0.8	0.7	10.2	0.56	3.8	61	4	23	4.5	47
	1.05	71	ND	0.9	9.6	0.58	4	58	2	20	4.2	46
	1.15	75	1.4	1	10.1	0.56	3.8	71	ND	22	4.4	48
	1.25	100	1.2	ND	9.6	0.55	3.1	60	ND	17	3.9	47
	1.36	82	0.9	0.8	9.7	0.50	3.7	66	ND	22	4	44
44	**0.05**	**104**	**ND**	**1**	**14.7**	**0.48**	**5.1**	**141**	**ND**	**17**	**3.8**	**114**
	0.15	**84**	**1.4**	**0.9**	**13.6**	**0.41**	**4**	**147**	**ND**	**10**	**3.5**	**117**
	0.25	**86**	**ND**	**1**	**14.2**	**0.56**	**4.4**	**143**	**ND**	**30**	**3.9**	**135**
	0.35	**82**	**ND**	**1.1**	**13.8**	**0.59**	**4.3**	**150**	**ND**	**24**	**3.7**	**137**
	0.45	**76**	**ND**	**1**	**16.4**	**0.62**	**5.1**	**157**	**ND**	**25**	**4.2**	**143**
	0.55	**67**	**1**	**0.8**	**14**	**0.57**	**4.5**	**133**	**ND**	**27**	**4**	**129**
	0.65	**65**	**1.1**	**0.9**	**11.6**	**0.62**	**4.3**	**93**	**4**	**33**	**3.9**	**83**
	0.75	61	ND	1.1	10.7	0.60	3.3	81	ND	30	3.9	68
	0.85	56	1.6	0.9	9.7	0.50	3.6	65	4	25	3.3	56
	0.95	57	1	0.7	9.7	0.54	3.4	73	4	25	3.5	54
	1.05	60	0.9	0.9	9.5	0.42	3.5	61	ND	27	3.4	58
	1.15	59	0.8	0.8	9.6	0.35	4	52	3	26	3.5	55

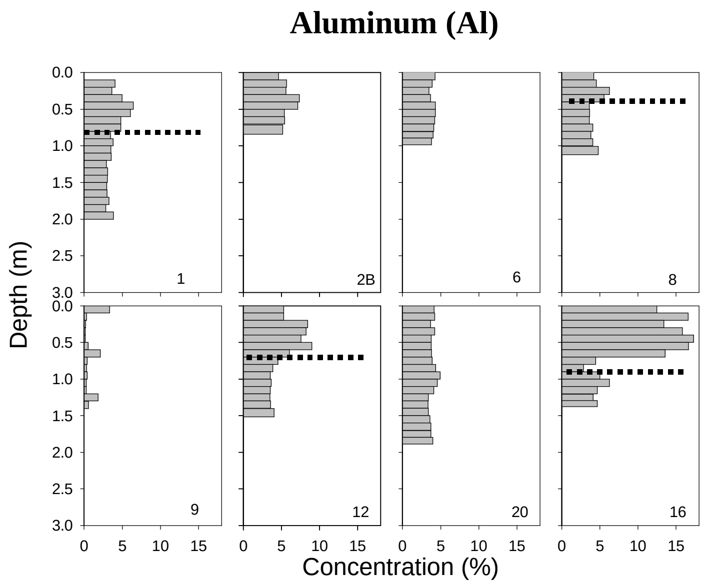


Figure 4-12. Variation in the concentration of aluminum (Al; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

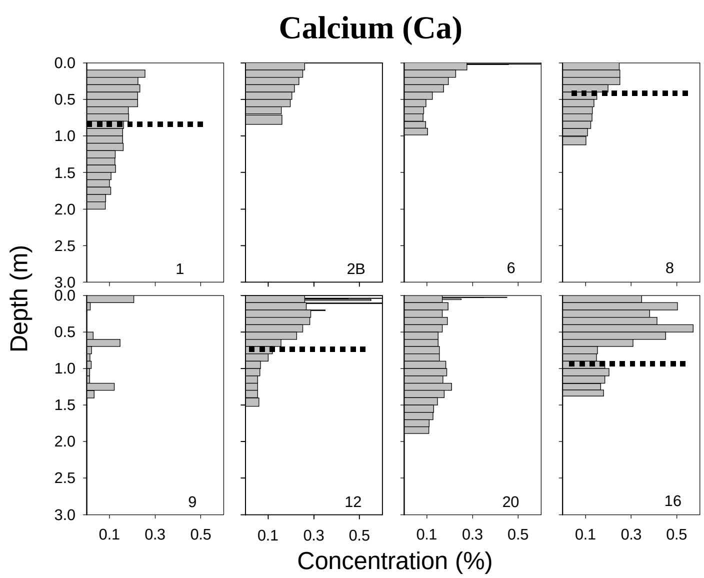


Figure 4-13. Variation in the concentration of calcium (Ca; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

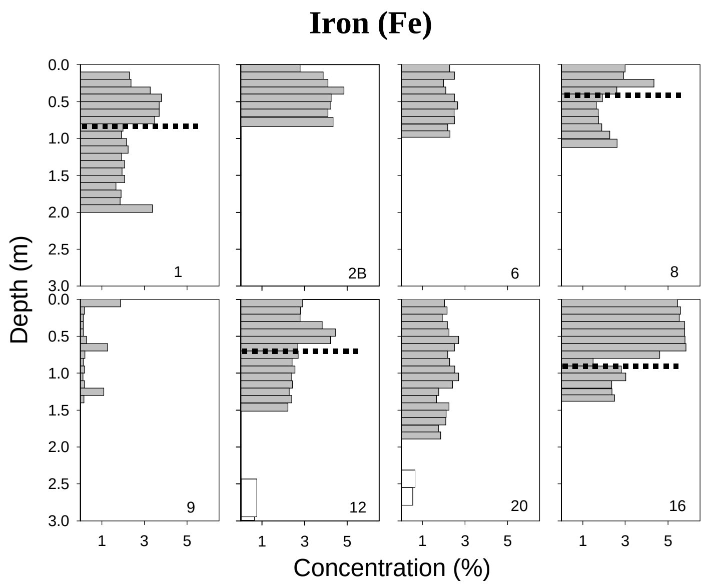


Figure 4-14. Variation in the concentration of iron (Fe; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

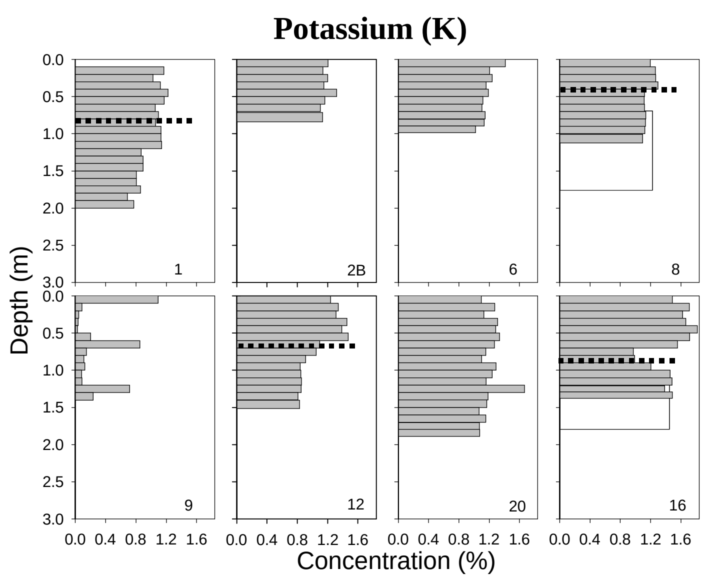


Figure 4-15. Variation in the concentration of potassium (K; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

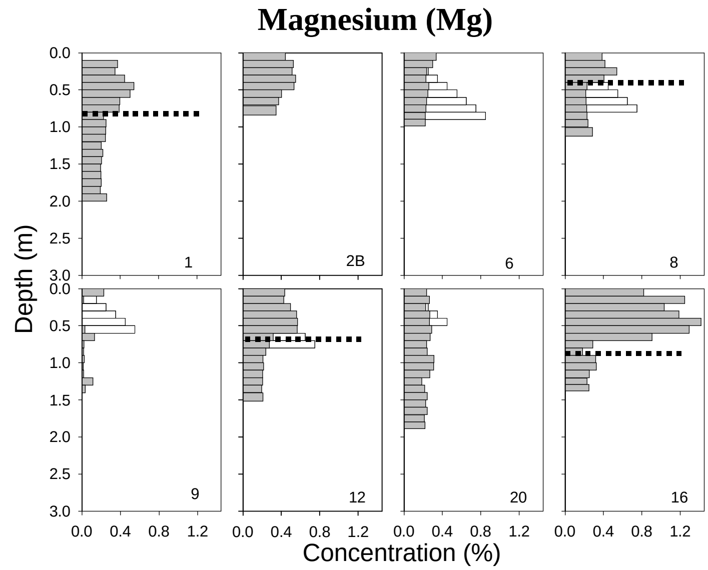


Figure 4-16. Variation in the concentration of magnesium (Mg; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

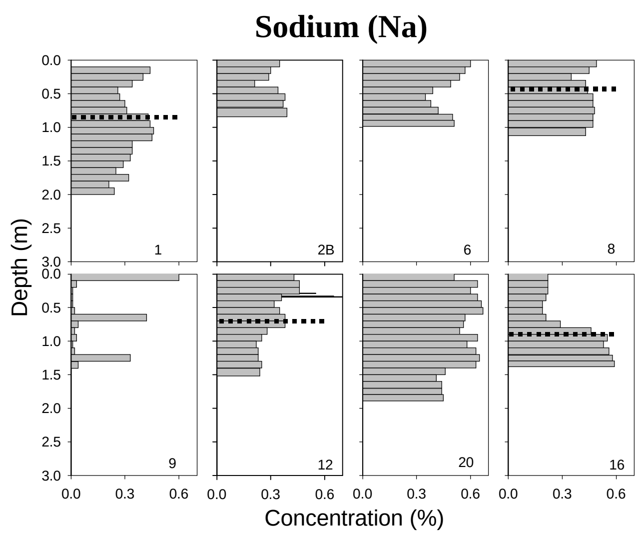


Figure 4-17. Variation in the concentration of sodium (Na; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

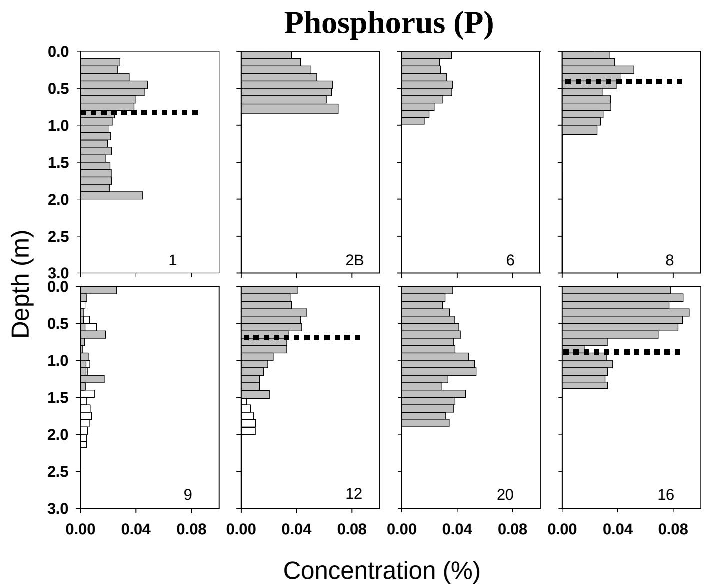


Figure 4-18. Variation in the concentration of phosphorus (P; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

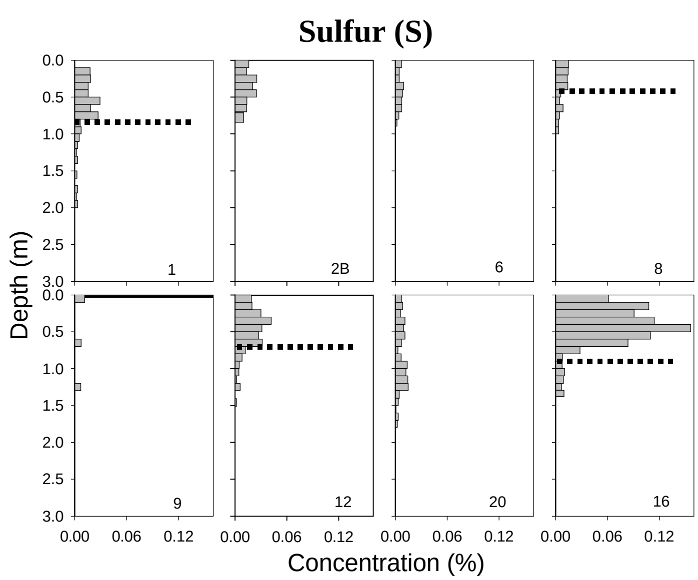


Figure 4-19. Variation in the concentration of sulfur (S; % by mass) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

Arsenic (As)

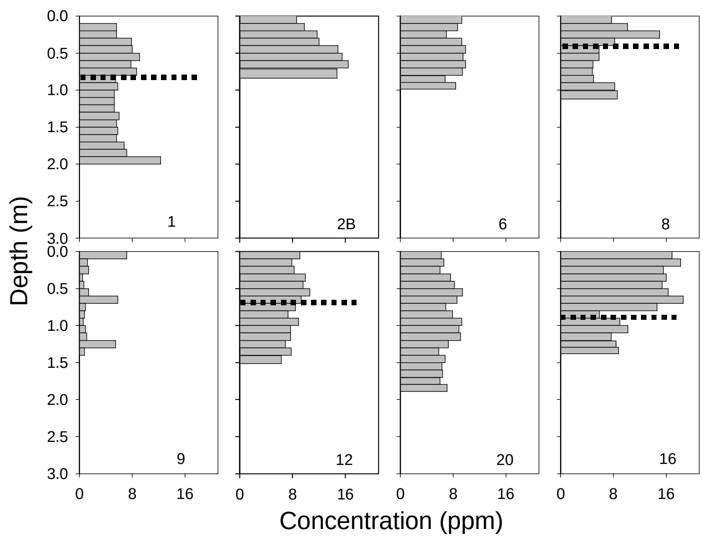


Figure 4-20. Variation in the concentration of arsenic (As; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

Cadmium (Cd)

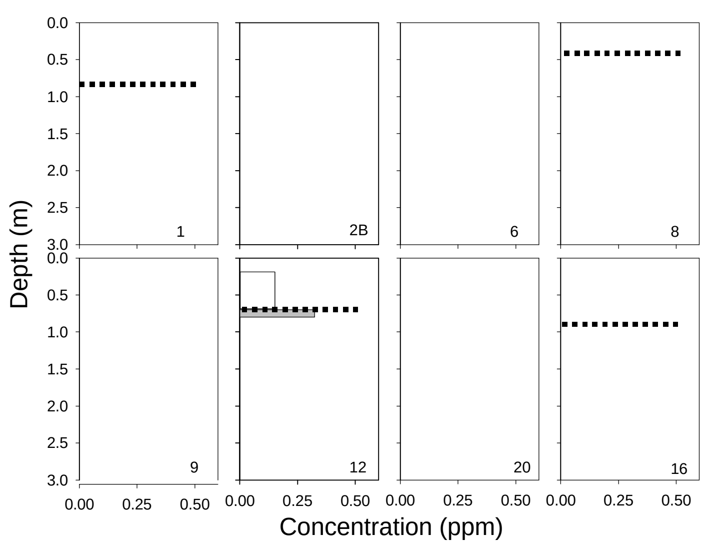


Figure 4-21. Variation in the concentration of cadmium (Cd; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

Chromium (Cr)

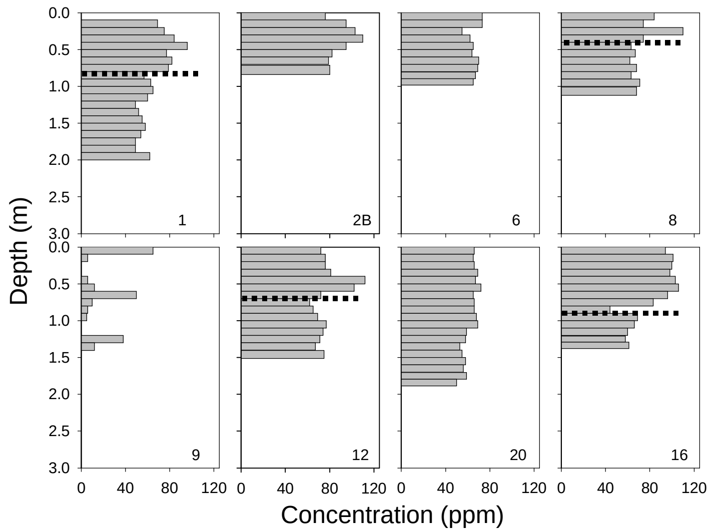


Figure 4-22. Variation in the concentration of chromium (Cr; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

Copper (Cu)

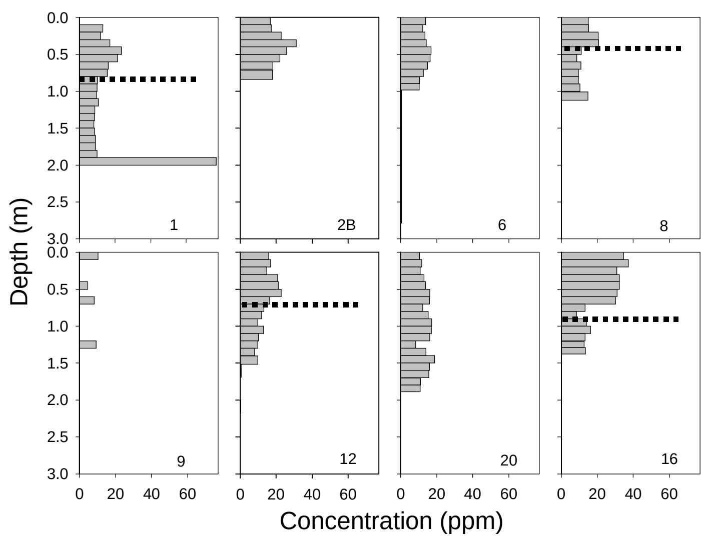


Figure 4-23. Variation in the concentration of copper (Cu; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

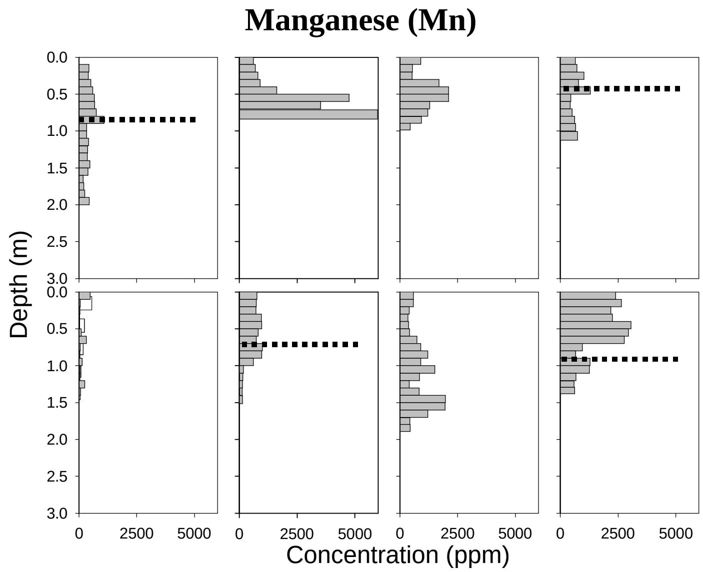


Figure 4-24. Variation in the concentration of manganese (Mn; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

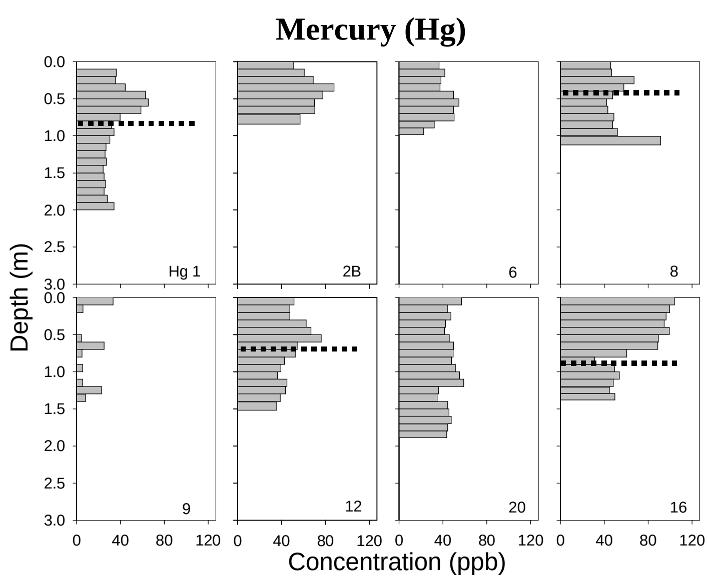


Figure 4-25. Variation in the concentration of mercury (Hg; parts per billion) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

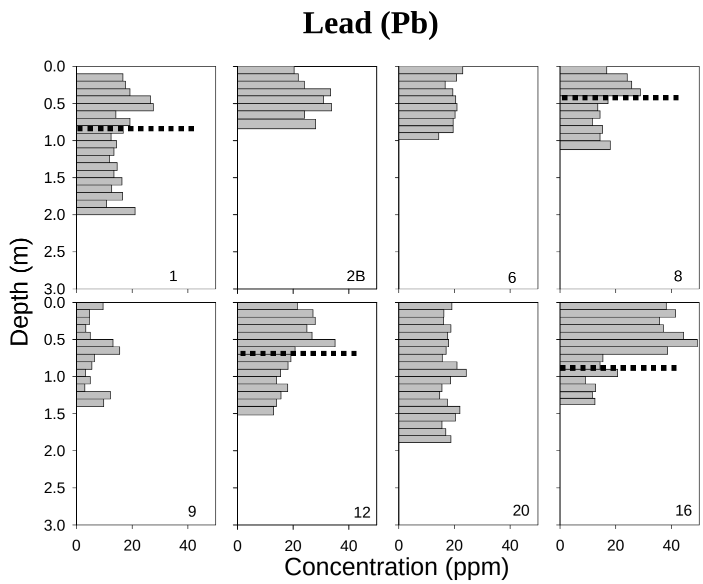


Figure 4-26. Variation in the concentration of lead (Pb; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

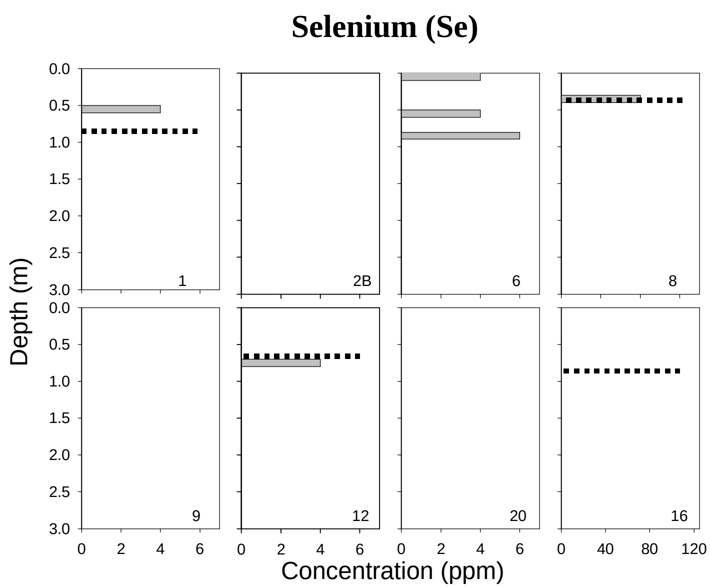


Figure 4-27. Variation in the concentration of selenium (Se; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

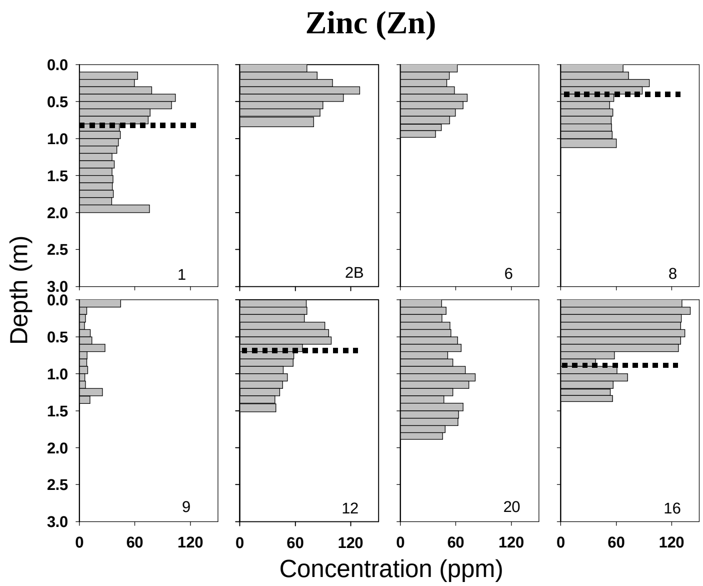


Figure 4-28. Variation in the concentration of zinc (Zn; parts per million) within the sediments of cores along the Skuna River arm of Grenada Lake moving in space from upstream (Core 1) to downstream (Core 16 in the pool). Dashed lines separate post-impoundment deposition (above) from pre-impoundment materials (below). Refer to Figure 3-2 for core locations.

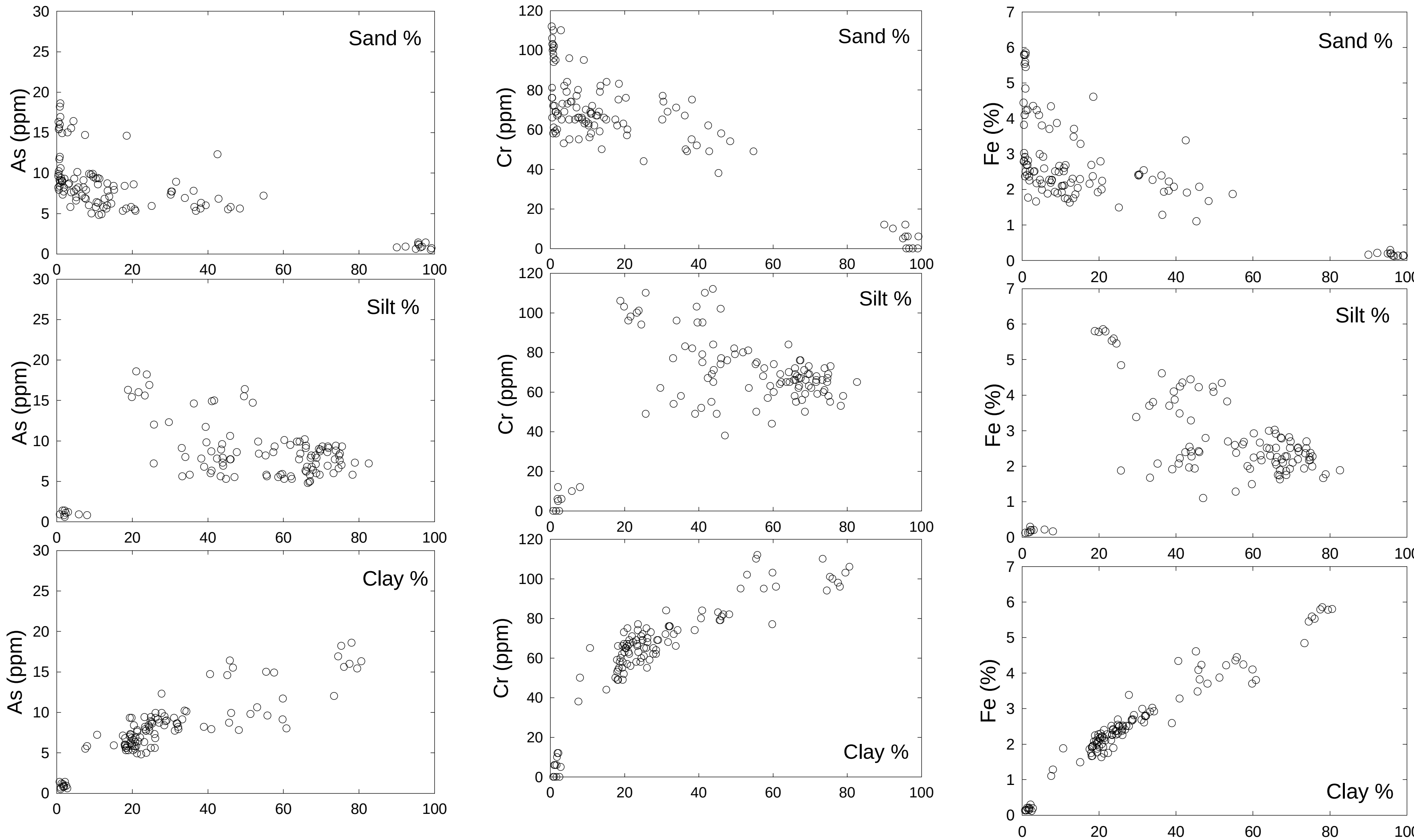


Figure 4-29. Variation of arsenic (left), chromium (center), and iron (right) concentration with sediment texture for all cores along the Skuna River arm of Grenada Lake.

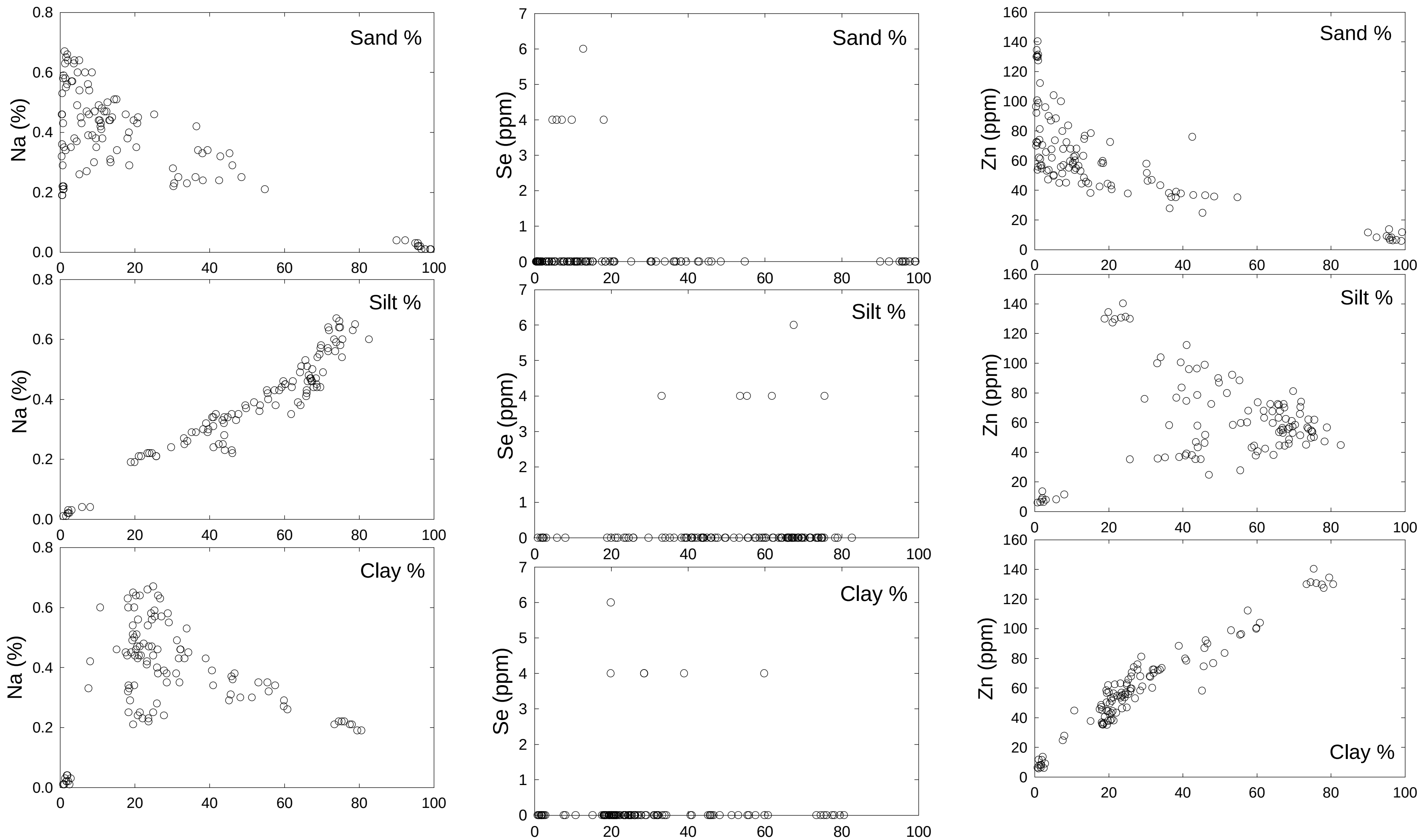


Figure 4-30. Variation of sodium (left), selenium (center), and zinc (right) concentration with sediment texture for all cores along the Skuna River arm of Grenada Lake.

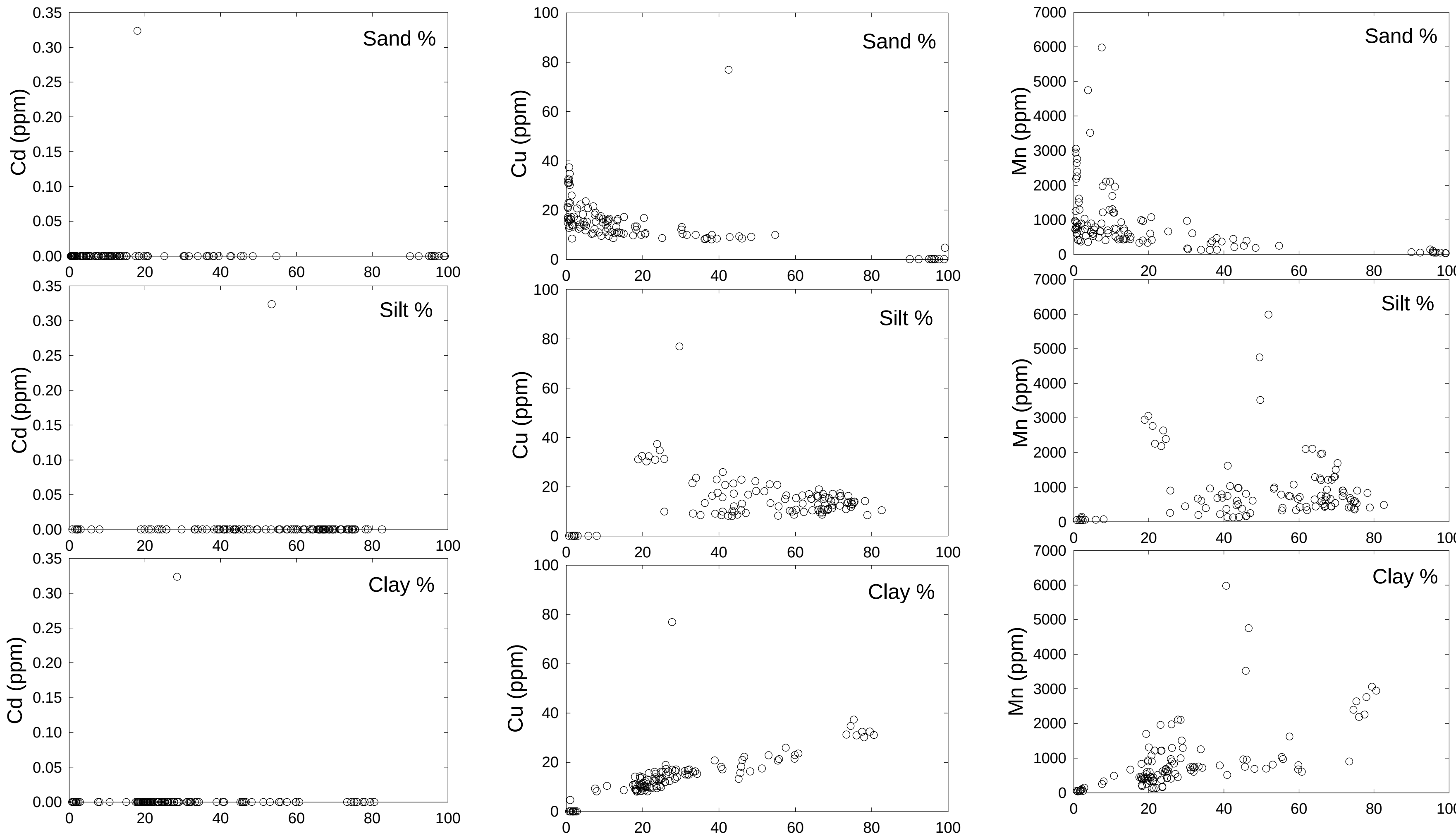


Figure 4-31. Variation of cadmium (left), copper (center), and manganese (right) concentration with sediment texture for all cores along the Skuna River arm of Grenada Lake.

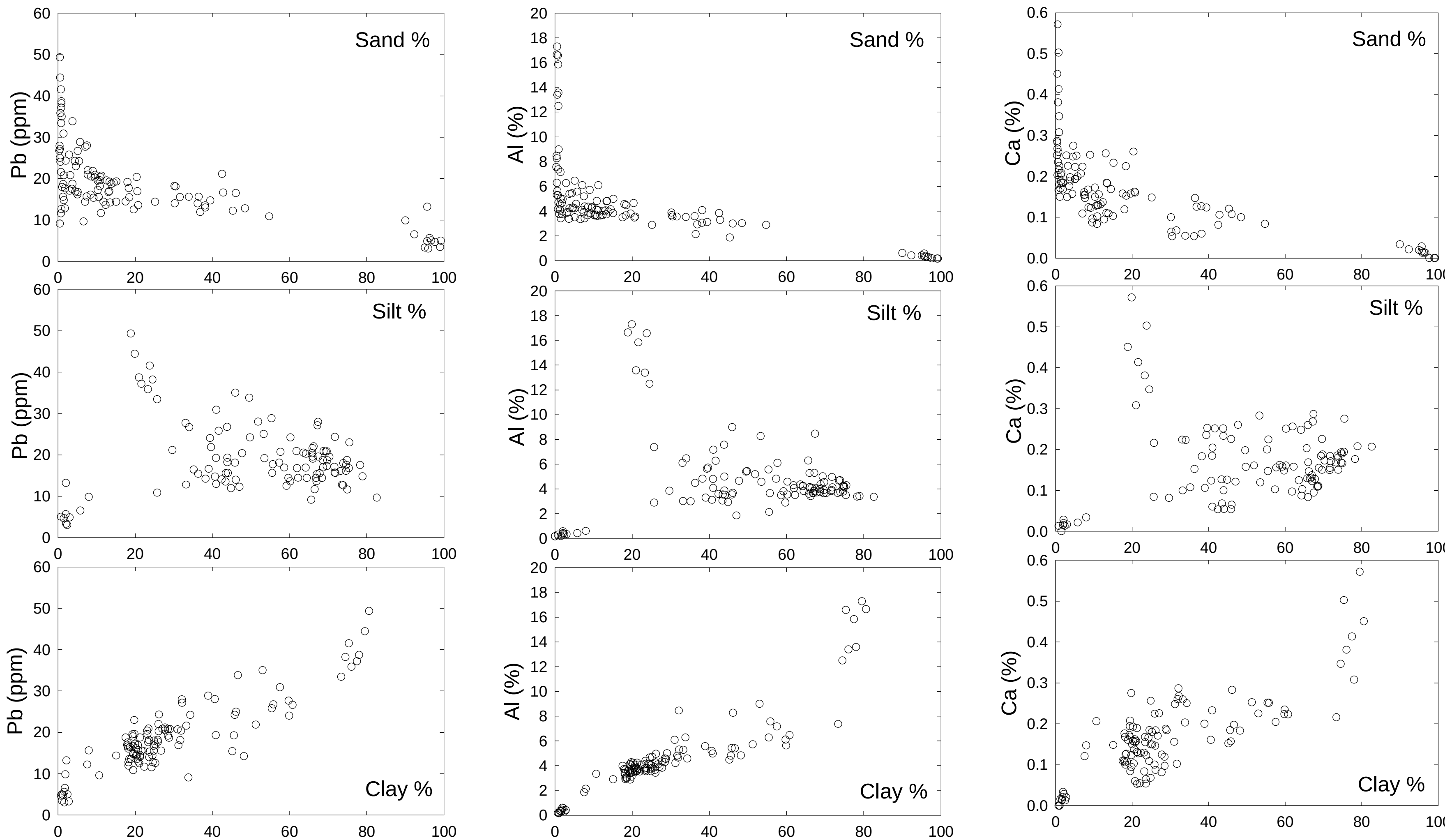


Figure 4-32. Variation of lead (left), aluminum (center), and calcium (right) concentration with sediment texture for all cores along the Skuna River arm of Grenada Lake.

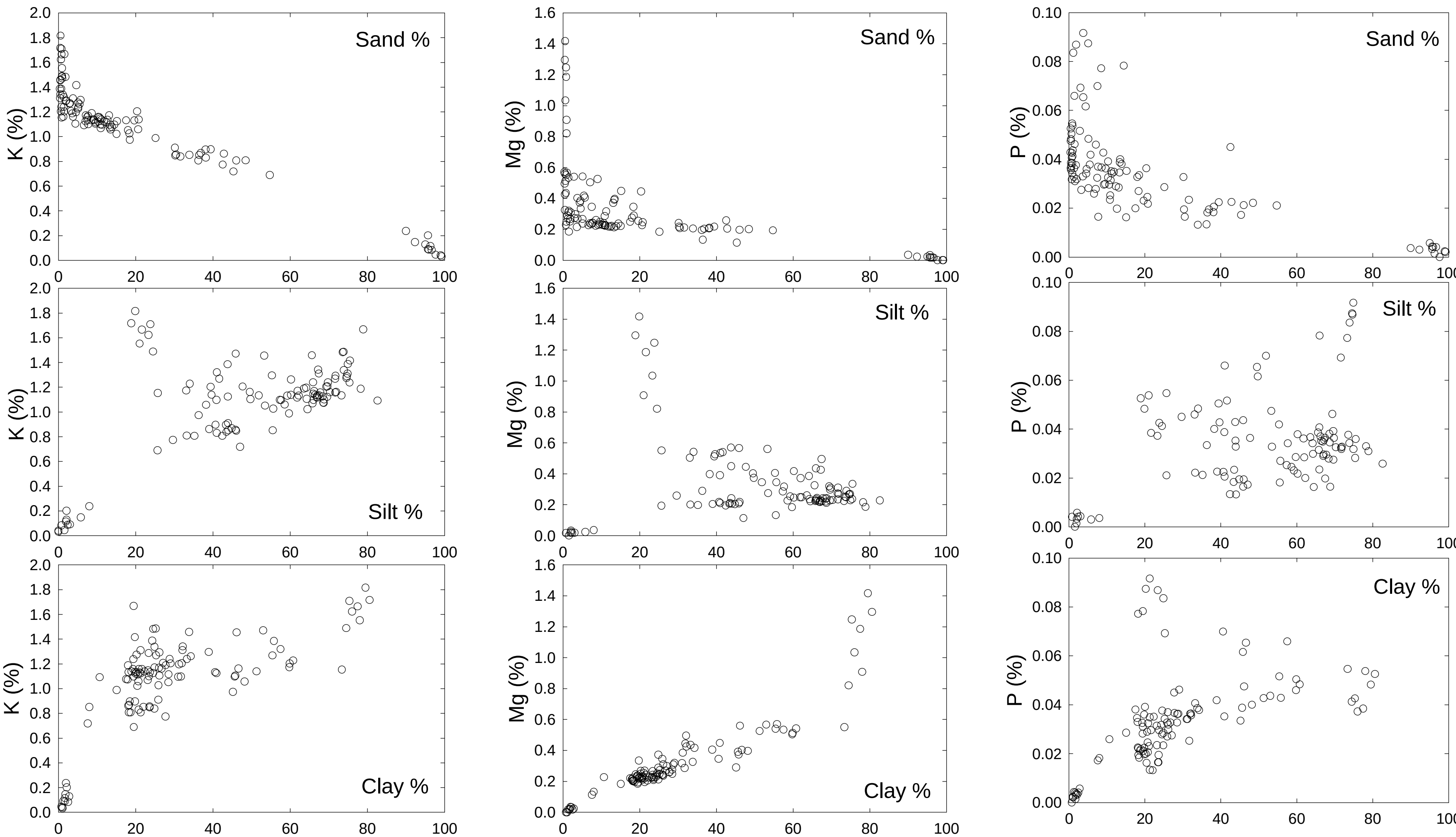


Figure 4-33. Variation of potassium (left), magnesium (center), and phosphorus (right) concentration with sediment texture for all cores along the Skuna River arm of Grenada Lake.

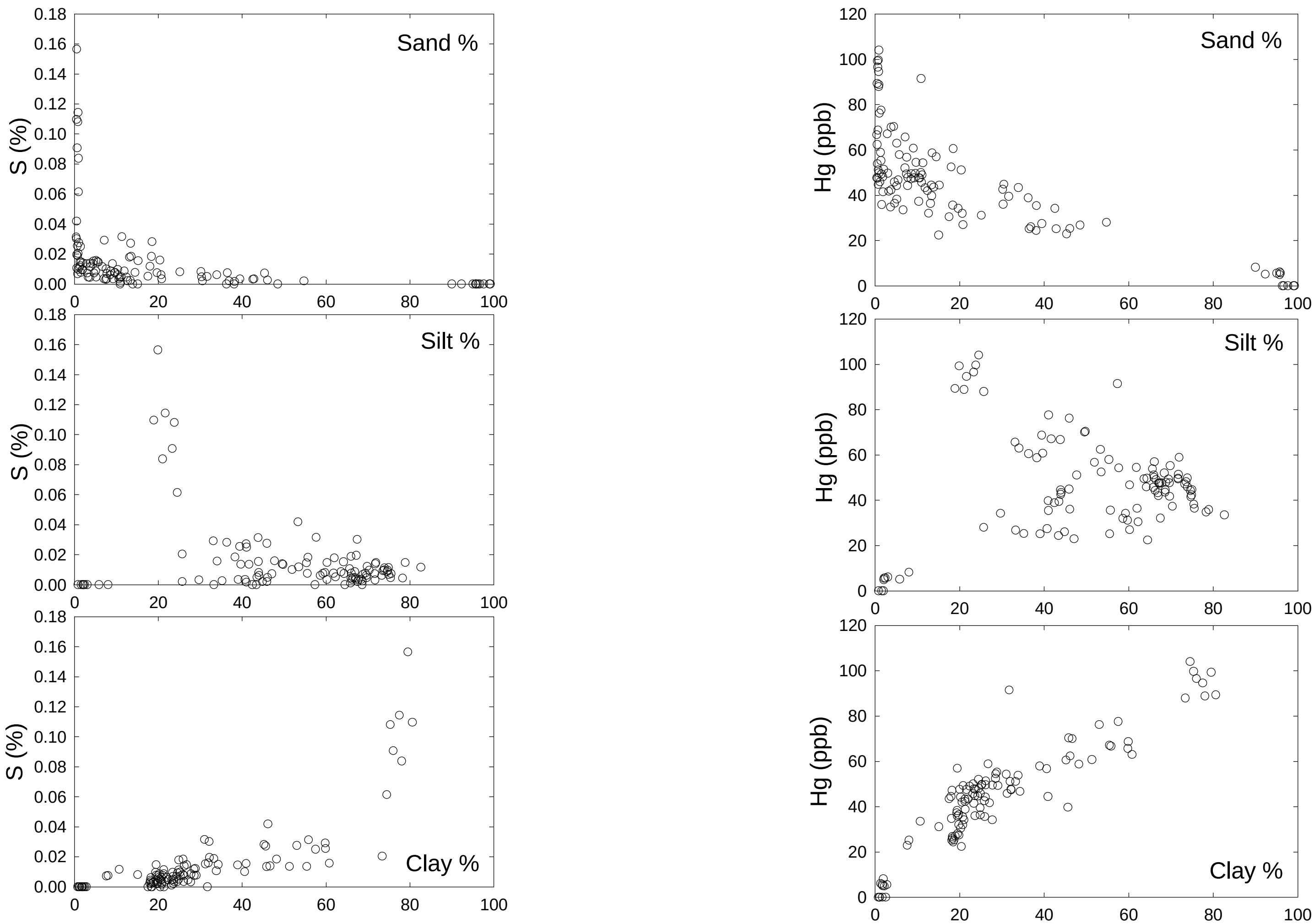


Figure 4-34. Variation of sulfur (left) and mercury (right) concentration with sediment texture for all cores along the Skuna River arm of Grenada Lake.

4.6 Bulk Chemical Analysis of Sediment: Yalobusha River Arm

Figures 4-35 to 4-43 show the variation of concentration for select elements plotted with depth within individual cores, from the most upstream core within the Yalobusha River arm (Core 27) to the most downstream core within the pool region of Grenada Lake (Core 16).

The major elements further examined here are aluminum (Al), calcium (Ca), iron (Fe), potassium (K), magnesium (Mg), sodium (Na), phosphorus (P), and sulfur (S). For Al (Figure 4-35), Ca (Figure 4-35), Fe (Figure 4-36), Mg (Figure 4-37), P (Figure 4-38), and S (Figure 4-38), the concentrations of these elements are markedly higher in the post-impoundment sediment as compared to the pre-impoundment sediment. In the pool region for the post-impoundment sediment, these same elements are two to three times higher in concentration as compared to the post-impoundment sediments found upstream. The concentration of Na (Figure 4-37) is about the same for both the pre- and post-impoundment sediments, but in the pool region its concentration in the post-impoundment sediments is about two times lower than found upstream. The concentration of S (Figure 4-19) in the post-impoundment sediments is about three times higher than in the pre-impoundment materials, and in the pool region S concentrations in the post-impoundment sediments are eight to ten times higher than found upstream.

The concentrations of most major elements show good correlation with sediment texture (Figures 4-44 to 4-49). As sand content decreases and silt and clay contents increase, the concentrations of Al, Ca, Fe, K, Mg, Mn, P, and S increase by as much as 5 to 10 times. The concentration of Na is positively correlated to silt content, and non-linearly related to clay content (Figure 4-45). The concentration of some elements, specifically Ca (Figure 4-47), K and P (Figure 4-38), and S (Figure 4-49) show more scatter when plotted against sediment texture compared to other elements. These variations are probably related to organic contributions to total element concentration in addition to mineralogical (inorganic).

The environmentally important elements further examined here are arsenic (As), cadmium (Cd), chromium, (Cr), copper (Cu), manganese (Mn), mercury (Hg), lead (Pb), selenium (Se), and zinc (Zn). For As (Figure 4-39), Cu (Figure 4-40), Pb (Figure 4-42), and Zn (Figure 4-43), the concentrations for these elements are about two times higher in the post-impoundment sediment as compared to the pre-impoundment materials. Moreover, the highest concentrations of these elements occur in the post-impoundment sediments located in the pool region, and these concentrations decrease in the upstream direction. The concentrations of Cr (Figure 4-40) and Mn (Figure 4-41) in the post-impoundment sediment are slightly higher than the pre-impoundment sediment, yet the highest concentrations occur in the post-impoundment sediments within the pool region. In the post-impoundment sediments, the concentration of Hg (Figure 4-41) is up to two times higher than the pre-impoundment sediments, and the highest Hg concentrations occur in the post-impoundment sediments of the pool region. Little to no Cd (Figure 4-39) and Se (Figure 4-42) were found in these sediments.

The concentrations of EIE show good correlations with sediment texture. Elements such as Zn (Figure 4-45), Cu (Figure 4-46), and Pb (Figure 4-47) show that as sand content decreases and silt and clay contents increase, the concentrations of these elements increase. EIE concentrations are typically 5 to 15 times higher in the silt and clay dominated horizons as compared to the sand dominated horizons (Table 4-3). Elements such as As, Cr, Mn, and Hg also show similar trends with sediment texture (Figures 4-44, 4-46, and 4-49), but display more scatter. Very little Se and Cd were observed in the sediment (Figures 4-45 and 4-49).

The cause for the increase in element concentration for both major elements and EIE is the post-impoundment sediment is due to sediment texture. These more recent sediments are enriched in clay, hence controlling the bulk sediment chemistry.

The concentrations of these elements found in Grenada Lake are not atypical for agricultural watersheds in Mississippi. Comparable concentrations of elements such As, Cd, Cr, Cu, Hg, Pb, and Zn have been observed in soil and lake sediment samples in Otoucalofa Creek watershed, located in Yalobusha County (Knight and Cooper, 1996) and Hubbard-Murphree Lake, located in Tallahatchie County, MS (Bennett, 2001).

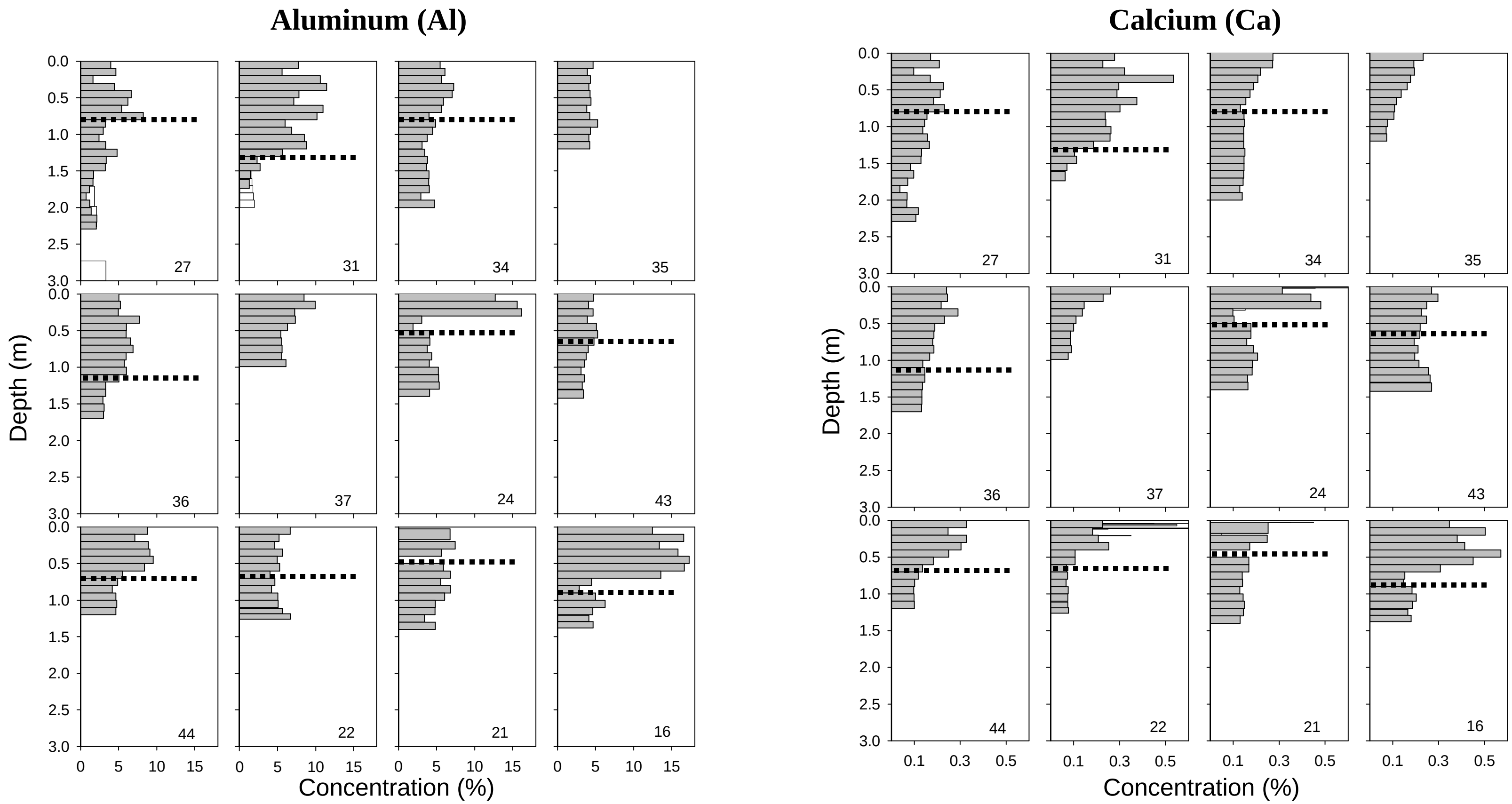


Figure 4-35. Variation in the concentration of aluminum (on left; Al; % by mass) and calcium (on right, Ca; % by mass) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.

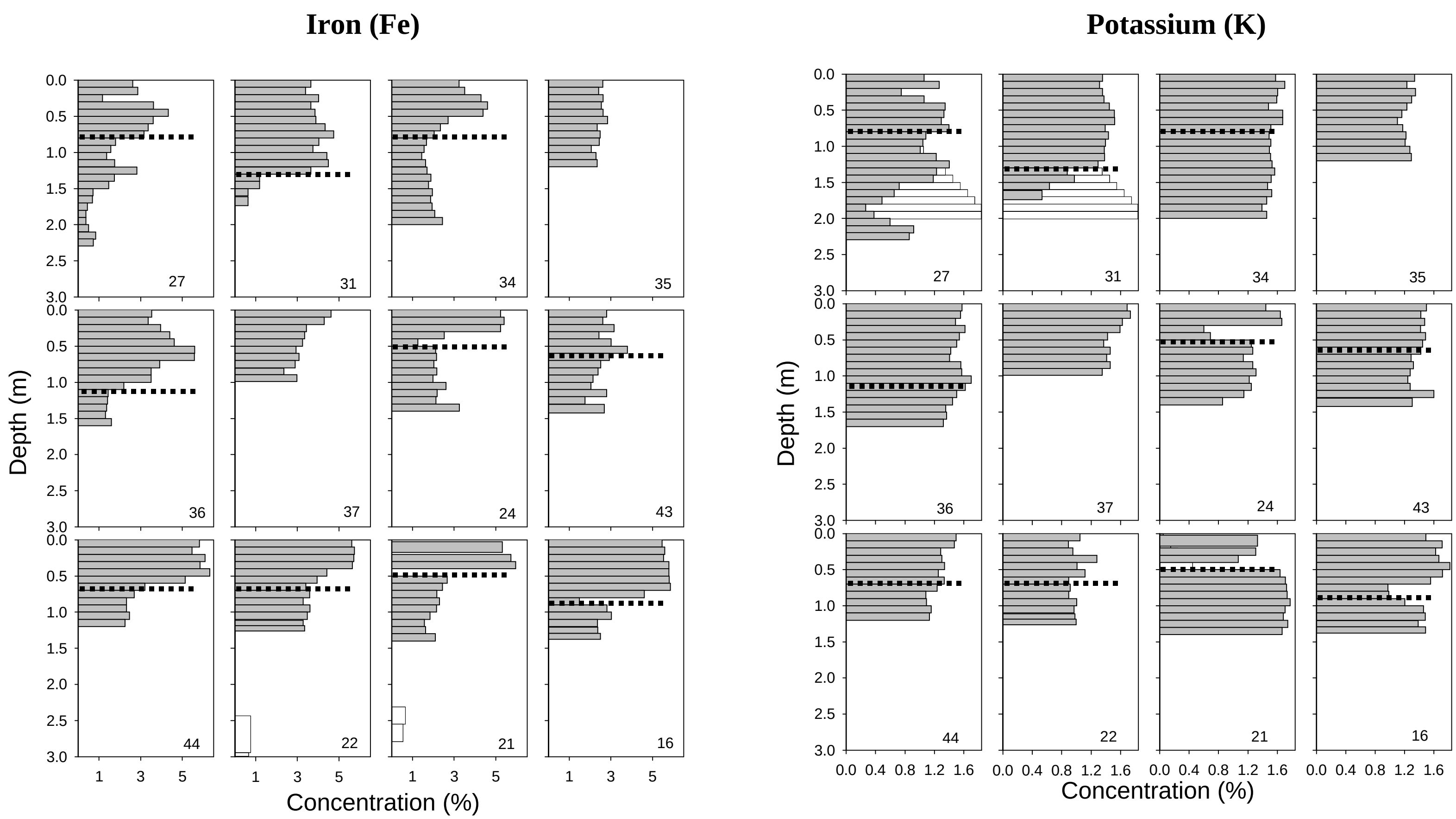
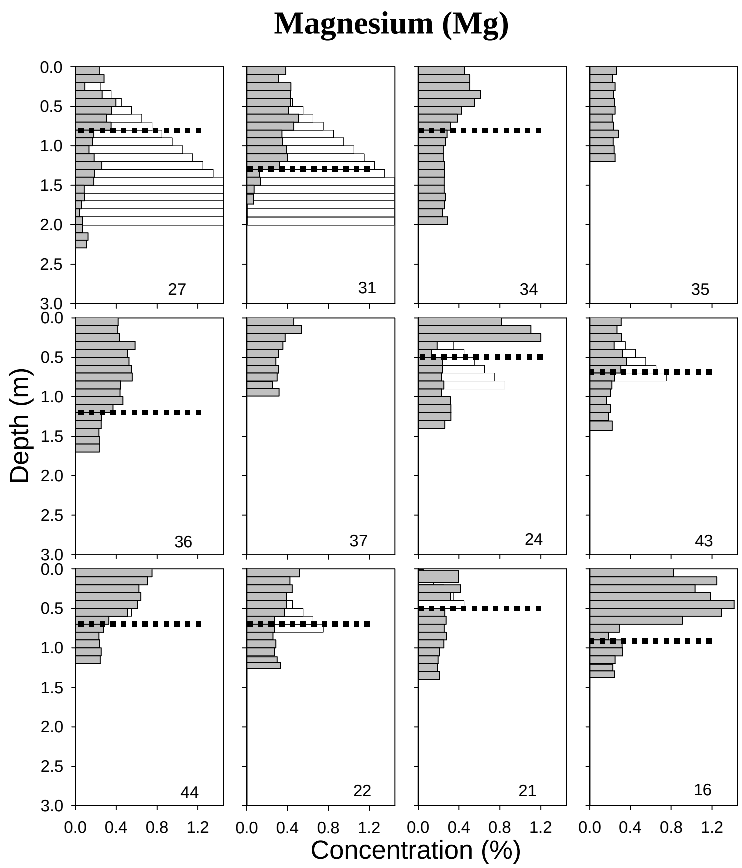


Figure 4-36. Variation in the concentration of iron (on left; Fe; % by mass) and potassium (on right, K; % by mass) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.



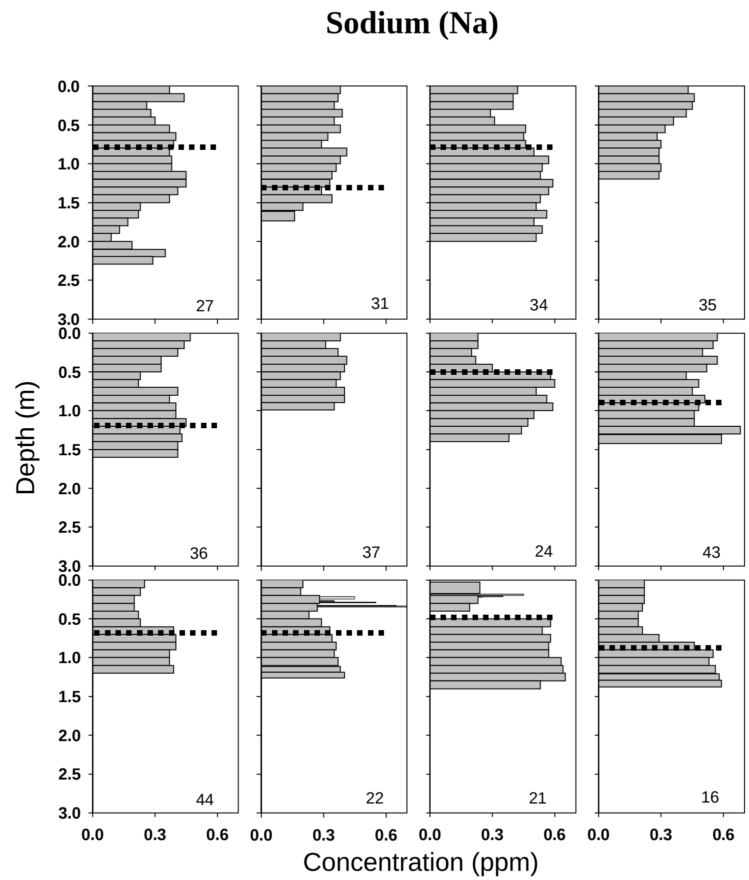


Figure 4-37. Variation in the concentration of magnesium (on left; Mg; % by mass) and sodium (on right, Na; % by mass) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.

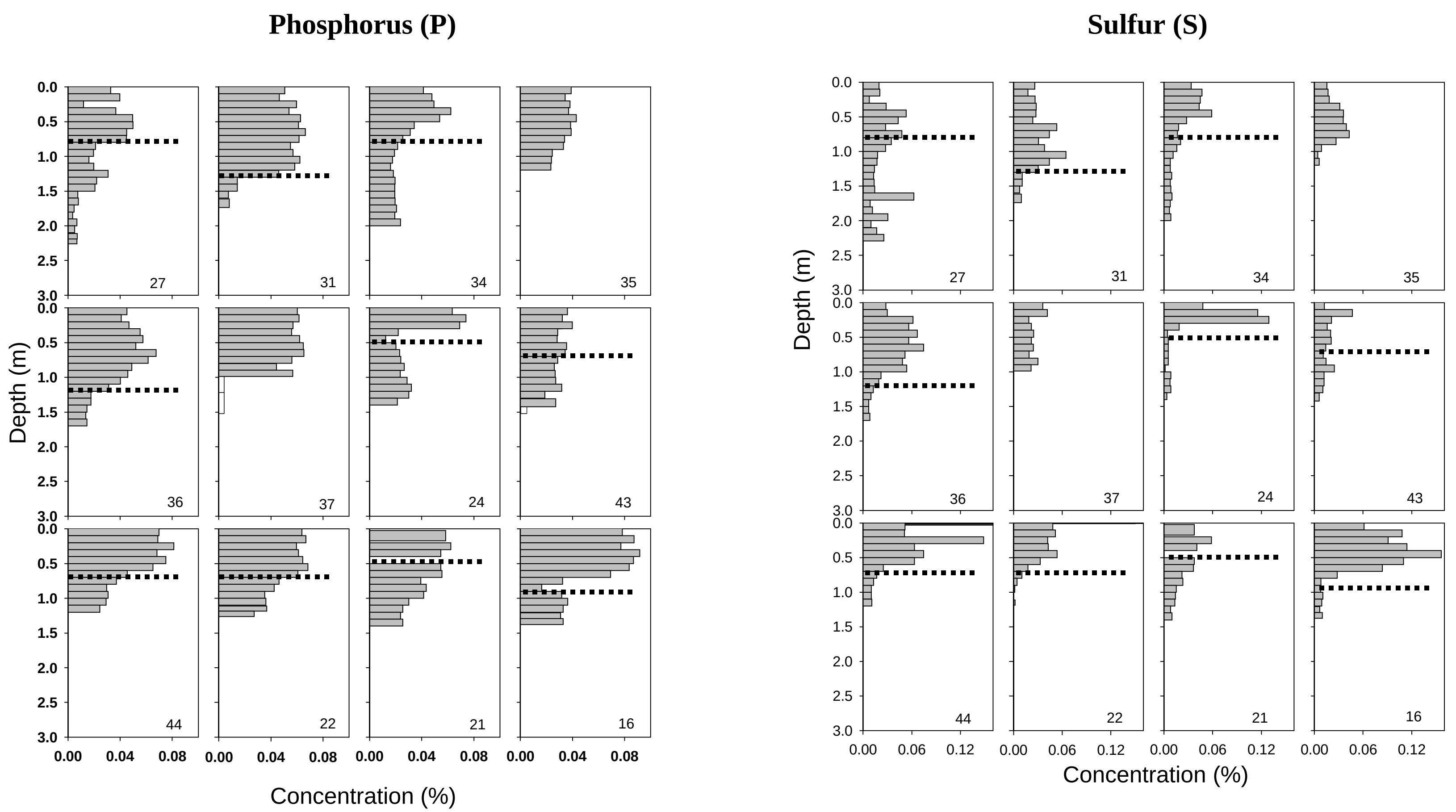


Figure 4-38. Variation in the concentration of phosphorus (on left; P; % by mass) and sulfur (on right, S; % by mass) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.

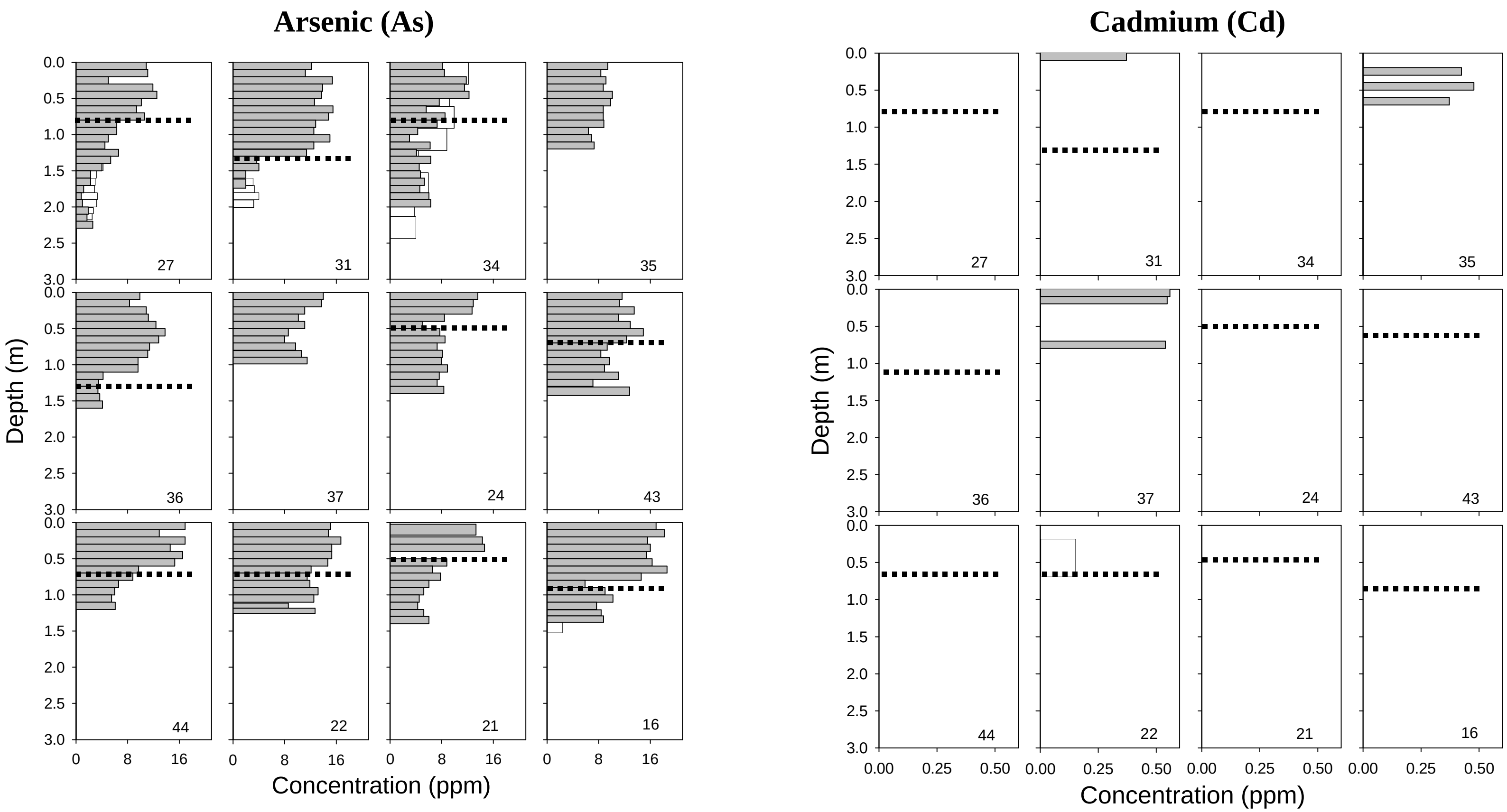


Figure 4-39. Variation in the concentration of arsenic (on left; As; parts per million) and cadmium (on right, Cd; parts per million) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.

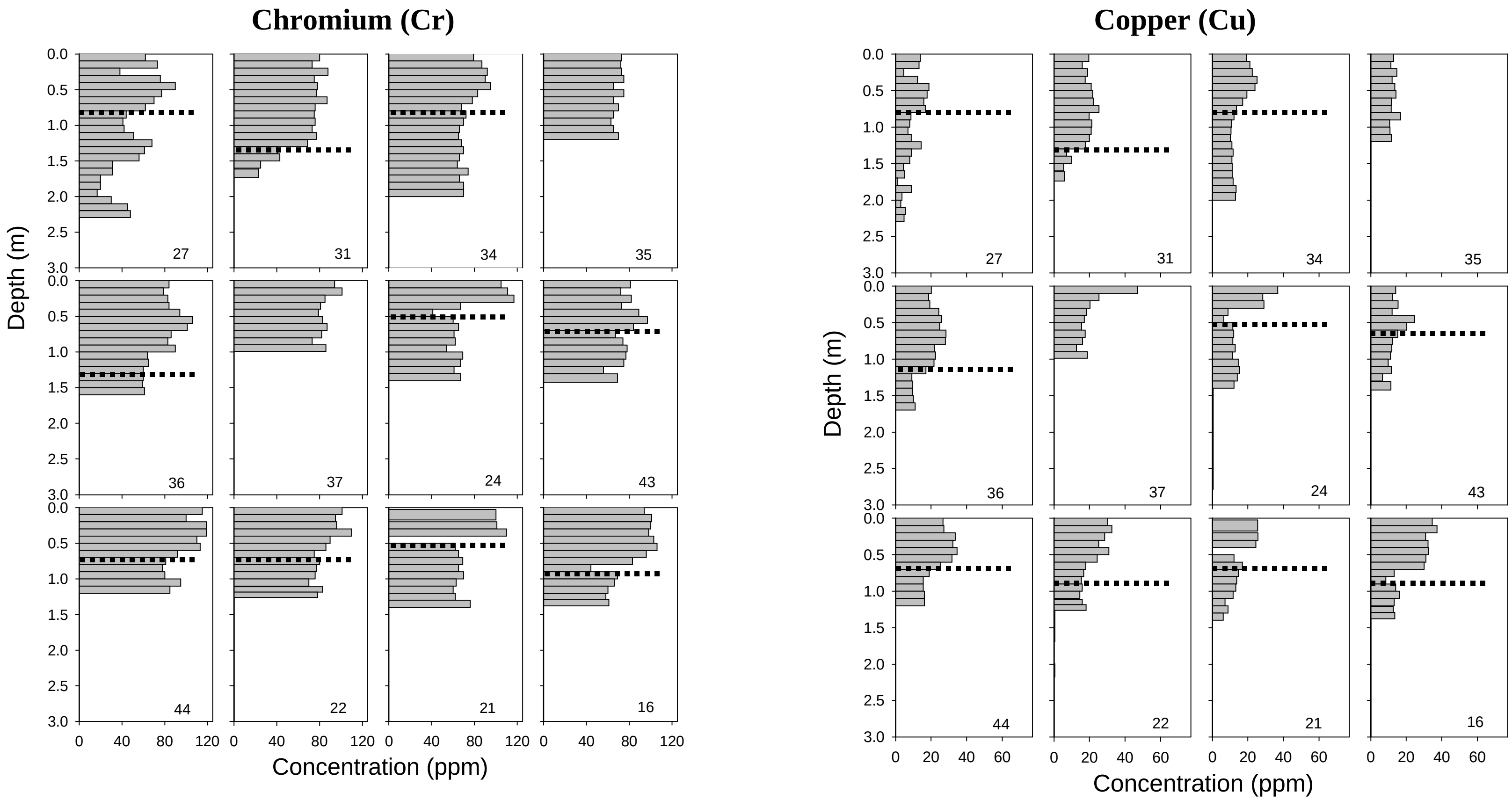
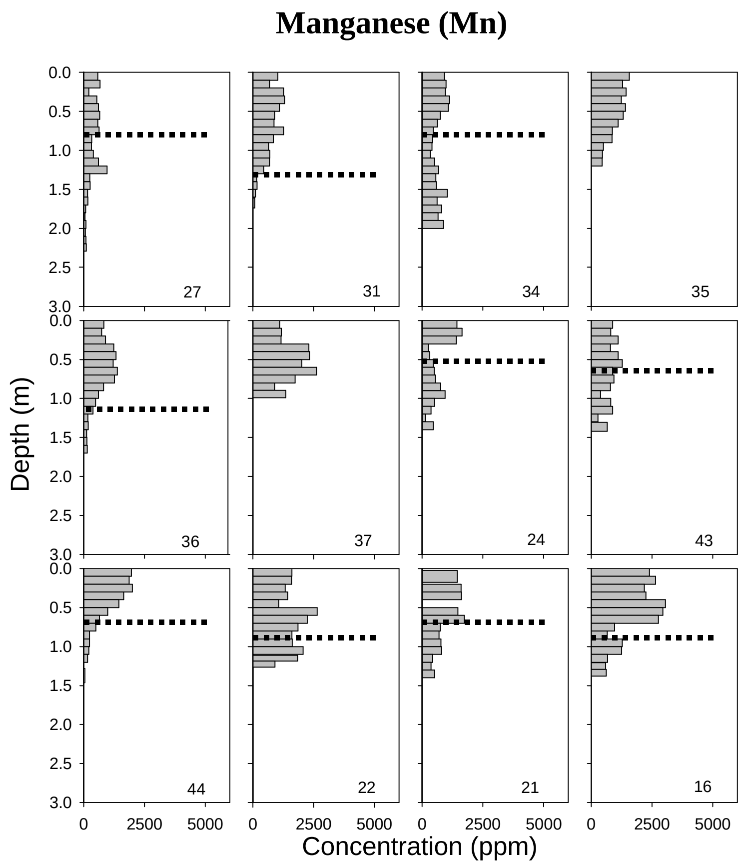


Figure 4-40. Variation in the concentration of chromium (on left; Cr; parts per million) and copper (on right, Cu; parts per million) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.



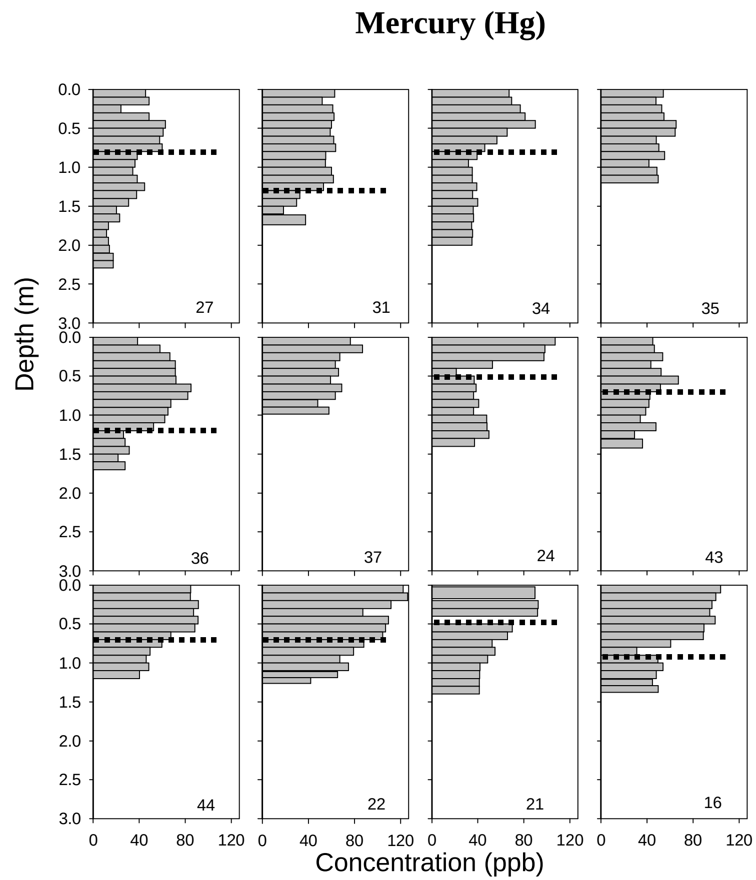


Figure 4-41. Variation in the concentration of manganese (on left; Mn; parts per million) and mercury (on right, Hg; parts per billion) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.

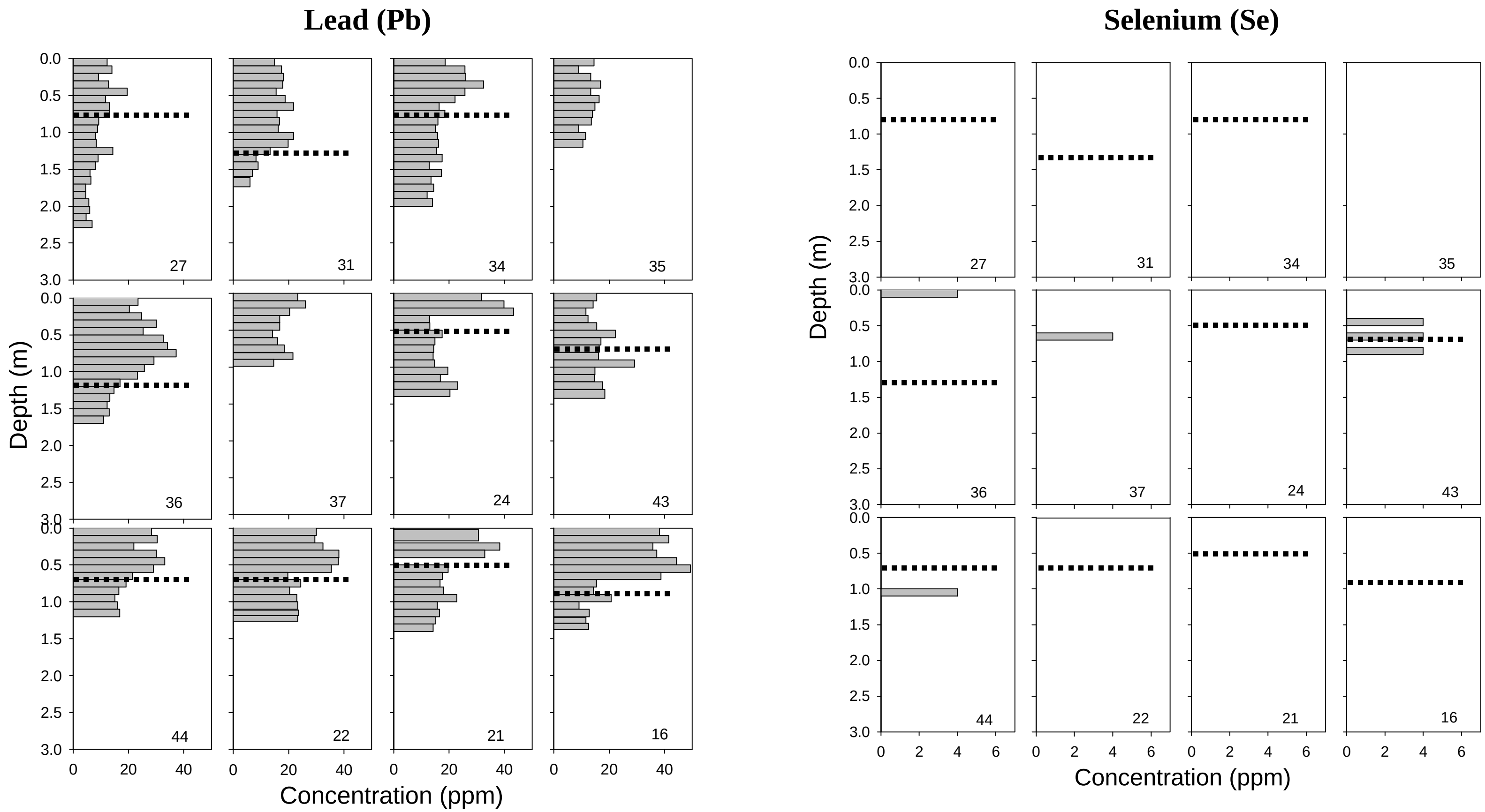


Figure 4-42. Variation in the concentration of lead (on left; Pb; parts per million) and selenium (on right; Se; parts per million) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.

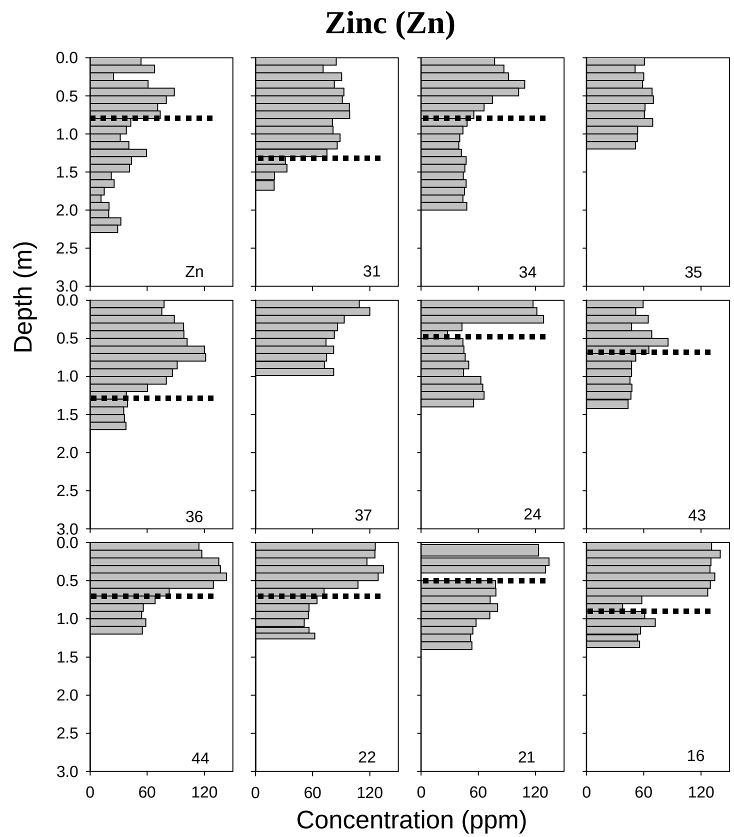


Figure 4-43. Variation in the concentration of zinc (Zn; parts per million) within the sediments of cores along the Yalobusha River arm of Grenada Lake moving in space from upstream (Core 27) to downstream (Core 16 in the pool). Refer to Figure 3-2 for core locations.

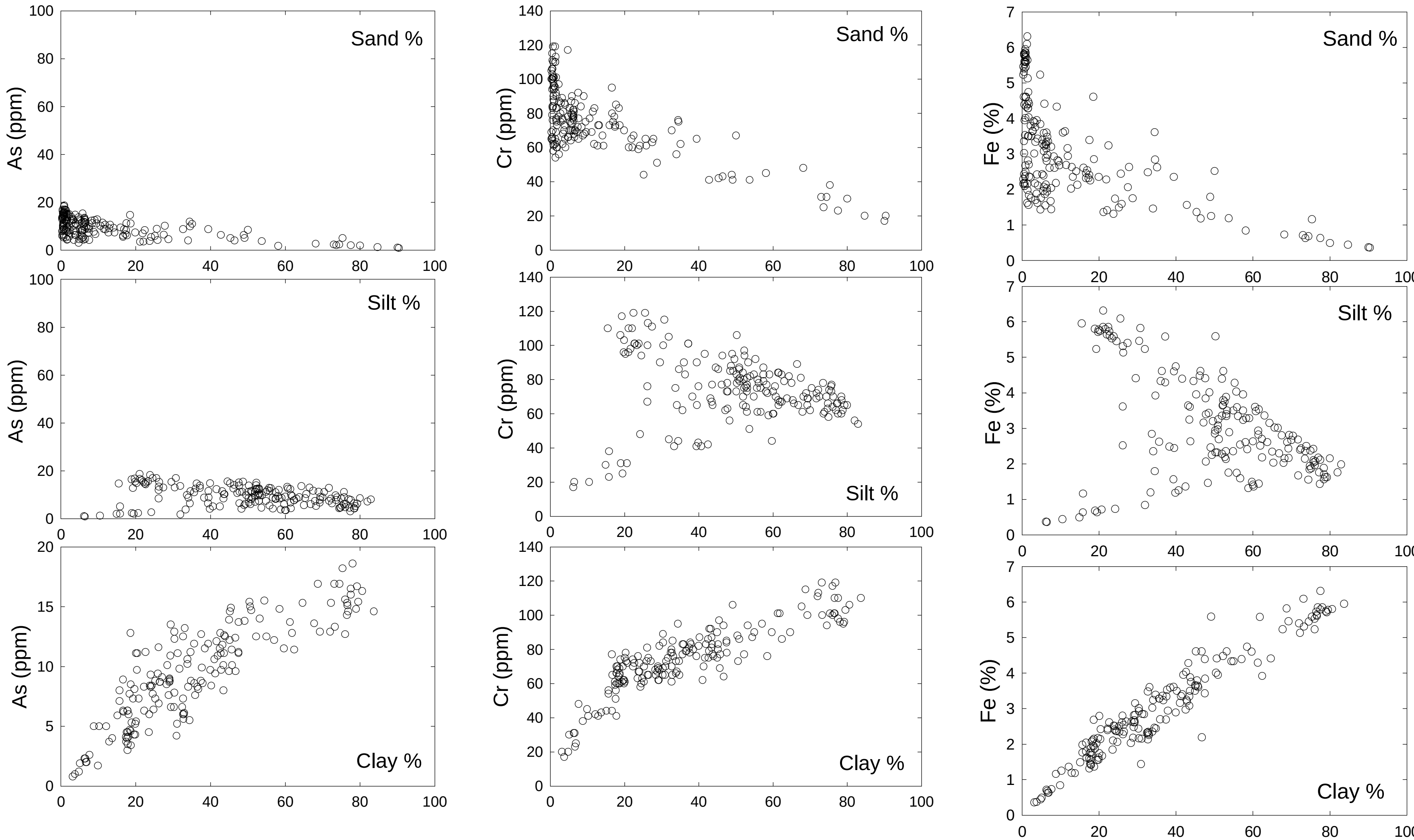


Figure 4-44. Variation of arsenic (left), chromium (center), and iron (right) concentration with sediment texture for all cores along the Skuna River arm of Grenada Lake.

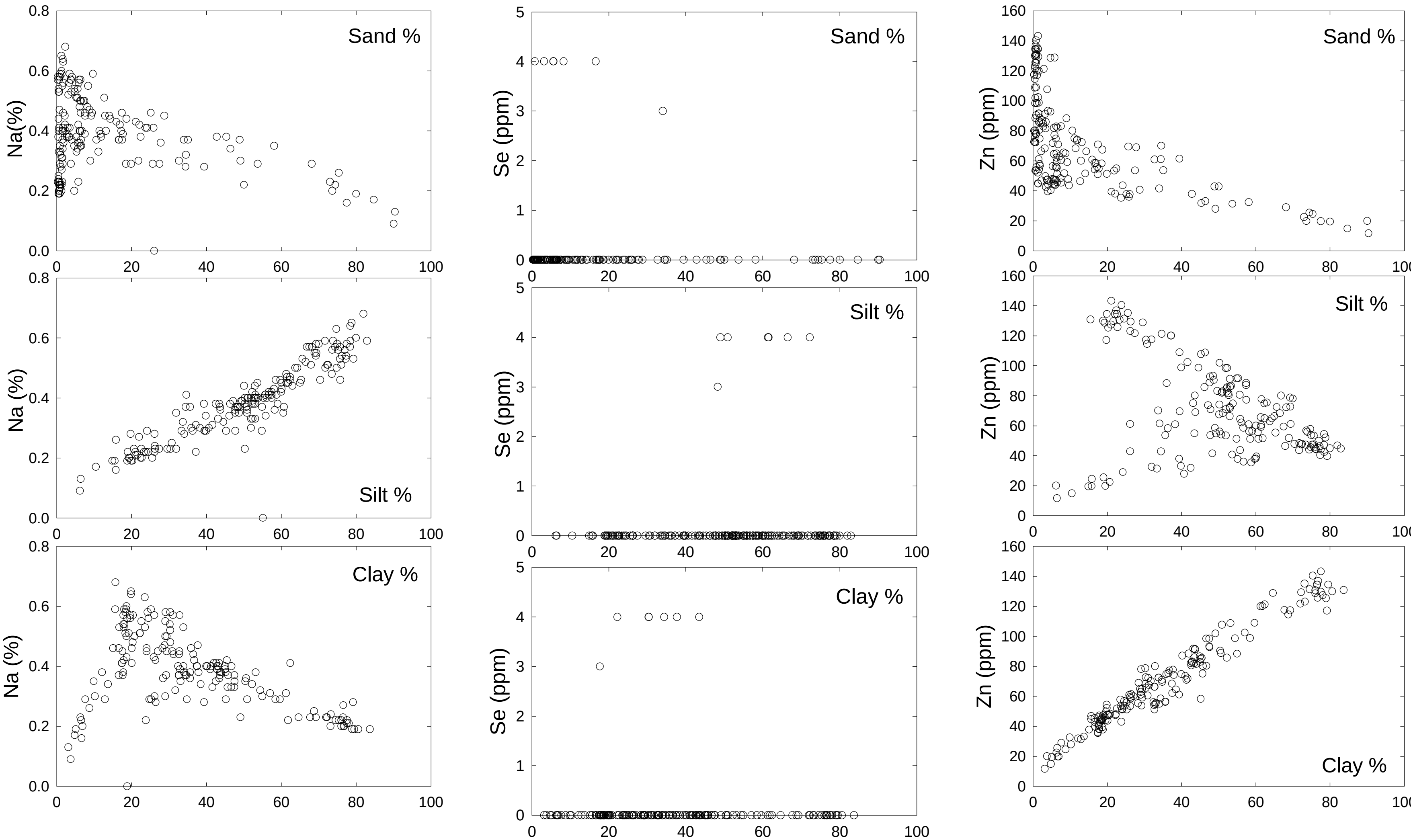


Figure 4-45. Variation of sodium (left), selenium (center), and zinc (right) concentration with sediment texture for all cores along the Yalobusha River arm of Grenada Lake.

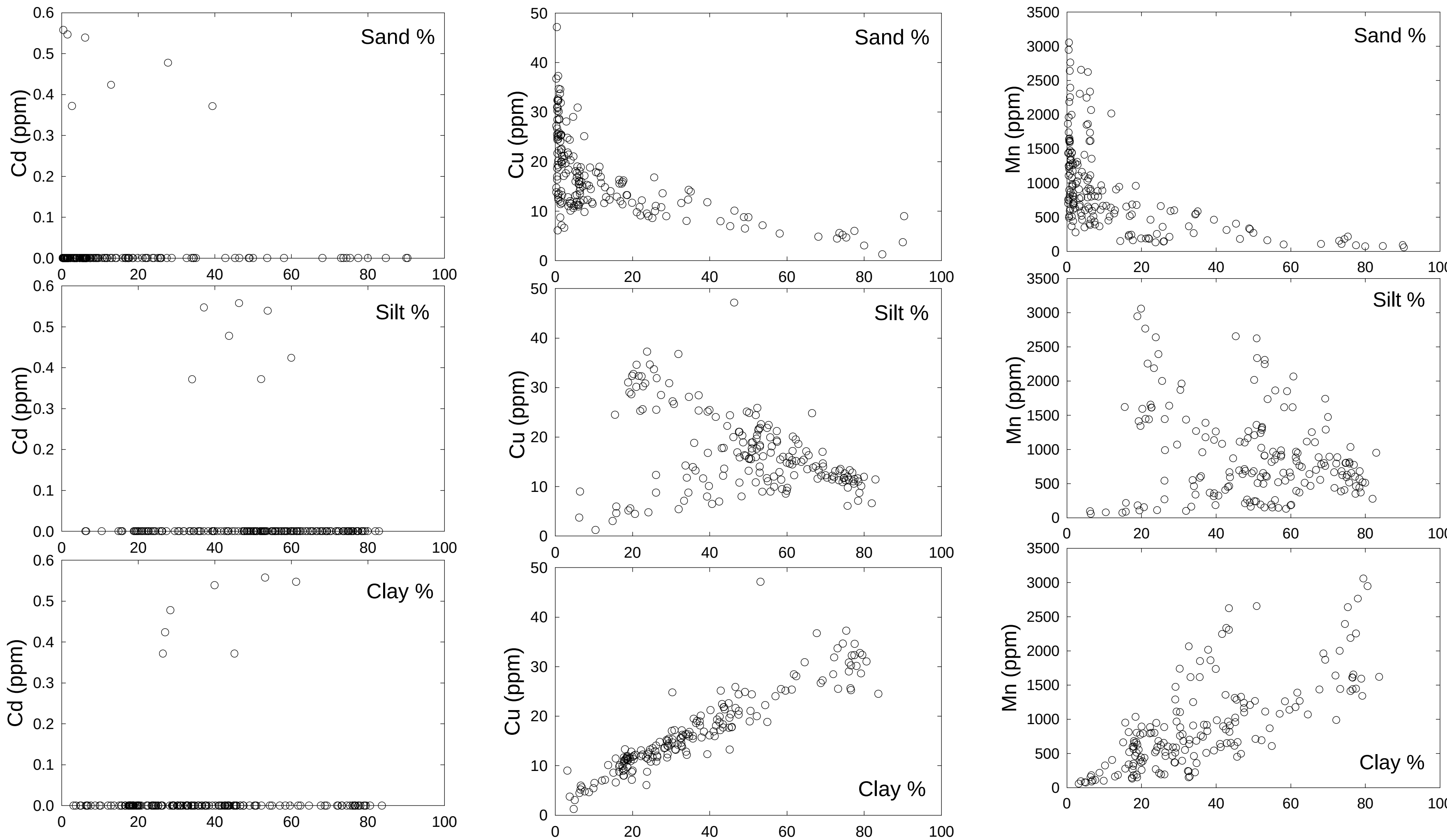


Figure 4-46. Variation of cadmium (left), copper (center), and manganese (right) concentration with sediment texture for all cores along the Yalobusha River arm of Grenada Lake.

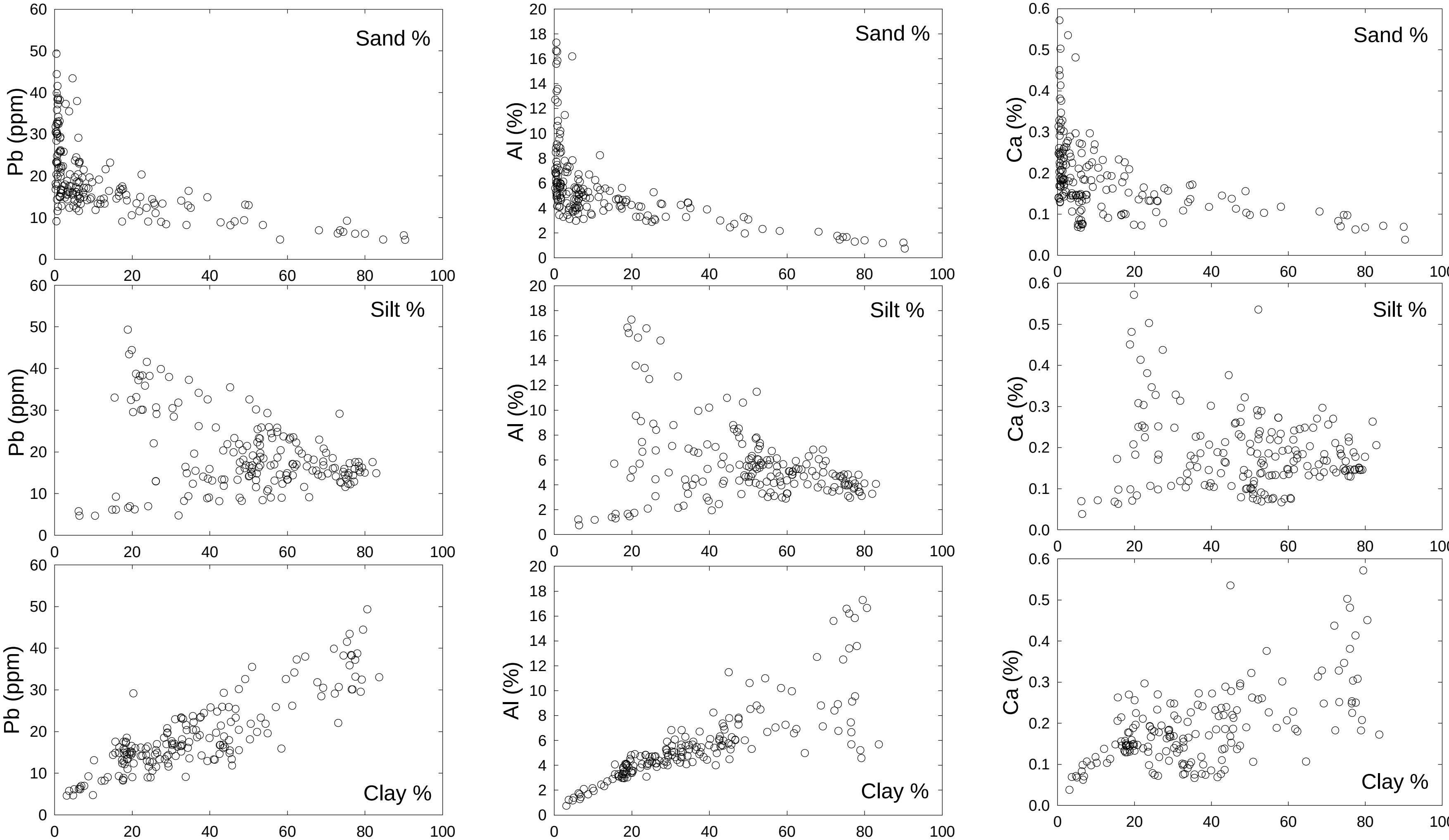


Figure 4-47. Variation of lead (left), aluminum (center), and calcium (right) concentration with sediment texture for all cores along the Yalobusha River arm of Grenada Lake.

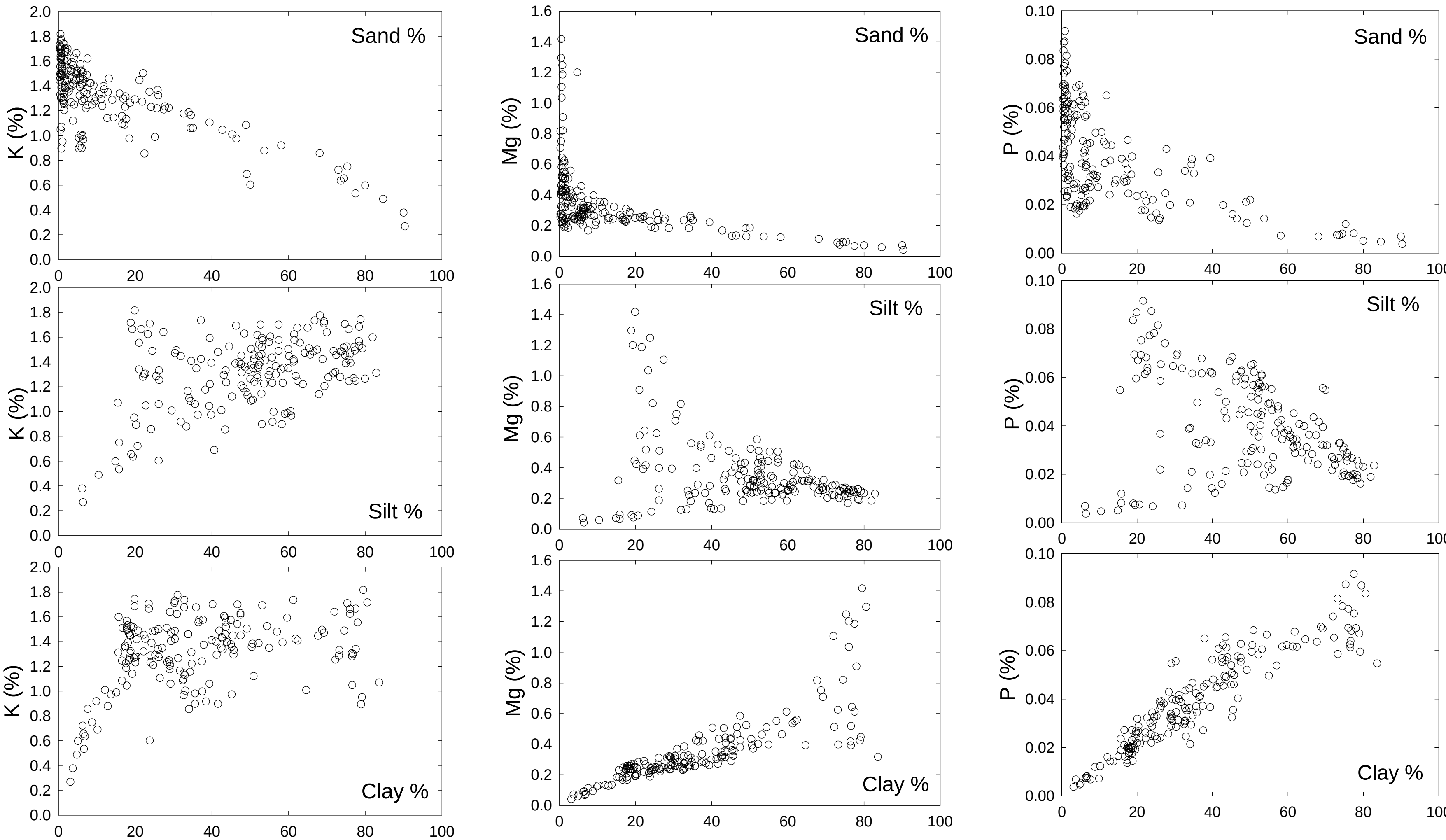


Figure 4-48. Variation of potassium (left), magnesium (center), and phosphorus (right) concentration with sediment texture for all cores along the Yalobusha River arm of Grenada Lake.

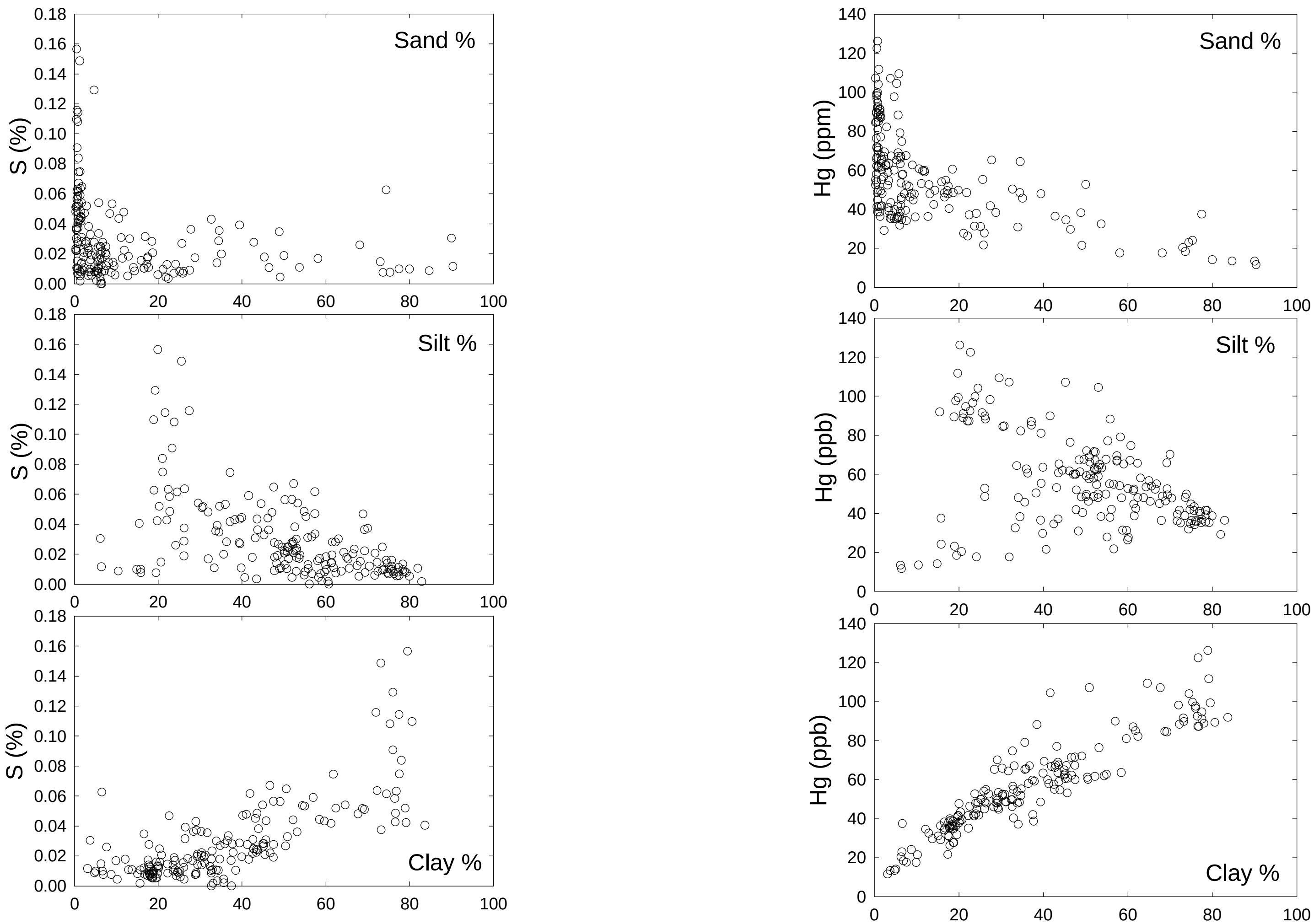


Figure 4-49. Variation of sulfur (left) and mercury (right) concentration with sediment texture for all cores along the Yalobusha River arm of Grenada Lake.

4.7 Agrichemical Results

Table 4-4 summarizes the results of all agrichemical and PCB analyses performed on the collected sediments. Figures 4-50 to 4-54 show the spatial variation in compound concentrations for select agrichemicals for two longitudinal transects, one starting at the most upstream core location on the Skuna River arm (Core 2a) and extending nearly 14 km downstream to the pool region of the lake (Core 17), and a second starting at the most upstream core location on the Yalobusha River arm (Cores 27 and 28) and extending nearly 17 km downstream to the pool region of the lake (Core 17).

Within the Skuna River arm deposits, aldrin (up to 103 ppb), dieldrin (up to 3 ppb), endosulfan I (up to 1 ppb), BHC-alpha (up to 3 ppb), BHC-beta (up to 527 ppb), BHC-gamma (up to 318 ppb), DDD (up to 13 ppb), DDE (up to 16 ppb), DDT (up to 4 ppb), heptachlor (up to 114 ppb), and heptachlor epoxide (up to 6 ppb) are found in measurable concentrations (Table 4-4, Figures 4-51 and 4-52). Compounds such as DDD, DDE, and heptachlor are found in nearly all sediment samples in comparable concentrations (Figures 4-51 and 4-52).

Within the Yalobusha River arm deposits, aldrin (up to 37 ppb), endosulfan I (up to 2 ppb), BHC-alpha (up to 8 ppb), BHC-beta (up to 258 ppb), BHC-gamma (up to 451 ppb), DDD (up to 18 ppb), DDE (up to 26 ppb), DDT (up to 7 ppb), heptachlor (up to 61 ppb), and heptachlor epoxide (up to 6 ppb) are found in measurable concentrations (Table 4-4, Figures 4-53, 4-54). Compounds such as DDD, DDE, DDT, BHC-alpha, and heptachlor are found in nearly all sediment samples in comparable concentrations (Figures 4-53 and 4-54).

The concentrations of these agrichemicals are not atypical for agricultural watersheds in Mississippi. Comparable concentrations of compounds such as aldrin, DDT, DDD, DDE, dieldrin, heptachlor, and heptachlor epoxide have been observed in soil and lake sediment samples in Bear Creek watershed, located in Humphreys, Sunflower, and Leflore Counties (Cooper et al., 1987), Moon Lake, located in Coahoma County (Cooper, 1991), and Otoucalofa Creek watershed, located in Yalobusha County (Knight and Cooper, 1996).

Table 4-4. Summary of agrichemical analyses performed on all cores from Grenada Lake. Analyses were performed on depth-integrated samples except for Core 13 and Core 17, where the upper and lower halves were analyzed separately. ND—not detected, TR—trace, ppb—parts per billion. Refer to Figure 3-2 for core locations.

Parameter	Units	Core ID																	
		2A	3	8	9	13		17		21	22	24	25	27	28	31	35	36	43
						0-4 ft	4-8 ft	0-2 ft	2-4 ft										
ALDRIN	ppb	103	ND	ND	1	ND	ND	1	37	2	1	ND	ND	ND	1	TR	2	2	TR
BHC-ALPHA	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	3	4	2	2	ND	ND	ND	2	8
BHC-BETA	ppb	23	6	ND	527	ND	ND	258	ND	58	1	ND	ND	ND	TR	TR	ND	ND	TR
BHC-DELTA	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	TR	ND	ND	ND
BHC-GAMMA	ppb	ND	ND	155	18	318	120	6	ND	ND	ND	ND	ND	150	231	ND	232	451	266
CHLORDANE	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DDD	ppb	13	ND	1	2	3	4	ND	5	5	2	1	2	1	11	18	7	5	3
DDE	ppb	16	ND	3	2	6	8	ND	10	6	1	2	3	1	9	26	9	4	2
DDT	ppb	4	ND	ND	ND	3	3	ND	3	ND	1	ND	ND	ND	7	7	3	4	3
DIELDRIN	ppb	ND	ND	ND	ND	ND	3	ND	ND	ND	ND	ND	ND	ND	TR	ND	ND	ND	ND
ENDRIN	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDRIN ALDEHYDE	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ENDOSULFAN I	ppb	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	TR	2	TR	TR	TR
ENDOSULFAN II	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	TR	TR	TR	TR	ND
ENDOSULFAN SULFATE	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HEPTACHLOR	ppb	114	ND	ND	7	ND	2	12	61	12	17	5	3	10	4	TR	7	9	8
HEPTACHLOR EPOXIDE	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	ND	2	ND	ND	ND	ND
AROCLOR 1016	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1221	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1232	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1242	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1248	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1254	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AROCLOR 1260	ppb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

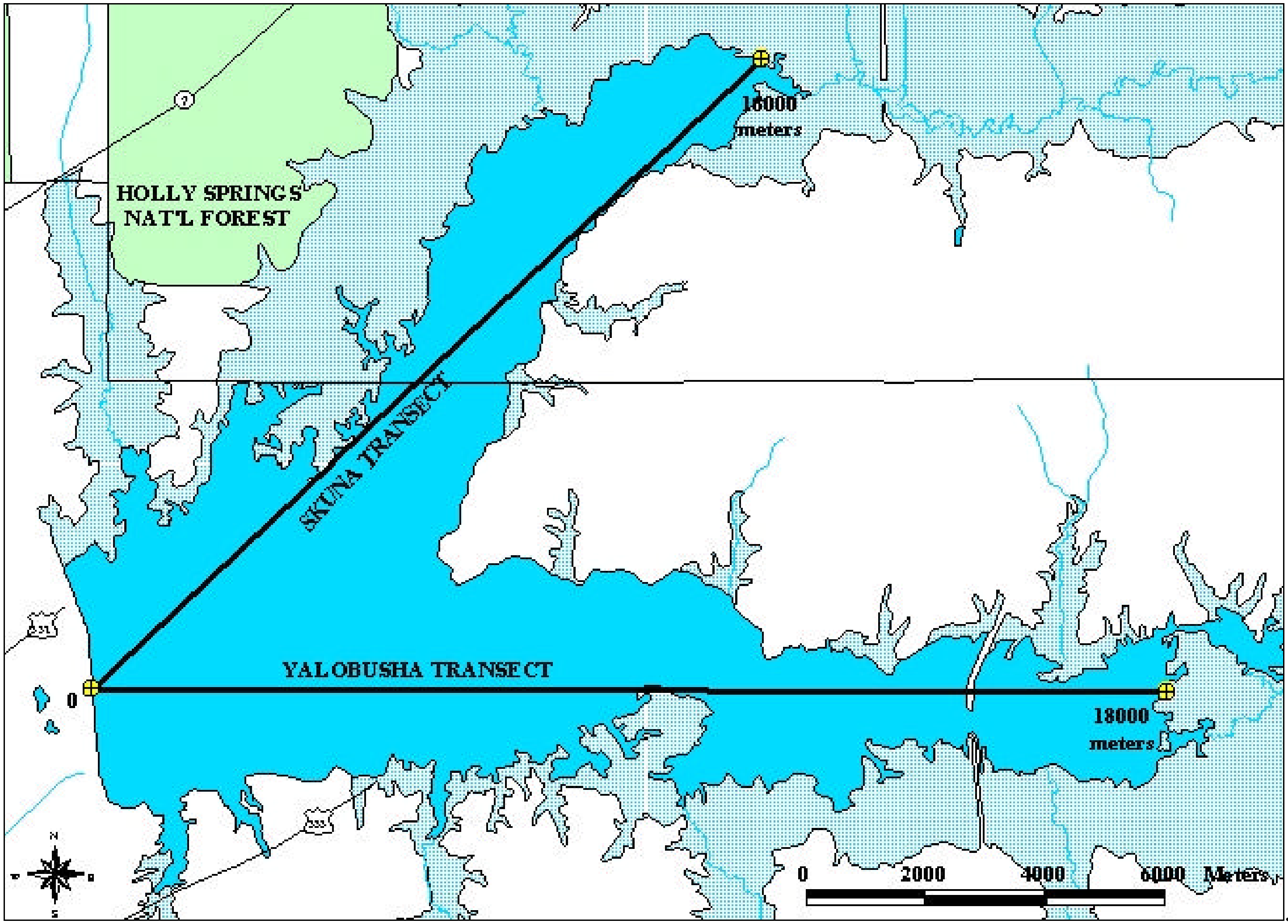


Figure 4-50. Map of Grenada Lake showing the Skuna and Yalobusha transects used to examine the spatial variation of agrichemicals contained in the sediments.

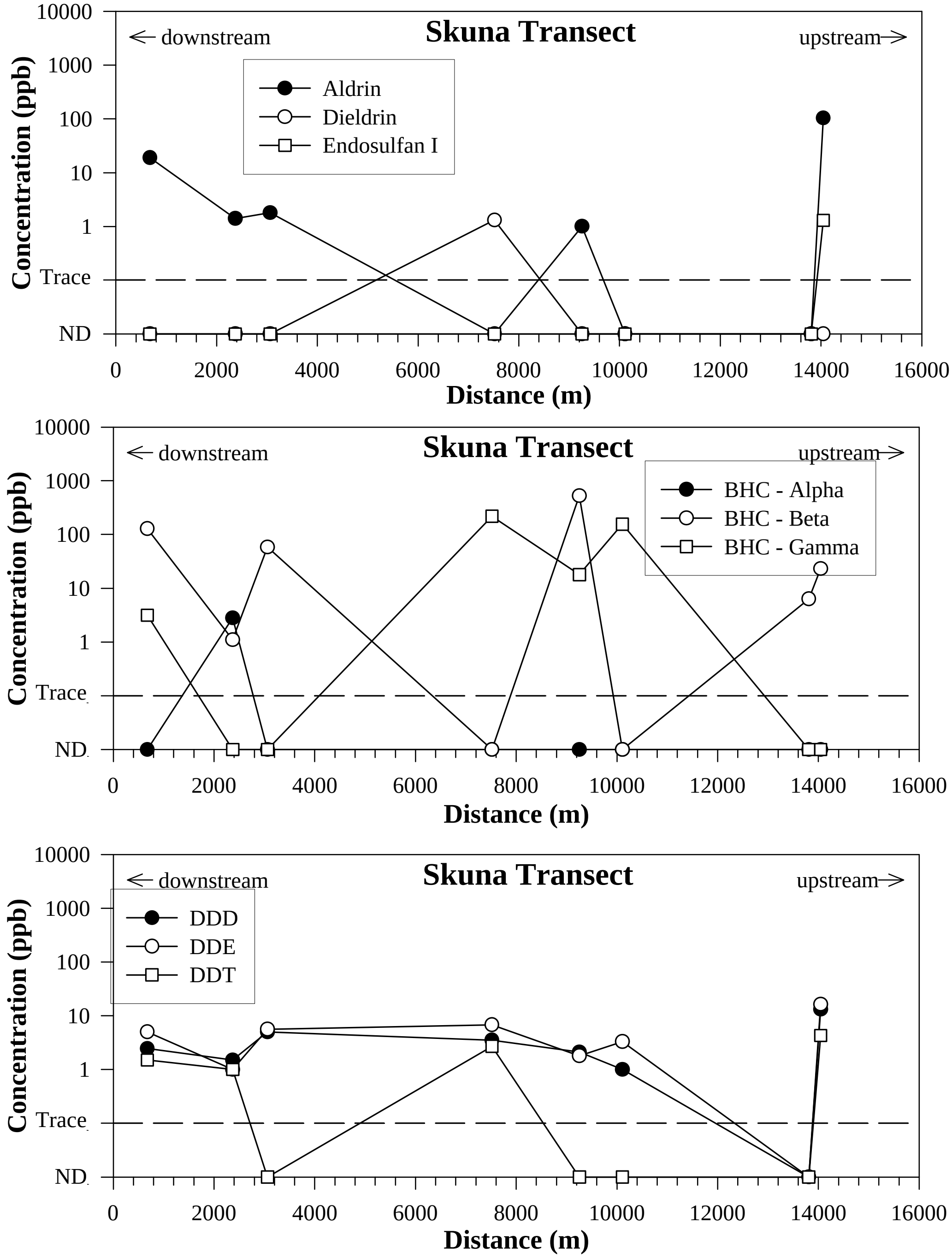


Figure 4-51. Variation of select agrichemical results (aldrin, dieldrin, endosulfan I, BHC-alpha, BHC-beta, BHC-gamma, DDD, DDE, and DDT) along the Skuna arm transect of Grenada Lake. Refer to Figures 4-50 and 3-2 for core locations.

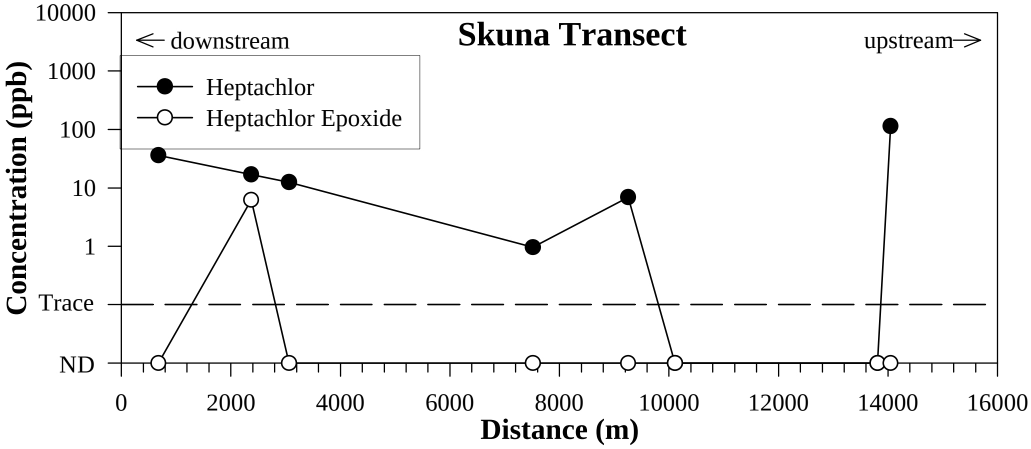


Figure 4-52. Variation of select agrichemical results (heptachlor and heptachlor epoxide) along the Skuna arm transect of Grenada Lake. Refer to Figures 4-50 and 3-2 for core locations.

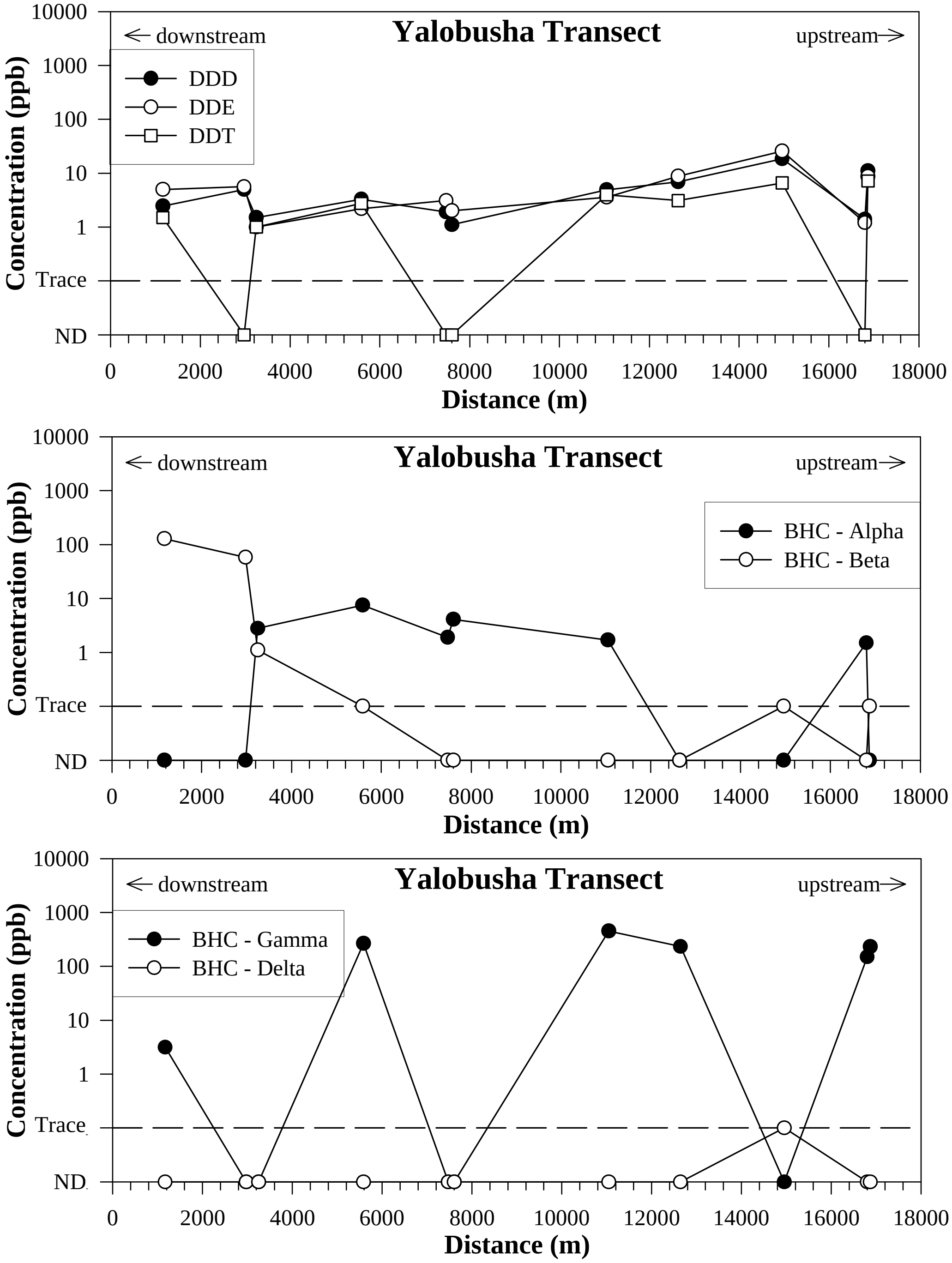


Figure 4-53. Variation of select agrichemical results (DDD, DDE, DDT, BHC-alpha, BHC-beta, BHC-gamma, and BHC-delta) along the Yalobusha arm transect of Grenada Lake. Refer to Figures 4-50 and 3-2 for core locations.

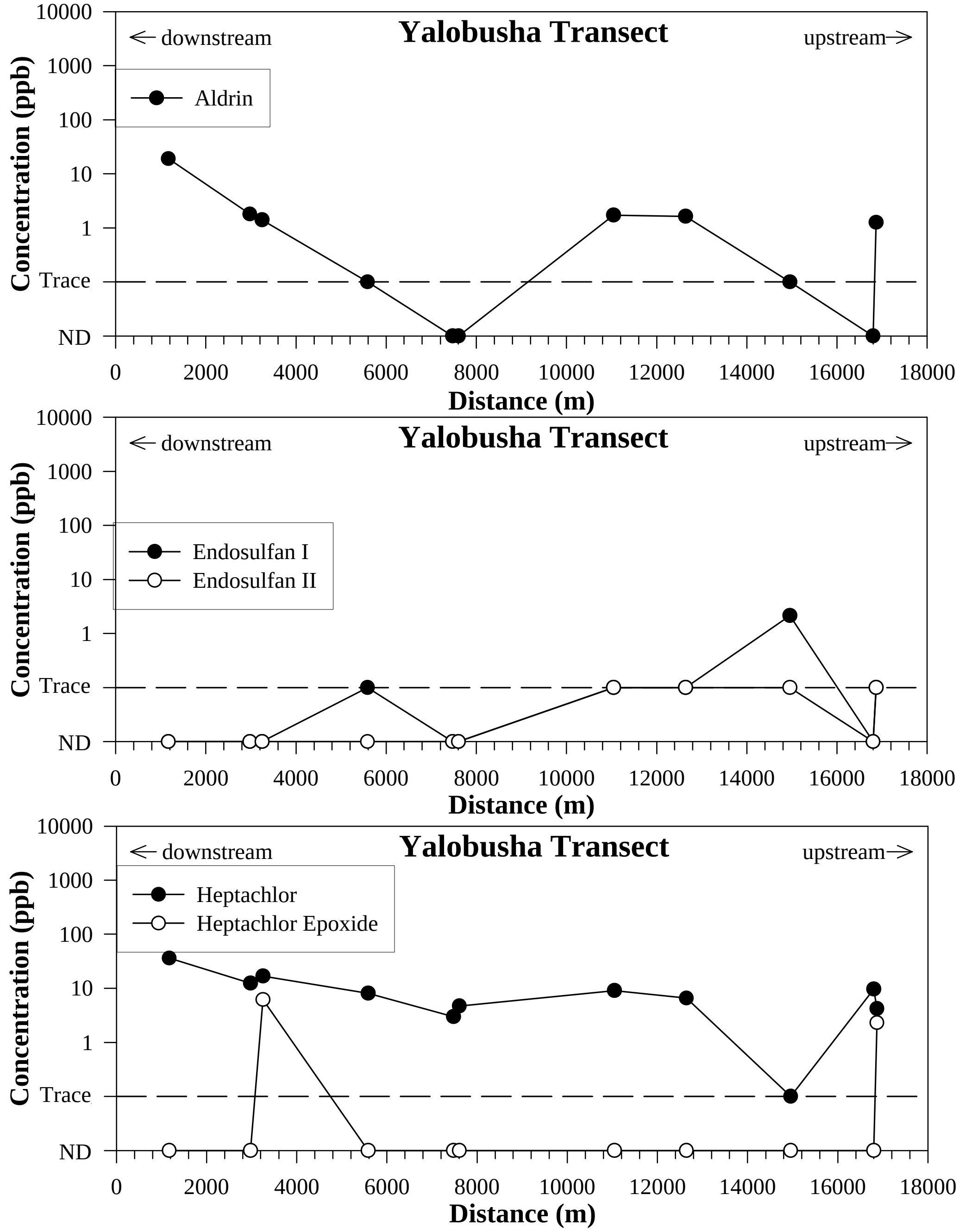


Figure 4-54. Variation of select agrichemical results (aldrin, endosulfan I, endosulfan II, heptachlor, and heptachlor epoxide) along the Yalobusha arm transect of Grenada Lake. Refer to Figures 4-50 and 3-2 for core locations.

5. CONCLUSIONS

Streams and rivers within the Yalobusha River basin, located in north-central Mississippi, have experienced severe erosion, bed incision, and channel widening due to channelization projects during the early 1900s and again in the 1950s and 1960s. Straightening of the Yalobusha River and Topashaw Creek has markedly altered the base level of these streams and promoted basin-wide degradation of the river channels. The primary results of this base level change were channel incision, bank destabilization, and channel widening. Large volumes of sediment and woody riparian vegetation were delivered to the flow and were transported through the river network. When the channelized, straightened Yalobusha River reaches met the natural, unchannelized meanders, the woody debris in transport was deposited. These processes, left unrequited for decades, resulted in the rapid accumulation of a large woody debris plug on the lower Yalobusha River downstream of Calhoun City. As much as 5 m of sediment and debris has accumulated vertically since 1967 and input of vegetation due to bank failure in the vicinity of major knickpoints is around 28 m^3/yr. This debris accumulation has significantly increased the magnitude, frequency, and severity of flooding within Calhoun City, MS.

Before the U.S. Army Corps of Engineers initiates debris plug removal and channel improvements, an assessment of sedimentation within Grenada Lake located downstream of the plug is required. This report summarizes research results collected to meet this need, and the main conclusions are listed below.

1. Forty-seven continuous sediment cores, ranging in length from 0.55 to 2.55 m, were collected within Grenada Lake. Select cores were analyzed for particle size, agrichemicals, bulk sediment chemistry, bulk sediment density, total carbon, and isotopes.

2. Discrimination of post-impoundment sediment (sediment deposited since dam construction) and pre-impoundment sediment (parent material or pre-existing sediment) was accomplished by (a) the use of chemical isotopes and their geochronological interpretation, and (b) variations in sediment texture and bulk density with depth. Two sediment cores were analyzed for radioactive lead (2^{10}Pb; 22-year half-life) and cesium (^{137}Cs; 30-year half-life) for the purpose of dating sediment horizons. The distributions of these isotopes were used to define the stratigraphic position of dam construction, i.e. 1954. Moreover, these timelines corresponded to depth variations in sediment texture and bulk density. That is, the post-impoundment sediments are enriched in clay (up to 80% by mass) and depleted in both silt (about 20% by mass) and sand (about 0% by mass) as compared to the parent or pre-impoundment materials. The interpretation of the physical and chemical characteristics of the sediment was based on whether the materials have accumulated since dam construction, and were dependent enriched in clay.

3. For the pre-impoundment materials of the Skuna River arm, sand content ranges from 5 to 50% by mass, silt content ranges from 50 to 75% by mass, and clay content ranges from 5 to 35% by mass. In general, there is more silt than clay in these deposits. The bulk density of the sediment ranges from 1500 to 1700 kg/m^3. Total organic content is generally 0.5 to 1.0 kg/m^2. For the post-impoundment material, sand content ranges from 5 to 10% by mass, silt

content ranges from 50 to 75% by mass, and clay content ranges from 25 to 75% by mass. In general, there is more clay than silt in these deposits. The bulk density of the sediment ranges from 1300 to 1400 kg/m^3 near the 1954 horizon, and decreases significantly toward the surface, attaining a value in the range of 100 to 500 kg/m^3. Total organic content is generally 0 to 1.5 kg/m^2, and near surface contents approach 0 kg/m^2.

4. For the pre-impoundment materials of the Yalobusha River arm, sand content ranges from 5 to 75% by mass, silt content ranges from 25 to 50% by mass, and clay content ranges from 5 to 35% by mass. In general, there is more silt than clay in these deposits. The bulk density of the sediment ranges from 1400 to 2000 kg/m^3. Total organic content is generally 0.5 to 2.0 kg/m^2. For the post-impoundment material, sand content ranges from 0 to 25% by mass, silt content ranges from 25 to 75% by mass, and clay content ranges from 25 to 75% by mass. In general, there is more clay than silt in these deposits. The bulk density of the sediment ranges from 1000 to 1500 kg/m^3 near the 1954 horizon, and decreases significantly toward the surface, attaining a value in the range of 100 to 300 kg/m^3. Total organic content is generally 0 to 2 kg/m^2, and near surface contents approach 0 kg/m^2.

5. Bulk chemical analysis of the sediment samples were performed incrementally on select cores. The concentrations of major elements such as aluminum (Al), calcium (Ca), iron (Fe), potassium (K), magnesium (Mg), phosphorus (P), and sulfur (S) are higher in the post-impoundment sediment as compared to the pre-impoundment sediment. The concentration of Na is about the same for both the pre- and post-impoundment sediments, but in the pool region its concentration in the post-impoundment sediments is about two times lower than found upstream. The concentration of S in the post-impoundment sediments is about three times higher than in the pre-impoundment materials, and in the pool region S concentrations in the post-impoundment sediments are eight to ten times higher than found upstream. The concentrations of most major elements show very good correlation with sediment texture. As sand content decreases and silt and clay contents increase, the concentrations of Al, Ca, Fe, K, Mg, Mn, P, and S increase by as much as 5 to 10 times. The concentration of Na is positively correlated to silt content, and non-linearly related to clay content.

6. The concentrations of environmentally important elements such as arsenic (As), cadmium (Cd), chromium, (Cr), copper (Cu), manganese (Mn), mercury (Hg), lead (Pb), selenium (Se), and zinc (Zn) are about two times higher in the post-impoundment sediment as compared to the pre-impoundment materials. Moreover, the highest concentrations of these elements occur in the post-impoundment sediments located in the pool region. The concentrations of EIE show good correlations with sediment texture. EIE concentrations are typically 5 to 15 times higher in the silt and clay dominated horizons as compared to the sand dominated horizons.

7. The cause for the increase in element concentration for both major elements and EIE is the post-impoundment sediment is due to sediment texture. These more recent sediments are enriched in clay, hence controlling the bulk sediment chemistry. Moreover, the concentrations of these elements are not atypical for agricultural watersheds in Mississippi.

8. Select sediment cores were analyzed for 25 agrichemicals and PCBs. These analyses were performed on composite (depth-averaged) sediment samples. Within the Grenada Lake, aldrin (up to 103 ppb), dieldrin (up to 3 ppb), endosulfan I (up to 2 ppb), BHC-alpha (up to 8 ppb), BHC-beta (up to 527 ppb), BHC-gamma (up to 451 ppb), DDD (up to 18 ppb), DDE (up to 26 ppb), DDT (up to 7 ppb), heptachlor (up to 114 ppb), and heptachlor epoxide (up to 6 ppb) are found in measurable concentrations. Compounds such as DDD, DDE, DDT, BHC-alpha, and heptachlor are found in nearly all sediment samples in comparable concentrations. The concentrations of these agrichemicals are not atypical for agricultural watersheds in Mississippi.

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Appendix: Summary of carcinogenic levels for chemicals and compounds.

IMPORTANT DISCLAIMER

The USDA-ARS National Sedimentation Laboratory does not advocate nor enforce the suggested regulatory levels for the chemicals and compounds listed. Other federal and state regulatory bodies with proper authority and jurisdiction can and will supersede the information provided herein. These data should not be used for any purpose other than for background information. The USDA-ARS National Sedimentation Laboratory is exonerated from any errors or inaccuracies reported herein.

Introduction

Summarized in table form is a listing of all chemicals and compounds analyzed in the report. There is no definitive source for toxicity levels for the chemicals and compounds, only sparse recommendations. The majority of the information comes from the U.S. Environmental Protection Agency Office of Water and can be found at the web address www.epa.gov/safewater/mcl.html (see also www.epq.gov/reg6rcei). Additional information can be obtained from Linda Faulk, EPA Region 6, falk.linda@epa.gov, tel. 214-665-8535.

Tables are subdivided into use of chemical (H is a herbicide, I is an insecticide), where and in what capacity the material is located (residential soils, Table A-1; industrial soils for an indoor worker, Table A-2; industrial soils for an outdoor worker, Table A-3; and ambient air and tap water, Table A-4), and the type of exposure (inhalation, application to skin (dermal), and ingestion). If there are no values listed for a particular chemical of compound, there are three possible reasons: (1) it may not be regulated by the EPA, and/or (2) it may be on the National Recommended Water Quality Criteria, and/or (3) it may be on the Final Revisions to the Unregulated Contaminant Monitoring List.

Key Definitions

The **National Primary Drinking Water Regulations** (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. Primary standards protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in public water systems.

Contaminants not included in the primary standards may be found in the **National Secondary Drinking Water Regulations** (NSDWRs or secondary standards). These standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, states may choose to adopt them as enforceable standards.

MCLG – Maximum Contaminant Level Goal is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health effect of persons would occur, and which allows for and adequate margin of safety. MCLGs are non-enforceable health goals.

MCL – Maximum Contaminant level is the permissible level of a contaminant in water, which is delivered to any user of a public water system. MCLs are enforceable standards. The margins of safety in MCLGs ensure that exceeding the MCL slightly does not pose significant risk to public health.

Cancer Risk – All levels reported are based on carcinogenicity risk of 10^{-6}. Alternate risk levels may be obtained by moving the decimal point.

Table A-1. Summary of carcinogenic levels for chemicals and compounds found in residential soils.

Compound/Chemical Name	Trade Name	Use	Inhale (ppm)	Dermal (ppm)	Ingest (ppm)
Alachlor	Lasso	H	110000	25	8
Aldrin	Aldrex	I	520	0.12	0.038
Arsenic (noncancer endpoint)					
Arsenic (cancer endpoint)			590	4.5	0.43
Atrazine	(multiple)	H	40000	9.1	2.9
Barium and compounds					
BHC Alpha		I			
BHC Beta		I			
BHC Delta		I			
BHC Gamma	Lindane	I			
Bifenthrin	Talstar	I			
Cadmium and compounds			1400		
Chlordane	(multiple)	I	25000	14	1.8
Chlorfenapyr	Pirate				
Chlorpyrifos	Lorsban	I			
Total Chromium (1/6 ratio Cr VI/ Cr III)			210		
Cyanazine		H	11000	2.4	0.76
λ-Cyhalothrin	Karate	I			
DDD	TDE	I	37000	28	2.7
DDE		I	26000	20	1.9
DDT	(multiple)	I	26000	20	1.9
Dieldrin	Dieldrex	I	550	0.13	0.04
Endosulfan-alpha	Endosulfan	I			
Endosulfan-beta		I			
Endosulfan Sulfate					
Endrin	Endrex	I			
Endrin Aldehyde					
Heptachlor	(same)	I	1900	0.45	0.14
Heptachlor Epoxide	(same)	I	970	0.22	0.70
Lead					
Mercury and compounds					
Mercury (elemental)					
Methyl Parathion	(same)	I			
Metolaclor	Dual	I			
Pendimethalin	Prowl	H			
Polychlorinated Biphenyls			4400	0.72	0.32
Aroclor 1016	PCBs		130000	21	9.1
Aroclor 1221	PCBs		4400	0.72	0.32
Aroclor 1232	PCBs		4400	0.72	0.32
Aroclor 1242	PCBs		4400	0.72	0.32

Table A-1 continued

Compound/Chemical Name	Trade Name	Use	Inhale (ppm)	Dermal (ppm)	Ingest (ppm)
Aroclor 1248	PCBs		4400	0.72	0.32
Aroclor 1254	PCBs				
Aroclor 1260	PCBs		4400	0.72	0.32
Selenium					
Silver and compounds					
Toxaphene	(multiple)	I	7900	1.8	0.58
Trifluralin	Treflan	H			
Zinc					

Table A-2. Summary of carcinogenic levels for chemicals and compounds found in industrial soils for an indoor worker.

Chemical/Compound Name	Trade Name	Use	Inhale (ppm)	Ingest (ppm)
Alachlor	Lasso	H	240000	100
Aldrin	Aldrex	I	1100	0.48
Arsenic (noncancer endpoint)				
Arsenic (cancer endpoint)			1300	5.5
Atrazine	(multiple)	H	86000	37
Barium and compounds				
BHC Alpha		I		
BHC Beta		I		
BHC Delta		I		
BHC Gamma	Lindane	I		
Bifenthrin	Talstar	I		
Cadmium and compounds			3000	
Chlordane	(multiple)	I	54000	23
Chlorfenapyr	Pirate			
Chlorpyrifos	Lorsban	I		
Total Chromium (1/6 ratio Cr VI/ Cr III)			450	
Cyanazine		H	22000	9.7
λ-Cyhalothrin	Karate	I		
DDD	TDE	I	78000	34
DDE		I	55000	24
DDT	(multiple)	I	55000	24
Dieldrin	Dieldrex	I	1200	0.51
Endosulfan-alpha	Endosulfan	I		
Endosulfan-beta		I		
Endosulfan Sulfate				
Endrin	Endrex	I		
Endrin Aldehyde				
Heptachlor	(same)	I	4100	1.8
Heptachlor Epoxide	(same)	I	2100	0.90
Lead				
Mercury and compounds				
Mercury (elemental)				
Methyl Parathion	(same)	I		
Metolaclor	Dual	I		
Pendimethalin	Prowl	H		
Polychlorinated Biphenyls			9400	4.1
Aroclor 1016	PCBs		270000	120
Aroclor 1221	PCBs		9400	4.1
Aroclor 1232	PCBs		9400	4.1
Aroclor 1242	PCBs		9400	4.1

Table A-2 continued

Chemical/Compound Name	Trade Name	Use	Inhale (ppm)	Ingest (ppm)
Aroclor 1248	PCBs		9400	4.1
Aroclor 1254	PCBs			
Aroclor 1260	PCBs		9400	4.1
Selenium				
Silver and compounds				
Toxaphene	(multiple)	I	17000	7.4
Trifluralin	Treflan	H		
Zinc				

Table A-3. Summary of carcinogenic levels for chemicals and compounds found in industrial soils for an outdoor worker.

Compound/Chemical Name	Trade Name	Use	Inhale (ppm)	Dermal (ppm)	Ingest (ppm)
Alachlor	Lasso	H	290000	67	44
Aldrin	Aldrex	I	1400	0.32	0.21
Arsenic (noncancer endpoint)					
Arsenic (cancer endpoint)			1600	12	2.4
Atrazine	(multiple)	H	110000	24	16
Barium and compounds					
BHC Alpha		I			
BHC Beta		I			
BHC Delta		I			
BHC Gamma	Lindane	I			
Bifenthrin	Talstar	I			
Cadmium and compounds			3700		
Chlordane	(multiple)	I	67000	39	10
Chlorfenapyr	Pirate				
Chlorpyrifos	Lorsban	I			
Total Chromium (1/6 ratio Cr VI/ Cr III)			560		
Cyanazine		H	28000	6.5	4.3
λ-Cyhalothrin	Karate	I			
DDD	TDE	I	98000	75	15
DDE		I	69000	53	11
DDT	(multiple)	I	69000	53	11
Dieldrin	Dieldrex	I	1500	0.34	0.22
Endosulfan-alpha	Endosulfan	I			
Endosulfan-beta		I			
Endosulfan Sulfate					
Endrin	Endrex	I			
Endrin Aldehyde					
Heptachlor	(same)	I	5200	1.2	0.79
Heptachlor Epoxide	(same)	I	2600	0.60	0.39
Lead					
Mercury and compounds					
Mercury (elemental)					
Methyl Parathion	(same)	I			
Metolaclor	Dual	I			
Pendimethalin	Prowl	H			
Polychlorinated Biphenyls			12000	1.9	1.8
Aroclor 1016	PCBs		340000	55	51
Aroclor 1221	PCBs		12000	1.9	1.8
Aroclor 1232	PCBs		12000	1.9	1.8
Aroclor 1242	PCBs		12000	1.9	1.8

Table A-3 continued

Compound/Chemical Name	Trade Name	Use	Inhale (ppm)	Dermal (ppm)	Ingest (ppm)
Aroclor 1248	PCBs		12000	1.9	1.8
Aroclor 1254	PCBs				
Aroclor 1260	PCBs		12000	1.9	1.8
Selenium					
Silver and compounds					
Toxaphene	(multiple)	I	21000	4.9	3.3
Trifluralin	Treflan	H			
Zinc					

Table A-4. Summary of carcinogenic levels for chemicals and compounds found in ambient air and tap water.

Compound/Chemical Name	Trade Name	Use	Ambient Air Cancer Risk (ppb)	Tap Water MCLG (ppb)	Tap Water MCL (ppb)	Tap Water Cancer Risk (ppb)
Alachlor	Lasso	H	0.084		2.0	0.84
Aldrin	Aldrex	I	0.00039			0.004
Arsenic (noncancer endpoint)					50	
Arsenic (cancer endpoint)			0.00045			0.045
Atrazine	(multiple)	H	0.031	3.0	3.0	0.3
Barium and compounds				2000	2000	
BHC Alpha		I				
BHC Beta		I				
BHC Delta		I				
BHC Gamma	Lindane	I				
Bifenthrin	Talstar	I				
Cadmium and compounds			0.0011	5.0	5.0	
Chlordane	(multiple)	I	0.019		2.0	0.19
Chlorfenapyr	Pirate					
Chlorpyrifos	Lorsban	I				
Total Chromium (1/6 ratio Cr VI/ Cr III)			0.00016	100	100	
Cyanazine		H	0.0080			0.080
λ-Cyhalothrin	Karate	I				
DDD	TDE	I	0.028			0.28
DDE		I	0.020			0.20
DDT	(multiple)	I	0.020			0.20
Dieldrin	Dieldrex	I	0.00042			0.0042
Endosulfan-alpha	Endosulfan	I				
Endosulfan-beta		I				
Endosulfan Sulfate						
Endrin	Endrex	I		2.0	2.0	
Endrin Aldehyde						
Heptachlor	(same)	I	0.0015		0.10	0.015
Heptachlor Epoxide	(same)	I	0.00074		0.20	0.0074
Lead					15	

Table A-4 continued

Compound/Chemical Name	Trade Name	Use	Ambient Air Cancer Risk (ppb)	Tap Water MCLG (ppb)	Tap Water MCL (ppb)	Tap Water Cancer Risk (ppb)
Mercury and compounds				2.0	2.0	
Mercury (elemental)						
Methyl Parathion	(same)	I				
Metolaclor	Dual	I				
Pendimethalin	Prowl	H				
Polychlorinated Biphenyls			0.0034		0.50	0.034
Aroclor 1016	PCBs		0.096			0.96
Aroclor 1221	PCBs		0.0034			0.034
Aroclor 1232	PCBs		0.0034			0.034
Aroclor 1242	PCBs		0.0034			0.034
Aroclor 1248	PCBs		0.0034			0.034
Aroclor 1254	PCBs					
Aroclor 1260	PCBs		0.0034			0.034
Selenium				50	50	
Silver and compounds						
Toxaphene	(multiple)	I	0.0060		3.0	0.061
Trifluralin	Treflan	H				
Zinc						