GEOLOGICAL SURVEY OF CANADA

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Data for ^{210}Pb dating of four peat cores from the vicinity of Detour Lake and Kinosheo Lake, Ontario, and Fort Simpson, Northwest Territories

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Data for the ^{210} Pb dating of four peat cores from the vicinity of Detour Lake and Kinosheo Lake, Ontario, and Fort Simpson, Northwest Territories.

This Open File report consists of a 78 page report, including 7 appendices, summarizing ^{210}Pb dating theory and methodology and presenting analytical results for the four peat cores.

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INTRODUCTION

Over the last fifteen years there has been considerable interest in dating peat using ^{210}Pb methods to gain insights for interpreting anthropogenic inputs of metals into the environment for understanding carbon cycling in peatlands (Pakarinen and Tolonen, 1977a,b; Aaby et. al., 1978; Oldfield et. al., 1979; El-Daoushy et. al., 1982; Binford, 1984; El-Daoushy and Tolonen, 1984; Malmer and Holm, 1984; Appleby et. al., 1988; Cole et. al., 1990; Urban et. al., 1990; Ohlson and Dahlberg, 1991; Norton et al., 1997; Jensen, 1997). As part of several environmental research initiatives at Geological Survey of Canada, peat cores were collected in northern Ontario and the Northwest Territories and analyzed to examine heavy metal distribution and cycling. To provide a geochronological framework for interpreting these data, surface peat from selected cores was dated using ^{210}Pb methods and the underlying peat from selected intervals using radiocarbon techniques. In this open file report, the ^{210}Pb data, including the calculated dates, for peat from four surface cores are presented. Two cores were analyzed from bogs near Detour Lake and Kinosheo Lake in northeastern Ontario, and two from a bog and fen near Fort Simpson, Northwest Territories (Fig. 1; Turner, 1994, 1995, 1996a, 1996b).

The use of ^{210}Pb dating methods is based on their being a relationship between depth and age in peat. However, some caution is needed when using ^{210}Pb dates because results from some studies listed above show that this relationship may be complicated. For example, the growth rate of peat may change from year to year due to changes in climate. Vegetation species also affects the growth rate, the decomposition rate, and the ability of organic materials to retain metals. Another factor is the compaction of organic remnants from the increasing weight of overlying material and of biological decay (humification). In addition, there is some evidence that the mobility of lead in peat is influenced by changes in the location of the water table.

CORE SITE LOCATIONS

The three study peatlands are located in the boreal forest region (National Wetland Working Group, 1986). Cores were collected from the Detour Lake (49° 59.58'N; 79° 53.97'W) and Kinosheo Lake (~~55°~~ 51° 33.00'N; 81° 48.85'W) peatlands in August, 1993. The Detour Lake site (Fig. 1), located 190 km north northeast of Timmins, Ontario, is a small bog covered with stunted black spruce. The core for ^{210}Pb dating was collected from a hummock. Less than a metre away in the flat part of the same bog, another core was collected through the complete peat sequence (120 cm). Also wood at 118 cm in the complete sequence was dated at 7280 +/- 70 BP using radiocarbon methods (Beta-70-113). The distribution of macrofossils, pollen, and trace and minor elements in peat from the Detour Lake and Kinosheo Lake bogs was examined (Kettles et al., in press) and Pb isotope ratios were determined for peat from the Detour Lake bog (Kettles and Bell, 1996).

The Kinosheo Lake core site (Fig. 1), which lies 200 km north northwest of the Detour Lake site, is a *Sphagnum* bog with sedges and sparse ericaceous shrubs. The Kinosheo Lake core for ^{210}Pb dating was collected from a hummock. Less than a metre away in the flat part of the bog another core through the complete peat sequence was also collected (Kettles et al., in press). In the complete core, the boundary between peat and the underlying glacial till was intercepted at 254, cm and peat at 251 cm was dated at 4000 +/- 80 BP using radiocarbon techniques. The Kinsoheo Lake peatland was an important site for a wetland ecosystems project (Jeglum and Cowell, 1982) and the Northern Wetlands Study (NOWES) (Glooschenko, et al. 1994).

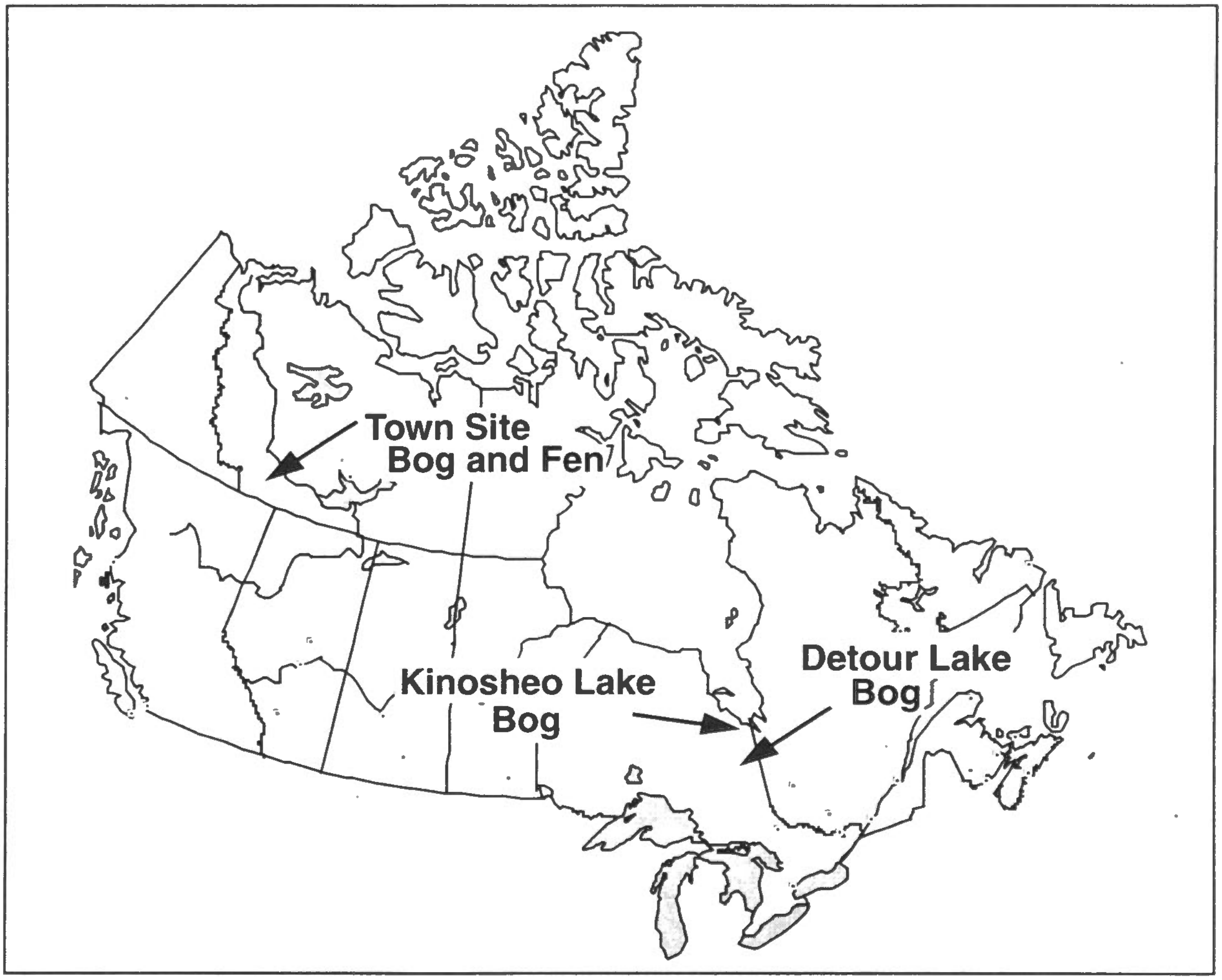

Figure 1. Map of Canada showing core site locations.

The underlying bedrock at Kinosheo Lake bog is flat-lying Devonian limestone, while at Detour Lake bog it is Precambrian metasedimentary bedrock (Ontario Geological Survey of Canada, 1991). Overlying the bedrock at both sites is calcareous silty till, derived primarily from Paleozoic carbonate bedrock in the Hudson and James Bay regions (Dredge and Cowan, 1989). Aerial photographs show that the two bogs developed in low-lying areas in fluted till plains; peatlands dominate the Kinosheo Lake area but form only a minor component of the landscape near Detour Lake.

Peat cores were collected from a peatland located 5 kilometres southwest of Fort Simpson (61° 48.397'N; 121° 20.876'W) in July, 1995. The Fort Simpson site (Fig. 1), referred to as the Town Site, is a bog-fen complex in a sand dune area. Peat for ^{210}Pb dating was collected from the active layer of a frozen peat plateau (bog) and from the surface of an unfrozen fen. In the peat plateau core, the sand and peat interface was intercepted at 75 cm and, in the fen core, at 105 cm. Peat between 102 and 105 cm in the fen was dated at 1380 +/- 80 BP (GSC-6069) using radiocarbon methods and peat between 75.4 and 79.5 cm in the peat plateau at 1410 +/- 50 (GSC-6078).

Fort Simpson lies at the confluence of the Liard and Mackenzie Rivers and is underlain by Devonian shale and siltstone (Douglas, 1959). The area was covered by Glacial Lake Mackenzie during the last deglaciation and extensive areas of sand dunes formed on the delta surface soon after the lake drained.

METHODOLOGY

Core Preparation

The cores were cut into the depth intervals described in Table 1, using a stainless steel knife and placed in cold storage. Later, in the Geological Survey of Canada laboratory, they were subsectioned using a stainless steel electric knife into slices that were generally 0.2 to 0.7 cm thick (Table 1). Twenty-five slices were analyzed from the Detour Lake core, 23 from the Kinosheo Lake core, 24 from the Town Site bog core, and 25 from the Town Site fen core. The core samples were weighed, dried, re-weighed, and then homogenized in a food processor and sent to Burlington, Ontario, for dating. The weights were used to calculate the cumulative dry weight, water content, and uncompacted depth (see Appendices A and B; Delorme, 1991).

Specific gravity was determined using an automated Accupyc pycnometer (Micrometrics, 1992). Mean specific gravity for each core was based on 10 samples and 50 determinations (see Appendix C, this report).

Laboratory Procedures for ^{210}Pb Dating

Homogeneous portions of peat samples (Table 2; including 2 sets of replicates) from the four cores were analyzed for ^{210}Po. 0.2 g portions of peat were mixed with approximately 10 dpm/ml of ^{209}Po spike in a beaker. The ^{209}Po spike was prepared on September 6, 1991 at 6.07 dpm/ml activity. The peat was digested in concentrated HNO_3 under reflux (to destroy organic material), then boiled down and digested with two HCl treatments to remove any remaining traces of HNO_3.

Table 1. Measured Depth Intervals for Core Slices from Four Study Cores

Detour Lake Bog Core				Kinosheo Lake Bog Core				Town Site Fen Core				Town Site Bog Core			
Slice	Segment (cm)	Slice	Segment (cm)	Slice	Segment (cm)	Slice	Segment (cm)	Slice	Segment (cm)	Slice	Segment (cm)	Slice	Segment (cm)	Slice	Segment (cm)
1	0.0-0.6	23	11.1-11.5	1	0.0-0.2	19	11.0-11.7	1	0-1.5	31	15.45-15.95	1	0-2.0	24	21.5-22.5
2	0.6-1.0	24	11.5-11.8	2	0.2-0.6	20	11.7-12.4	2	1.5-2.0	32	15.95-16.45	2	2.0-2.5	25	22.5-23.0
3	1.0-1.5	25	11.8-12.5	3	0.6-1.3	21	12.4-13.0	3	2.0-3.0	33	16.45-16.95	3	2.5-4.0	26	23.0-23.5
4	1.5-2.0	26	12.5-13.3	4	1.3-1.9	22	13.0-13.5	4	3.0-3.5	34	16.95-17.3	4	4.0-5.0	27	23.5-24.5
5	2.0-2.4	27	13.3-14.0	5	1.9-2.5	23	13.5-14.1	5	3.5-4.0	35	17.3-17.85	5	5.0-6.0	28	24.5-25.0
6	2.4-2.9	28	14.0-14.7	6	2.5-3.1	24	14.1-14.6	6	4.0-4.5	36	17.85-18.45	6	6.0-6.5	29	25.0-25.5
7	2.9-3.5	29	14.7-15.3	7	3.1-3.7	25	14.6-15.2	7	4.5-4.9	37	18.45-19.05	7	6.5-8.0	30	25.5-26.3
8	3.5-4.0	30	15.3-15.9	8	3.7-4.3	26	15.2-15.9	8	4.9-5.3	38	19.05-19.65	8	8.0-9.0	31	26.3-27.0
9	4.0-4.5	31	15.9-16.5	9	4.3-4.9	27	15.9-16.6	9	5.3-5.8	39	19.65-20.2	9	9.0-10.5	32	27.0-27.6
10	4.5-5.0	32	16.5-16.9	10	4.9-5.7	28	16.6-17.5	10	5.8-6.4	40	20.2-20.75	10	10.5-11.25	33	27.5-28.3
11	5.0-5.5	33	16.9-17.4	11	5.7-6.6	29	17.5-18.3	11	6.4-6.9	41	20.75-22.45	11	11.25-12.5	34	28.3-28.9
12	5.5-6.0	34	17.4-17.9	12	6.6-7.3	30	18.3-18.9	12	6.9-7.3	42	22.45-23.05	12	12.5-13.5	35	28.9-29.5
13	6.0-6.5	35	17.9-18.4	13	7.3-8.0	31	18.9-19.5	13	7.3-7.8	43	23.05-23.5	13	13.5-14.0	36	30.0-31.2
14	6.5-7.1	36	18.4-18.9	14	8.0-8.5	32	19.5-20.1	14	7.8-8.2	44	23.5-24.4	14	14.0-14.5	37	31.2-32.1
15	7.1-7.6	37	18.9-19.4	15	8.5-9.0	33	20.1-20.7	15	8.2-8.7	45	24.4-25.3	15	14.5-15.0	38	32.1-33.2
16	7.6-8.1	38	19.4-19.9	16	9.0-9.7	34	20.7-21.4	16	8.7-9.2	46	25.3-26.5	16	15.0-16.0	39	33.2-34.0
17	8.1-8.6	39	19.9-20.5	17	9.7-10.4	35	21.4-22.2	17	9.2-9.6	47	26.5-27.5	17	16.0-16.25	40	34.0-34.8
18	8.6-9.1	40	20.5-21	18	10.4-11.0	36	22.2-23.0	18	9.6-10	48	27.5-28.6	18	16.25-17.5	41	34.8-35.4
19	9.1-9.6	41	21-21.5					19	10.0-10.4	49	28.6-29.7	19	17.5-18.5	42	35.4-35.9
20	9.6-10.1	42	21.5-22					20	10.4-10.8	50	29.7-30.7	20	18.5-19.25	43	35.9-36.6
21	10.1-10.6	43	22-22.5					21	10.8-11.2	51	30.7-31.7	21	19.25-20.0	44	36.6-37.1
22	10.6-11.1							22	11.2-11.6	52	31.7-32.75	22	20.0-20.5	45	37.1-38.6
								23	11.6-11.9	53	32.75-33.8	23	20.5-21.5		
								24	11.9-12.35	54	33.8-34.9				
								25	12.35-12.85	55	34.9-36.0				
								26	12.85-13.3	56	36.0-37.0				
								27	13.3-13.8	57	37.0-38.2				
								28	13.8-14.4	58	38.2-39.3				
								29	14.4-14.8	59	39.3-40.4				
								30	14.8-15.45	60	40.4-41.5				
										61	41.5-43.0				

The polonium was then plated from the remaining solution onto a finely polished silver disk. The disk was counted in an alpha spectrometer. ^{209}Po was identified by its 4.88 MeV alpha particle, and ^{210}Po by its 5.305 MeV alpha particle. The ^{210}Po counts obtained from the spectrometer were compared to the ^{210}Po counts (of known activity) to determine the activity of ^{210}Po in the peat sample.

^{210}Pb Dating Theory

Dating of lacustrine, riverine and marine sediments, peatlands, and glacial ices has been actively pursued for several decades (Crozaz and Langway, 1966; Bruland et. al., 1974; Robbins and Edgington, 1975; Matsumoto, 1975; Eakins and Morrison, 1976; Appleby and Oldfield, 1978; and Farmer, 1978; Chanton et. al., 1983; El-Daoushy, 1986b). The ^{210}Pb method is generally used to determine the average accumulation rate over a period of 100 to 200 years. From the accumulation rate, the age of the sediment from a particular depth in the sediment sequence can be estimated.

^{210}Pb is a naturally occuring radioactive element that is part of the ^{238}U decay series (Faure, 1986). Included in the ^{238}U series is ^{222}Rn, which, if produced as a ^{222}Rn gas in soils close to the soil/air interface, escapes to the atmosphere before further decay. After several days residence time in the atmosphere, the ^{222}Rn naturally decays to ^{218}Po which over a period of hours or days falls to the earth with dust and rain. Over a period of minutes and a number of subsequent radioactive decays, ^{210}Pb (half-life = 22.3 years) is produced. The ^{210}Pb becomes permanently fixed onto sediment particles or into organic matter and within 2 years, ^{210}Po, the grandaughter of ^{210}Pb, is in secular equilibrium with ^{210}Pb.

Several methods have been devised to measure the ^{210}Pb accumulation rates which are discussed in Joshi (1989). Accumulation rates are derived using either the CIC (constant initial concentration of unsupported ^{210}Pb; Robbins and Edgington, 1975; Matsumoto, 1975) or the CRS (constant rate of supply; Appleby and Oldfield, 1978) model. The CIC model assumes a constant accumulation rate over the time period in which unsupported ^{210}Pb is measured. The CRS model assumes a variable accumulation rate. Both models assume a constant flux of unsupported ^{210}Pb to the interface of accumulation. Depth can be corrected for compaction in the CIC model using porosity measurements in sediments, otherwise cumulative dry weight is used. Compaction is accounted for in the CRS model by dealing with cumulative dry weight instead of depth.

The profile of ^{210}Pb in a accumulating core of material (sediment or peat) can be described as follows (Turner and Delorme, 1996):

$$A_{Tx} = (A_{Uo})e^{-\lambda t} + A' \qquad (1i)$$

where A_{Tx} is the total activity of ^{210}Pb in the sample in pCi/g dry weight (wt) at depth x, and of age t.

A' is the activity of ^{210}Pb supported by ^{226}Ra in pCi/g dry wt (represented by constant ^{210}Po activities attained at depth),

A_{Uo} is the unsupported activity of ^{210}Pb at the interface of accumulation (i.e. sediment/water interface or peat surface) in pCi/g dry wt,

λ is the radioactive decay constant for ^{210}Pb

($0.693/22.26\ yr^{-} = 0.0311\ /yr^{-}$),

And since $A_{Ux} = A_{Tx} - A'$ then $A_{Ux} = (A_{Uo})e^{-\lambda t}$ (1ii)

where A_{Ux} is the unsupported activity of ^{210}Pb in the sample in pCi/g dry wt at depth x.

The Constant Initial Concentration (CIC) Model:

In the following derivations, equations which refer to the usage of cumulative dry weight instead of uncompacted depth in the CIC model are designated with an 'a'.

In the CIC model, uncompacted mid-depth, z, can be used instead of natural depth, x, to compensate for material (sediment or peat) compaction. Otherwise cumulative dry weight is used. The uncompacted mid-depth is calculated from uncompacted thickness (Delorme 1991). (Uncompacted thickness is the thickness of a slice if it were to have a water content equal to that of the surface sample.)

$$t_{ui} = \{(\phi_o - \phi_i)/(1 - \phi_o)\} + (TV_i / V_q) \qquad (2)$$

where t_{ui} is the uncompacted thickness of the i^{th} sample,

ϕ_i is the porosity of the i^{th} sample expressed as a fraction

ϕ_o is the porosity at the interface of accumulation calculated by regressing the top four sample porosities (ϕ_i) against natural mid-depth, and ϕ_o = y intercept,

TV_i is the total volume of the i^{th} sample,

V_q is the volume of a cylinder 1 cm high and surface area equal to either the inside of the core tube or the stainless steel extrusion ring, whichever is appropriate.

The CIC model assumes a constant accumulation rate (or mass accumulation rate) over the time period in which unsupported ^{210}Pb is measured, thus

$$t = z/S_o \quad (3)$$

$$t = c/\omega \quad (3a)$$

where S_o is the accumulation rate in cm/yr at the interface of accumulation (sediment/water interface or peat surface)

z is uncompacted mid-depth,

c is cumulative dry weight in g/cm^2,

ω is the mass accumulation rate in $g/cm^2/yr$.

The total ^{210}Pb activity at the interface of accumulation is:

$$A_{To} = (P/\omega) \qquad (4)$$

where P is the flux of ^{210}Pb at the interface of accumulation in $pCi/cm^2/yr$, (assumed constant).

Substituting equations (3) [and (3a)] and (4) into equation (1a) gives:

$$A_{Tz} = (P/\omega)e^{-z\lambda/S_o} + A' \qquad (5)$$

or

$$A_{Tx} = (P/\omega)e^{-c\lambda/\omega} + A' \qquad (5a)$$

Equation (5) or [5(a)] can be simplified using natural logarithms:

$$\ln(A_{Tz} - A') = \ln(P/\omega) - (\lambda/S_o)z \qquad (6)$$

$$\ln(A_{Tx} - A') = \ln(P/\omega) - (\lambda/\omega)c \qquad (6a)$$

The form of the equation is $y = b + (m)\,x$

A graphical solution for P/ω (the y-intercept) and λ/S_o [or (λ/ω)] (the slope of the line) is possible from a plot of x and y {z vs $\ln(A_z - A')$} [or c vs $\ln(A_x - A')$] (see Figures 3,4,5). As λ is known, then S_o [or ω] can be calculated.

$$S_o = \lambda/\text{slope} = \lambda/(m) \qquad (7)$$

$$\omega = \lambda/\text{slope} = \lambda/(m) \qquad (7a)$$

When using uncompacted depth, the mass accumulation rate ω ($g/cm^2/yr$) is represented by:

$$\omega = S_o (1 - \phi_o) \rho_s = S_i (1 - \phi_i) \rho_s \quad (8)$$

where ρ_s is the density of the solid phase of the sample (assumed constant) and

S_i is the accumulation rate (cm/yr) at a given uncompacted mid-depth z.

The flux at the interface of accumulation P (pCi/cm²/yr) can be calculated from the y-intercept and mass accumulation rate.

$$P = \omega (e^b) \quad (9)$$

Using equation (6) [or (6a)] the time 't' in years since the sample was deposited is given by:

$$t = \frac{\ln (A_{Tz} - A') - \ln(P/\omega)}{(-\lambda)} = \frac{z}{S_o} \quad (10)$$

or

$$t = \frac{\ln (A_{Tx} - A') - \ln(P/\omega)}{(-\lambda)} = \frac{c}{\omega} \quad (10ai)$$

which can be written as:

$$t = -\frac{1}{\lambda} \ln \frac{(A_{Tz}-A')}{A_{To}} = \frac{z}{S_o} \text{ or } = \frac{c}{\omega} \quad (10aii)$$

The uncompacted mid-depth (cm) divided by the accumulation rate (cm/yr) [or cumulative dry weight, (g/cm²) divided by mass accumulation rate (g/cm²/yr)] gives t.

<u>The Constant Rate of Supply (CRS) Model</u>:

Since the CRS model assumes a constant rate of supply, then

$$P = A_{Ui} * \omega_t \qquad (11)$$

where P is the flux of ^{210}Pb at the interface of accumulation in $pCi/cm^2/yr$, (assumed constant)

A_{Ui} is the initial activity of unsupported ^{210}Pb in material (sediment or peat) of age t

ω_t is the dry Mass Accumulation Rate ($g/cm^2/yr$) at time t.

Material (sediment or peat) laid down during time period δt occupies a layer of thickness (δx):

$$\delta x = \frac{\omega_t}{\rho_x} \delta t \qquad (12)$$

were ρ_x is the dry mass/unit wet volume of the sample (g/cm^3)

at depth x.

$$\rho_x = \frac{d\omega}{dx} \qquad (13)$$

The rate of change of depth is

$$x' = \frac{\omega}{\rho_x} \tag{14}$$

where ' denotes differentiation with regards to t.

and $$x' \rho_x = \omega = x'_o \rho_o \tag{15}$$

Equation (15) combines with (1b) to give

$$x' \rho_x A_{Ux} = x'_o \rho_o (A_{Uo}) e^{-\lambda t} \tag{16}$$

Let $$B(x) = \int_X^{\infty} \rho_x * A_{Ux}\, dx = \int_X^{\infty} A_{Ux}\, d\omega \tag{17}$$

represent the total residual or cumulative unsupported ^{210}Pb beneath materials of depth x,

and $$B(0) = \int_0^{\infty} \rho_o * A_{Uo}\, dx = \int_0^{\infty} A_{Uo}\, d\omega \tag{18}$$

represent the total residual unsupported ^{210}Pb in the sediment column, then

$$B(x) = B(0) e^{-\lambda t} \tag{19}$$

The age of layer at depth x is thus:

$$t = -\frac{1}{\lambda} \ln \frac{B(x)}{B(0)} \qquad (20)$$

where B(x) and B(0) are calculated by direct numerical integration of the ^{210}Pb profile (the plot of unsupported activity versus cumulative dry weight).

The mass accumulation rate is calculated by dividing the change in the mid-sample cumulative dry weight by the difference of time in years for the sample analyzed.

The mean ^{210}Pb supply rate (flux) is calculated from

$$P = \lambda B(0) \qquad (21)$$

Quality Assurance/Quality Control

Quality Assurance: Collection and Preparation of Core Samples

Collection, weighing, drying, homogenization and sub-sampling of the peat was carried out by Geological Survey of Canada personnel. Errors in the calculation uncompacted depth will be present because of the nature of peat and the misrepresentation of the "porosity" calculation. The calculation for uncompacted depth assumes that the volume represented by each peat section consists of dry material (peat) and water (similar to a sediment core), the amounts of which are determined by the wet and dry weights. Using this method, the large amount of air contained in peat which takes up volume but does not have weight, is not considered.

Test runs for quality control on the alpha spectrometry equipment for the Detour Lake core were last done in October, 1994, for the Kinosheo Lake core in January, 1995, and for the Town Site cores in February, 1996.

Quality Control: Contamination and Method Checks

Blanks (no sample, no spike), were run through the same analytical procedures as samples, to determine if there was contamination from analytical reagents. Blanks, prepared at the same time as the peat samples, exhibited a background activity of 0.03 dpm when run in all detectors, an activity comparable to empty sample holders.

Yield tracer solutions (no sediment sample) were also run through the analytical procedure. No counts above background were detectable in the ^{210}Po region of the spectra for disks prepared using only the spike (no sample), indicating no polonium (^{210}Po) contamination in the analyses from spike solutions.

Quality Assurance: System Checks

The alpha spectrometer has been monitored since May of 1988. Sample chambers are examined on a monthly basis for contamination. Empty sample holders give a background count rate of 0.01 dpm which equals the equipment specifications.

RESULTS

Table 2 lists the ^{210}Po activities for the 25 samples prepared for the Detour Lake Bog core, the 23 samples for the Kinosheo Lake Bog core, the 24 samples from the Town Site Bog core, the 25 samples from the Town Site Fen core. Figure 2 shows the ^{210}Po activity profiles with cumulative dry weight for each of the above sites, respectively. The profile of the Town Site Fen core (Fig. 2) shows markedly high levels in activity in the first four samples of the core. Decreases of activity start with sample 6 and proceed over the lower part of the core.

Reproducibility of Results

Two slices from each of the four cores had the analysis for ^{210}Po repeated, as shown Table 3.

^{210}Pb Analysis Using the CIC model

For the first CIC model (CIC1), the unsupported activity of the Detour Lake and Kinosheo Lake cores is plotted against uncompacted mid-depth (Figures 3a and 4a) using the expanded equation (6). For the Detour Lake core, the y-intercept is $\ln(P/\omega) = 2.9659$ and the slope of the line (λ/So) is -0.1120, based on the graphical solution (see Appendix D1). Samples 2 to 19 were used to calculate an average accumulation rate of 0.28 cm/yr, an average mass accumulation rate of 0.02 $g/cm^2/yr$ and a flux of 0.40 $pCi/cm^2/yr$. For the Kinosheo Lake core, the y-intercept is $\ln(P/\omega) = 3.4012$ and the slope of the line (λ/So) is -0.1664 (see Appendix D2). Samples 1 to 18 were used to calculate an average accumulation rate of 0.19 cm/yr, an average mass accumulation rate of 0.01 $g/cm^2/yr$ and a flux of 0.27 $pCi/cm^2/yr$.

Table 2. Activity of ^{210}Po in Four Study Cores

Core Site	Slice Number	Cum. Dry Wt. (g/cm^2)	Uncomp. Mid Depth cm	^{210}Po Activity (dpm/g)	Detector Number	Core Site	Slice Number	Cum. Dry Wt. (g/cm^2)	Uncomp. Mid Depth cm	^{210}Po Activity (dpm/g)	Detector Number
Detour L. Bog	2	0.09	1.26	34.8	1	Kinosheo L. Bog	1	0.02	0.54	37.7	1
Detour L. Bog	3	0.13	1.92	41.3	1	Kinosheo L. Bog	2	0.05	1.83	35.2	2
Detour L. Bog	4	0.16	2.57	39.0	1	Kinosheo L. Bog	3	0.09	3.02	39.2	1
Detour L. Bog	6	0.24	3.87	32.9	2	Kinosheo L. Bog	4	0.11	3.74	39.5	1
Detour L. Bog	7	0.27	4.34	27.4	2	Kinosheo L. Bog	6	0.16	4.69	35.8	2
Detour L. Bog	8	0.32	4.84	21.2	1	Kinosheo L. Bog	8	0.20	5.58	34.6	3
Detour L. Bog	9	0.35	5.45	21.2	1/2/3	Kinosheo L. Bog	10	0.25	6.84	24.8	3
Detour L. Bog	10	0.41	6.17	21.2	3	Kinosheo L. Bog	12	0.31	7.87	22.2	1/2/3
Detour L. Bog	11	0.46	6.95	19.1	3	Kinosheo L. Bog	14	0.36	9.06	19.7	1
Detour L. Bog	12	0.49	7.60	19.0	1	Kinosheo L. Bog	16	0.42	10.13	14.5	3
Detour L. Bog	13	0.53	8.21	22.9	1	Kinosheo L. Bog	18	0.47	11.38	13.7	2
Detour L. Bog	14	0.56	8.73	21.8	3	Kinosheo L. Bog	20	0.53	12.40	13.7	1
Detour L. Bog	15	0.60	9.23	22.4	1	Kinosheo L. Bog	22	0.58	13.56	11.7	3
Detour L. Bog	20	0.79	12.15	20.5	3	Kinosheo L. Bog	24	0.64	14.57	11.5	2
Detour L. Bog	25	1.03	15.28	16.0	2	Kinosheo L. Bog	26	0.70	15.70	8.3	1
Detour L. Bog	30	1.33	19.70	9.2	2	Kinosheo L. Bog	28	0.81	17.93	6.3	1/2/3
Detour L. Bog	32	1.39	20.97	8.1	2	Kinosheo L. Bog	30	0.88	19.53	4.0	2
Detour L. Bog	35	1.50	22.62	5.1	1	Kinosheo L. Bog	32	0.96	21.25	3.0	3
Detour L. Bog	37	1.60	23.94	5.7	1/2/3	Kinosheo L. Bog	36	1.13	24.59	2.2	2
Detour L. Bog	40	1.70	25.61	3.3	3						
Detour L. Bog	43	1.79	27.30	4.5	1						

Table 2. Activity of ^{210}Po in Four Study Cores (cont.)

Core Site	Slice Number	Cum. Dry Wt. (g/cm^2)	Uncomp. Mid Depth cm	^{210}Po Activity (dpm/g)	Detector Number	Core Site	Slice Number	Cum. Dry Wt. (g/cm^2)	Uncomp. Mid Depth cm	^{210}Po Activity (dpm/g)	Detector Number
Town Site Bog	1	0.03	n/a	41.4	2	Town Site Fen	1	0.06	n/a	11.8	2
Town Site Bog	2	0.05	n/a	25.6	1	Town Site Fen	2	0.12	n/a	17.7	1
Town Site Bog	3	0.12	n/a	19.7	2	Town Site Fen	3	0.21	n/a	20.2	3
Town Site Bog	4	0.21	n/a	17.4	1/2/3	Town Site Fen	4	0.30	n/a	21.4	1/2/3
Town Site Bog	5	0.30	n/a	14.2	3	Town Site Fen	5	0.35	n/a	22.0	3
Town Site Bog	6	0.36	n/a	14.5	3	Town Site Fen	6	0.39	n/a	19.6	3
Town Site Bog	7	0.43	n/a	19.2	1	Town Site Fen	7	0.45	n/a	16.5	1
Town Site Bog	8	0.48	n/a	14.1	3	Town Site Fen	8	0.50	n/a	14.1	2
Town Site Bog	9	0.54	n/a	11.2	3	Town Site Fen	9	0.55	n/a	12.8	3
Town Site Bog	10	0.61	n/a	11.8	1	Town Site Fen	10	0.61	n/a	12.3	1/2
Town Site Bog	11	0.71	n/a	7.7	1	Town Site Fen	11	0.67	n/a	9.8	2/3
Town Site Bog	12	0.80	n/a	4.9	2	Town Site Fen	12	0.74	n/a	6.2	1/2
Town Site Bog	13	0.84	n/a	1.3	1	Town Site Fen	13	0.80	n/a	5.0	2/3
Town Site Bog	14	0.88	n/a	4.2	2	Town Site Fen	14	0.86	n/a	3.4	2/3
Town Site Bog	15	0.92	n/a	1.4	3	Town Site Fen	15	0.93	n/a	2.8	1
Town Site Bog	16	1.02	n/a	2.6	1	Town Site Fen	16	0.98	n/a	2.0	2
Town Site Bog	18	1.15	n/a	0.9	1/2/3	Town Site Fen	17	1.03	n/a	1.3	3
Town Site Bog	20	1.35	n/a	0.5	2	Town Site Fen	18	1.07	n/a	1.5	1/2/3
Town Site Bog	30	2.81	n/a	0.5	3	Town Site Fen	19	1.12	n/a	1.0	2
Town Site Bog	44	4.40	n/a	0.9	1	Town Site Fen	20	1.15	n/a	0.9	1
						Town Site Fen	60	5.28	n/a	0.5	3

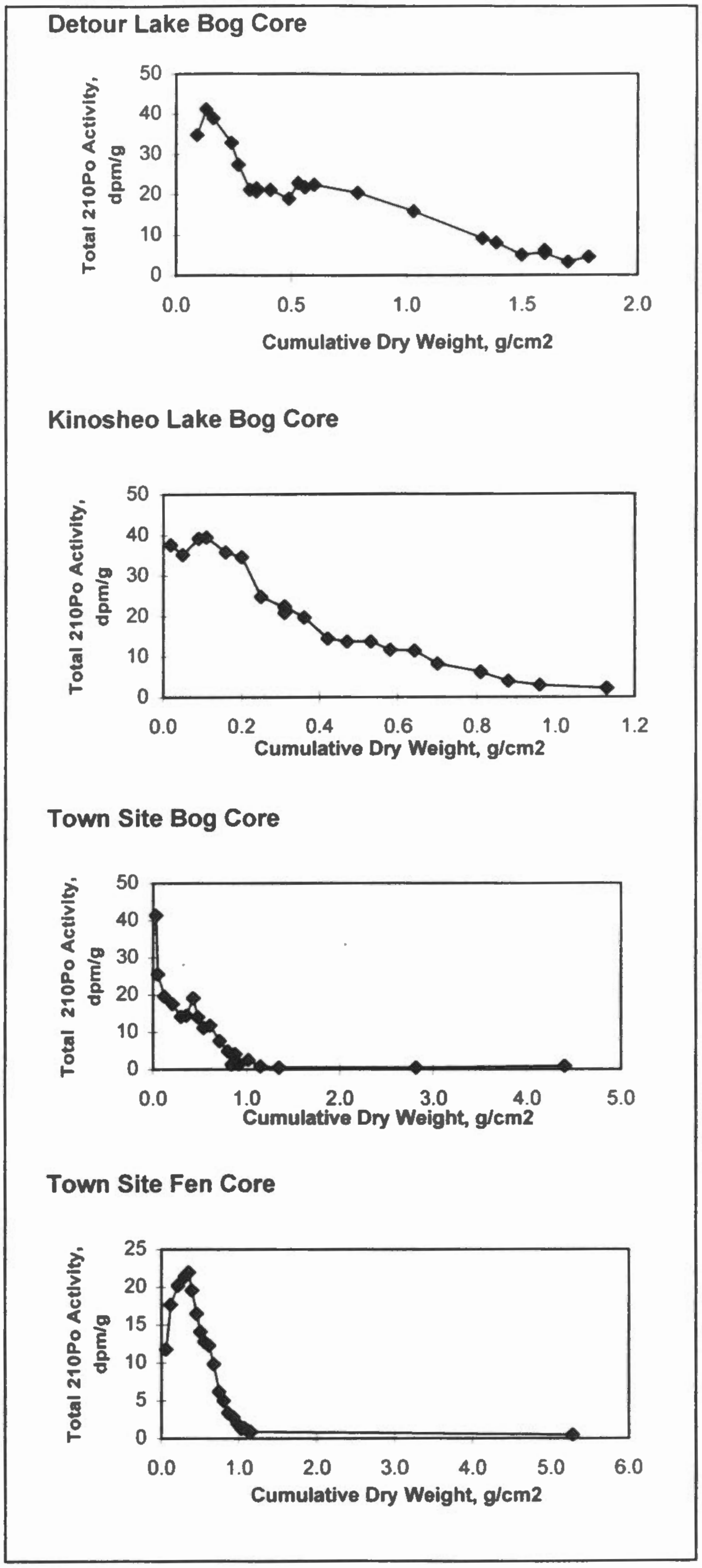

Figure 2. Distribution of total ^{210}Po activity in dpm/g in relation to cumulative dry weight for four study cores

Table 3. Reproducibility of Sample Analyses from the Four Cores

Core	Slice Number	Uncompacted Mid Depth (cm)	^{210}Po Activity Mean±Std Deviation (dpm/g)
Detour L. Bog	9	5.45	21.2 ± 1.9
Detour L. Bog	9R	5.45	20.8 ± 0.3
Detour L. Bog	9R2	5.45	21.6 ± 0.6
Detour L. Bog	37	23.94	5.7 ± 0.5
Detour L. Bog	37R	23.94	6.2 ± 0.7
Detour L. Bog	37R2	23.94	5.4 ± 0.2
Kinosheo L. Bog	12	7.87	22.2 ± 0.3
Kinosheo L. Bog	12R	7.87	20.8 ± 0.8
Kinosheo L. Bog	12R2	7.87	22.4 ± 0.5
Kinosheo L. Bog	28	17.93	6.3 ± 0.6
Kinosheo L. Bog	28R	17.93	6.1 ± 0.1
Kinosheo L. Bog	28R2	17.93	6.1 ± 0.4
Town Site Bog	4	n/a	17.4 ± 0.1
Town Site Bog	4R	n/a	15.9 ± 0.6
Town Site Bog	4R2	n/a	19.5 ± 0.4
Town Site Bog	18	n/a	0.9 ± 0.1
Town Site Bog	18R	n/a	0.7 ± 0.1
Town Site Bog	18R2	n/a	0.9 ± 0.1
Town Site Fen	4	n/a	21.4 ± 0.7
Town Site Fen	4R	n/a	21.4 ± 0.4
Town Site Fen	4R2	n/a	21.4 ± 0.1
Town Site Fen	18	n/a	1.5 ± 0.2
Town Site Fen	18R	n/a	1.5 ± 0.1
Town Site Fen	18R2	n/a	1.2 ± 0.1

The mean dates calculated for each section of the Detour Lake and Kinosheo Lake cores, based on a division of the uncompacted mid-depth by the accumulation rate (equation 3), are given in Appendices G1 and G2. The '+/-' values are two standard deviations based on data calculated for the top, bottom, and mid-depth of the sample.

On account of the errors involved in the calculation of the uncompacted depth for the Town Site Bog and Fen cores, the CIC1 model (which uses this parameter) could not be used for activitiy profile analysis.

For the second CIC model (C1C2), the unsupported activity of the four cores is plotted against cumulative dry weight (Fig. 3b, 4b, 5a, 6a) using the expanded equation (6a). The y-intercept for the Detour Lake core is $\ln(P/\omega) = 2.9120$ and the slope of the line (λ/ω) is -1.6727, based on the graphical solution (see Appendix E1). Samples 2 to 19 were used to calculate an average mass accumulation rate of 0.02 $g/cm^2/yr$ and a flux of 0.34 $pCi/cm^2/yr$. For the Kinosheo Lake core, the y-intercept is $\ln(P/\omega) = 3.1816$ and the slope of the line (λ/ω) is -3.5678 (see Appendix E2). Samples 1 to 18 were used to calculate an average mass accumulation rate of 0.01 $g/cm^2/yr$ and a flux of 0.21 $pCi/cm^2/yr$. The y-intercept of the Town Site Bog core is $\ln(P/\omega) = 2.9111$ and the slope of the line (λ/ω) is -3.4862 (See Appendix E3). Samples 1 to 16 were used to calculate an average mass accumulation rate of 0.01 $g/cm^2/yr$ and a flux of 0.16 $pCi/cm^2/yr$.

Several attempts were made to calculate the accumulation rate of the Town Site Fen core. On the initial attempt, samples 1 to 21 were used (Fig. 6a). However, decreased activity in samples 1 to 4 caused problems with the fit. The fit was optimized by removal of samples 1 to 4. Based on the

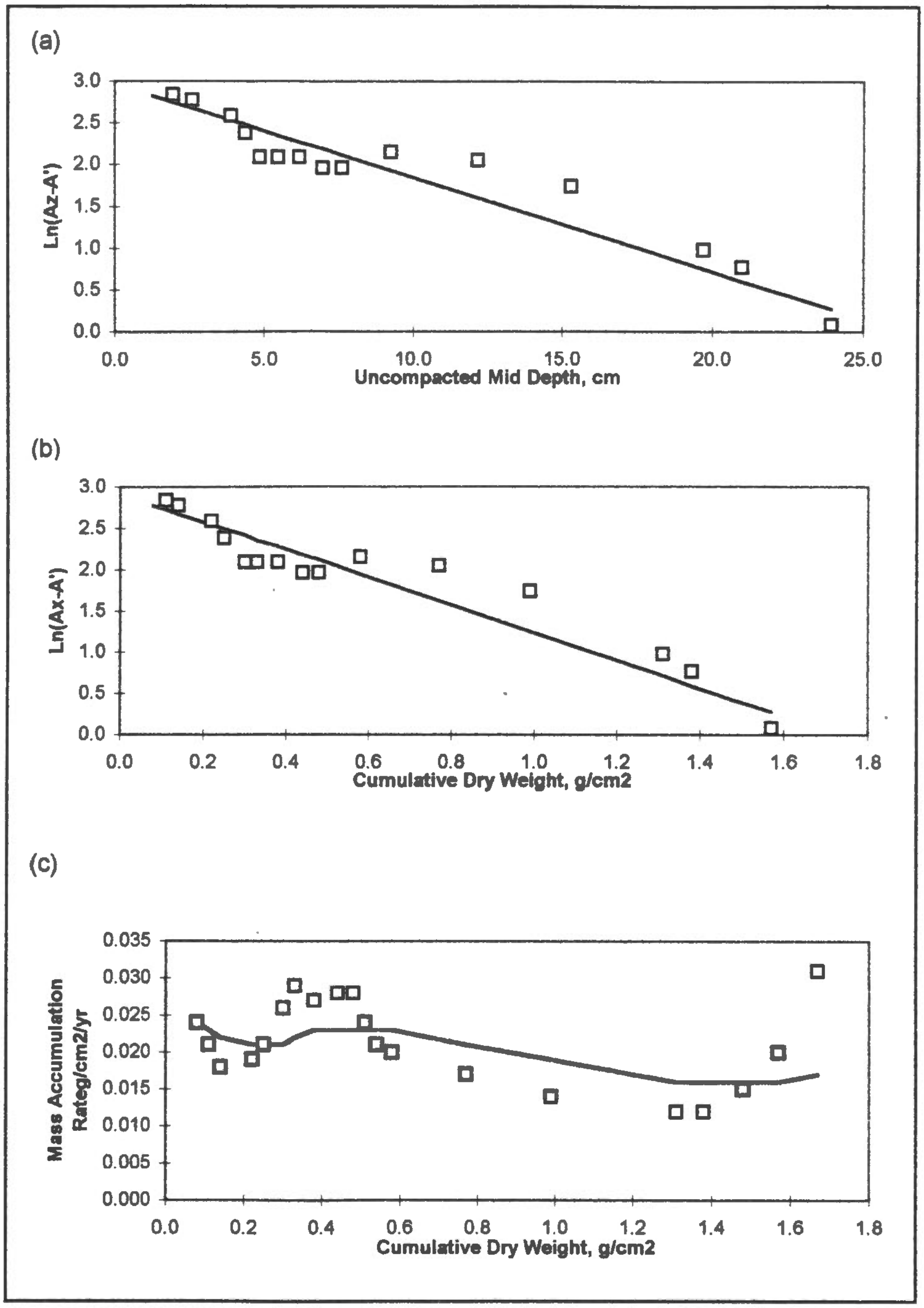

Figure 3. (a) The distribution of uncompacted mid-depth against ln(Az-A') for the Detour Lake Bog Core. The y-intercept of the regression line=2.9659, the slope=-0.1120.

(b) The distribution of cumulative dry weight against ln(Ax-A') for the Detour Lake Bog Core. The y-intercept of the regression line=2.9120 and the slope=-1.6727.

(c) Plot of mass accumulation rate versus cumulative dry weight for the Detour Lake Bog core. Points represent mass accumulation rates determined from integrated area defined by activity and cumulative dry weight for the sample. The line represents the running mean of mass accumulation rate.

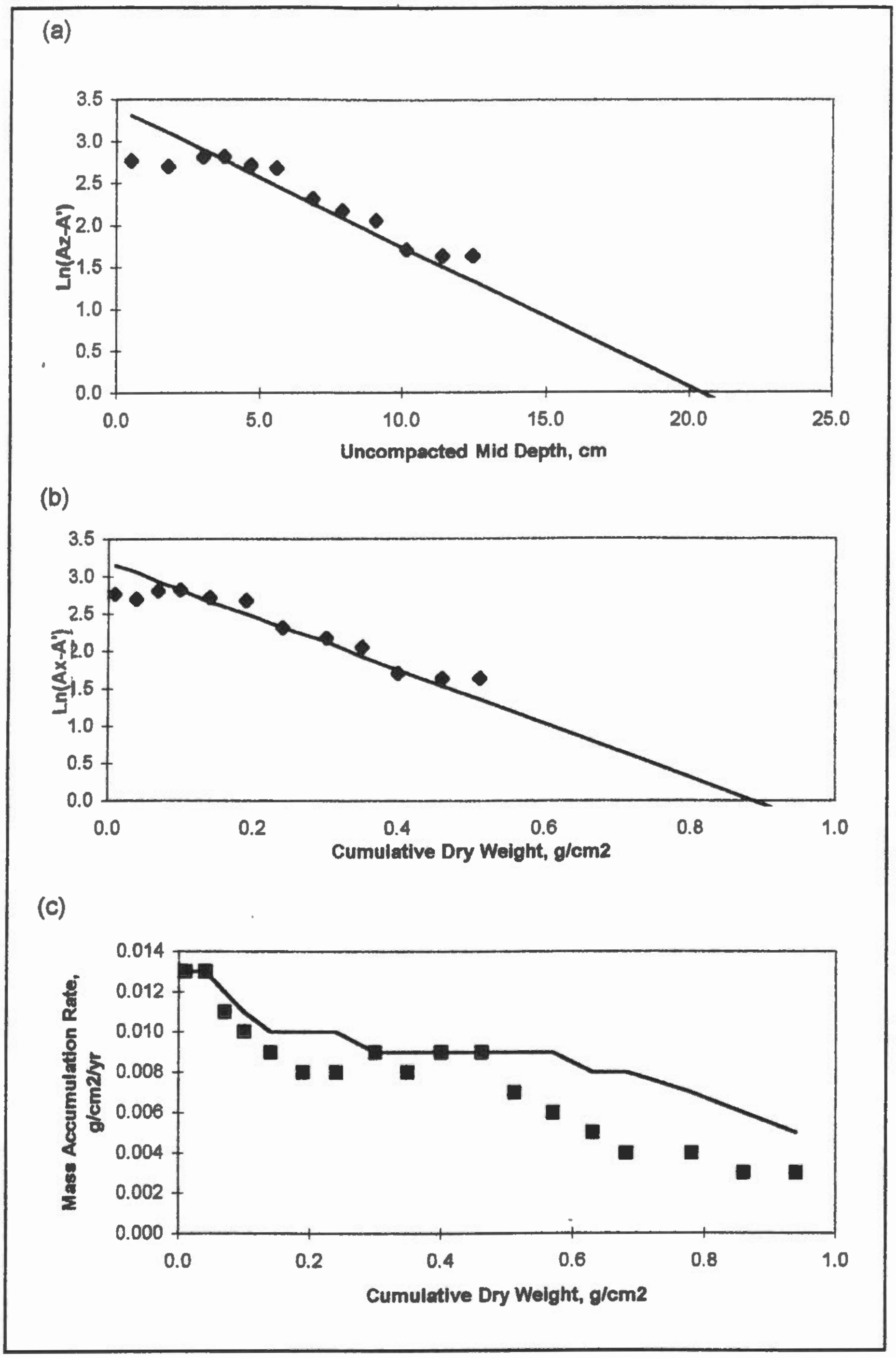

Figure 4. (a) The distribution of uncompacted mid-depth against ln(Az-A') for the Kinosheo Lake Bog Core. The y-intercept of the regression line=3.4012, the slope=-0.1664.

(b) The distribution of cumulative dry weight against ln(Ax-A') for the Kinosheo Lake Bog Core. The y-intercept of the regression line=3.1816 and the slope=-3.5678.

(c) Plot of mass accumulation rate versus cumulative dry weight for the Kinosheo Lake Bog core. Points represent mass accumulation rates determined from integrated area defined by activity and cumulative dry weight for the sample. The line represents the running mean of mass accumulation rate.

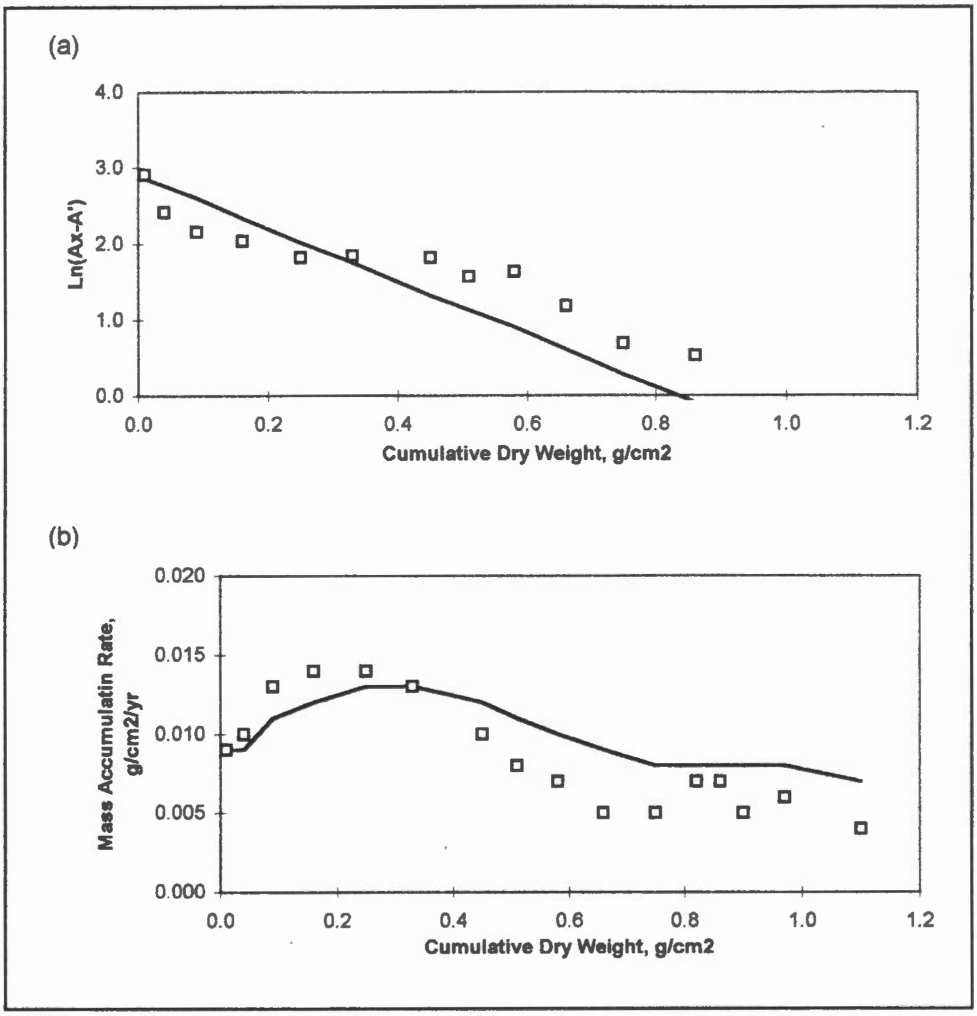

Figure 5. (a) The distribution of cumulative dry weight against ln(Ax-A') for the Town Site Bog Core. The y-intercept of the regression line=2.9111, the slope=-3.4862.

(b) Plot of mass accumulation rate versus cumulative dry weight for the Town Site Bog core. Points represent mass accumulation rates determined from integrated area defined by activity and cumulative dry weight for the sample. The line represents the running mean of mass accumulation rate.

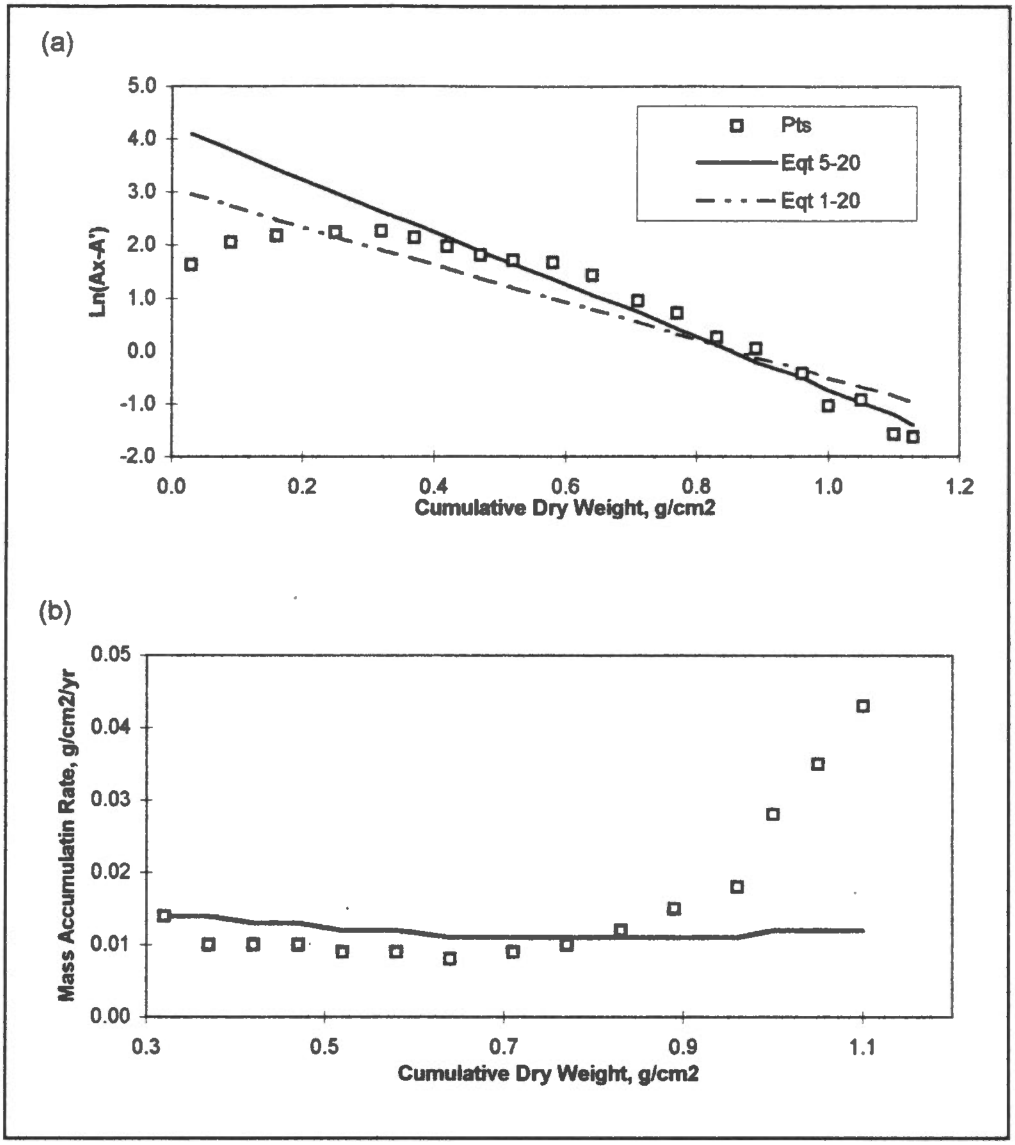

Figure 6. (a) The distribution of cumulative dry weight against ln(Ax-A') for the Town Site Fen Core. The dotted line represents the regression fit of points 1-20. The solid line represents the regression fit of points 5-20. The y-intercept of the solid regression line=4.2482, the slope=-4.9770.

(b) Plot of mass accumulation rate versus cumulative dry weight for the Town Site Fen core. Points represent mass accumulation rates determined from integrated area defined by activity and cumulative dry weight for the sample. The line represents the running mean of mass accumulation rate.

graphical solution, the y-intercept is ln $(P/\omega) = 4.2482$ and the slope of the line (λ/ω) is -4.9770 (see Appendix E4). Samples 5 to 20 were used to calculate an average mass accumulation rate of 0.01 $g/cm^2/yr$ and a flux of 0.44 $pCi/cm^2/yr$.

The dates calculated for each section of the four cores, based on a division of the cumulative dry weight by the mass accumulation rate (equation 3a) are given in Appendices G1, G2, G3, and G4. The '+/-' values are two standard deviations based on data calculated for the top, bottom, and mid-section of the sample.

Ideally, the CIC1 and CIC2 models should give almost identical results. A difference in the mass accumulation rates and atmospheric fluxes determined from the CIC1 and CIC2 models for a core usually indicates a problem in the calculation of uncompacted mid-depth (i.e. it may indicate a change in lithology that was not completely accounted for by porosity or specific gravity measurements). The calculation of "uncompacted depth" for peat is a problem in and of itself, as the concept and the calculation of uncompacted depth must be applied differently than for a sediment core. A comparison of the mass sedimentation and atmospheric flux rates for the Detour Lake Bog and Kinosheo Lake cores shows good agreement. However, the dates calculated for the Kinosheo Lake Bog core are in poor agreement.

^{210}Pb Analysis Using the CRS Model

For the CRS model, the unsupported activity of the four cores is plotted against cumulative dry weight (Figs. 3b. 4b, 5a, 6a). The profile for each is integrated to determine B(0) and B(x) and calculate time (see Appendices F1, F2, F3, and F4) according to equation 20. Since for the Detour Lake, Kinosheo Lake, and Town Site Fen cores not all samples were analyzed for ^{210}Pb activity, a multiple regression analysis was performed to obtain the dates for each core section as given in Appendices G1, G2, and G4. For the Detour Lake core, samples 1 to 21 were used in this example to calculate an average mass accumulation rate of 0.02 +/-0.006 $g/cm^2/yr$ and flux of 0.36 $pCi/cm^2/yr$. Samples 1 to 19 from the Kinosheo Lake core were used for a rate of 0.01 +/- 0.002 $g/cm^2/yr$ and flux of 0.21 $pCi/cm^2/yr$, samples 1 to 17 from the Town Site Bog core for a rate of 0.01 ± 0.003 $g/cm^2/yr$ and flux of 0.16 pCi/cm^2yr, and samples. For the Town Site Fen core, samples 1 to 20 were used to calculate a rate of 0.02 +/- 0.010 $g/cm^2/yr$ and flux of 0.18 $pCi/cm^2/yr$, while using samples 5 to 20 (as done for the CIC2 model above) gave a rate of 0.02 +/- 0.010 $g/cm^2/yr$ and a flux of 0.19 $pCi/cm^2/yr$.

The variation in mass accumulation rate in the four cores is illustrated in Figures 3c, 4c, 5b, and 6b. In the Detour lake core (Fig. 3c), variability is observed in the upper 0.5 g/cm^2. As well, a trend of increasing accumulation rate is observed with cumulative dry weight above 1.4 g/cm^2. The Kinosheo Lake core (Fig. 4c) shows an uneven pattern of decrease in accumulation with depth. For the Town Site Bog core (Fig. 5b), there appears to be a slight variation in accumulation rate near the core surface which decreases with increasing depth. The variation in mass accumulation rate in the Town Site Fen core (Fig. 6b) is illustrated for the samples 5-20 run. Between points 5 and 13 for this core, the mass accumulation rate is fairly constant but the rate starts to increase below point 13. This increase could be real or could be caused by the increasing error involved in estimating the integrated activity near the base of the activity profile.

Comparison of CIC and CRS ^{210}Pb Analysis

Table 4 lists mass accumulation and atmospheric flux rates for the four cores as calculated from the CIC and CRS models. For the Detour Lake and Kinosheo Lake cores, the rates are in good agreement. The mass accumulation and atmospheric flux rates were calculated from only the CIC2 and CRS models for the Town Site Bog and Fen cores. Although the rates from the Town Site Bog core are in excellent agreement, the mass accumulation rate is shown to have been greater than the average in the upper part of the core and less in the lower part (Fig.5b). For the Town Site Fen core, the rates are not in agreement. The year corresponding to individual sections of the four cores (Appendices G1, G2, G3, and G4) as determined by the CIC and CRS models are plotted against cumulative dry weight in Figures 7a, 7b, 7c, and 7d.

Due to the possible variability in the growth rates of ombrotrophic peats, it was previously proposed that the CRS model maybe more appropriate than the CIC model in modelling peat accumulation (Oldfield et. al., 1979; Appleby et. al., 1988). The CIC model was shown in one study to underestimate age when compared to dates acquired by moss increment methods (El-Daoushy et. al., 1982), whereas good agreement was found with the CRS model in the younger part of the same cores (<100 years). However, CRS dates do not agree in all cases with dates obtained from independent dating techniques (Urban et. al., 1990). It is also important to note that the error in CRS dates becomes large for dates nearing 100 years because of the uncertainty involved in estimating the small amount of ^{210}Pb contained in older peat materials (El-Daoushy et; al., 1982; Appleby et. al., 1988).

Table 4. Summary of Mass Accumulation Rate and Atmospheric Flux

Core	Model	Average Mass Accumulation	Atmospheric Flux ($pCi/cm^2/yr$)
Detour L. Bog	CIC1	0.02	0.40
Detour L. Bog	CIC2	0.02	0.34
Detour L. Bog	CRS	0.02 $\pm$ 0.006*	0.36
Kinosheo L. Bog	CIC1	0.01	0.27
Kinosheo L. Bog	CIC2	0.01	0.21
Kinosheo L. Bog	CRS	0.01 $\pm$ 0.002*	0.21
Town Site Bog	CIC2	0.01	0.16
Town Site Bog	CRS	0.01 $\pm$ 0.003*	0.16
Town Site Fen	CIC2	0.01	0.44
Town Site Fen	CRS	0.02 $\pm$ 0.010*	0.18

*Based on incremental mass accumulation rates.
Note: See Appendices F1, F2, F3 and F4 for further detail.

There is fair agreement between the CIC and CRS models for the Detour Lake core from the surface to an approximate depth of 16 cm or a year of 1935 (Fig 7a) and for the Kinosheo Lake core to an approximate depth of 14 cm or a year of 1920 (Fig. 7b). It is difficult to interpret whether the divergence of the models in the lower part of the cores indicates that the assumption of a 'constant accumulation rate' for the CIC model is not acceptable for the two cores (i.e. that the growth rate was indeed variable), or if it is a reflection of the increasing error in the CRS model with depth, or both. For the Detour Lake core, there are nonlinear patterns shown in Figures 3a, 3b, and 3c (below 0.5 g/cm^2) but the variability lower in the core may or may not be real. Figure 4b for the Kinosheo Lake core indicates a decreasing accumulation rate with depth throughout the core, but it is difficult to say how significant the decrease is in terms of the overall chronology. Comparison of this data with that of an independent dating technique would indicate which model was more appropriate for the two cores. Until corroborating evidence is obtained, Detour Lake Bog core dates older than 1935 and Kinosheo Lake Bog core dates older than 1920 should be used with caution.

For the Town Site Bog core, Figure 7c shows agreement between the CIC2 and CRS models near the top of the core only. The divergence of the model chronology along with evidence in Figure 5a indicate that the assumption of a ‘constant accumulation rate’ for the CIC2 model is not acceptable for the Town Site Bog core (i.e. that the growth rate was indeed variable). Comparison of this data with that of an independent dating technique would likely confirm the CRS model to be more appropriate for this core. Until corroborating evidence is obtained, Town Site Bog core dates should be used with caution.

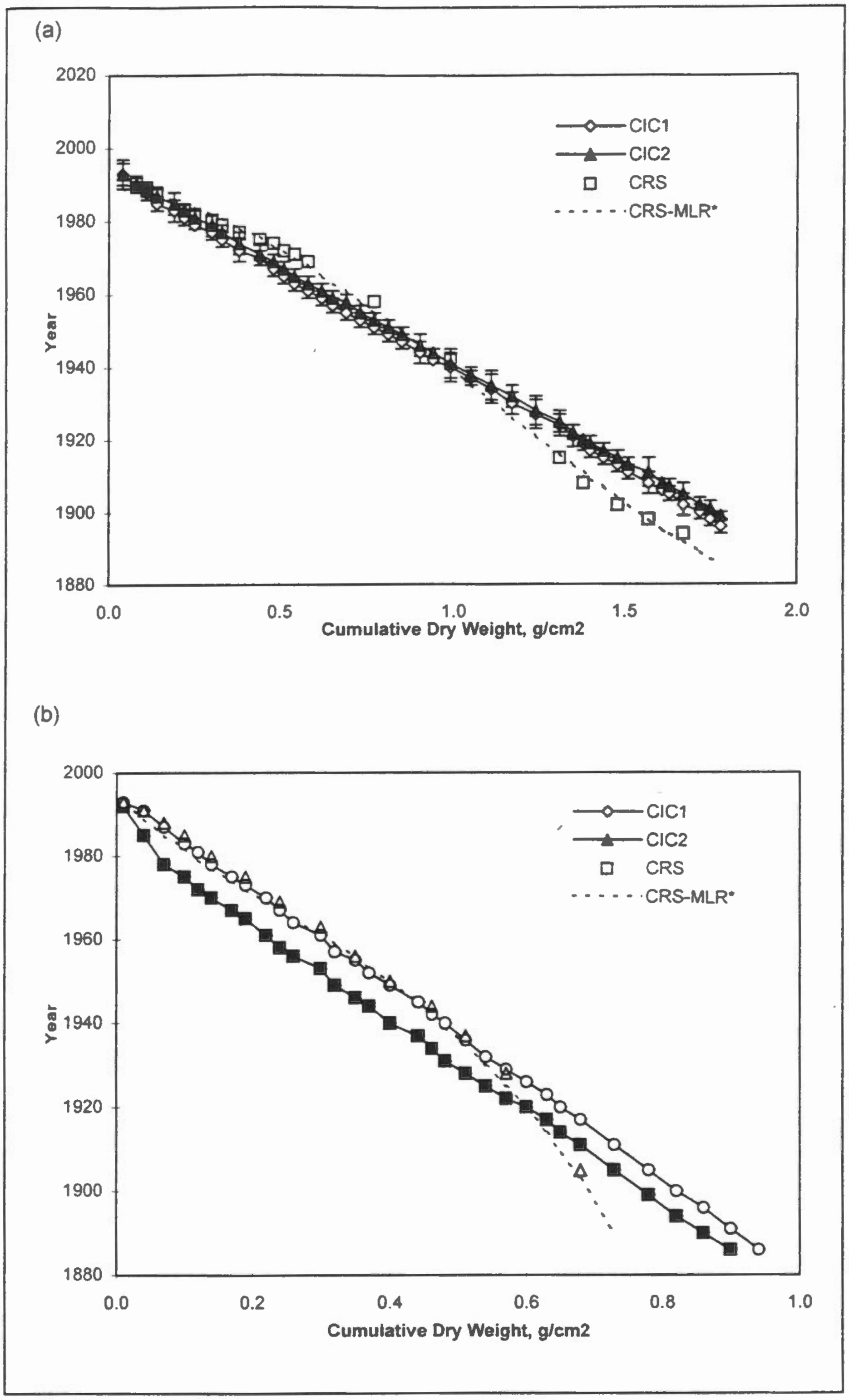

Figure 7. Plot of the year determined from CIC and CRS models versus cumulative dry weight for (a) Detour Lake core and (b) Kinosheo Lake Bog core.

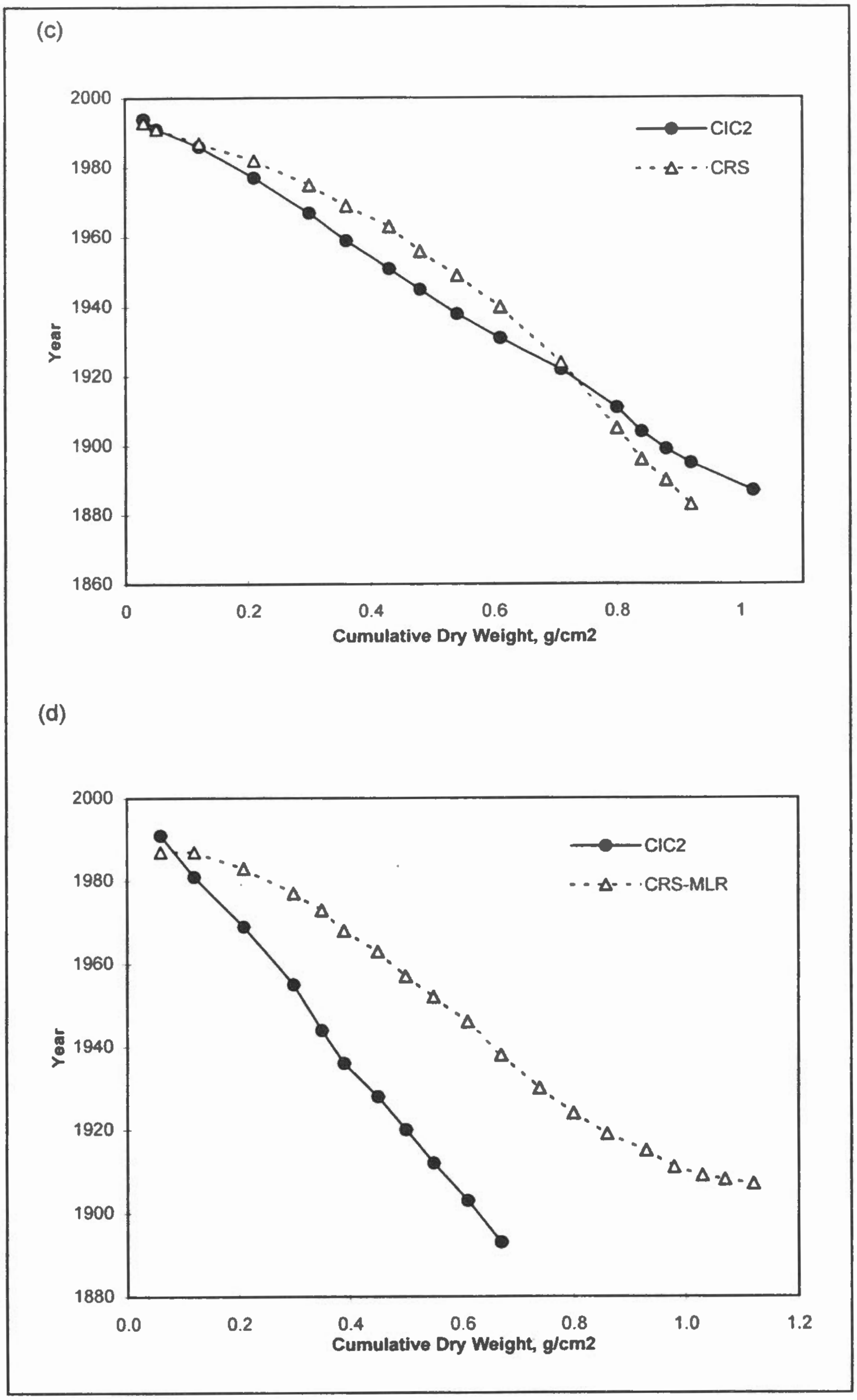

Figure 7. Plot of the year determined from CIC and CRS models versus
(cont.) cumulative dry weight for (c) Town Site Bog core and
(d) Town Site Fen core.

Table 4 and Figure 7d show no agreement between the CIC2 and CRS models for the Town Site Fen core. The accumulation rate calculated using the CIC2 model is half the value calculated using the CRS model. The atmospheric flux calculated using the CIC2 model is twice the value calculated using the CRS model. Other than the top two sample sections, the dates calculated for the Town Site Fen core using the two models are in disagreement.

Figure 7d indicates that the assumption of a constant accumulation rate for the CIC2 model was not acceptable for the Town Site Fen core (i.e. the growth rate was indeed variable), especially in the parts of the profile below core sample 13. However, some of the model divergence in the lowermost part of the profile may be a reflection of the increasing error in the CRS model with depth. Lack of agreement between the models was also influenced by the cumulative dry weight error caused by lack of wet/dry weight data. One model may have been influenced to a greater degree by this error than the other.

SUMMARY

Ombrotrophic peat was cored and dated from peatlands near Detour Lake and Kinosheo Lake in Ontario and both ombrotrophic and minerotrophic peat from a peatland near Fort Simpson, N.W.T. The ^{210}Pb profiles of the peat core was used to determine the chronological age of the peat as well as the accumulation rate.

The mean specific gravity of the Detour Lake peat was determined to be 1.500 g/cm^3. The accumulation rate was calculated to be 0.28 cm/yr using the CIC1 model, while the average mass accumulation rate was determined to be 0.02 g/cm^2/yr using the CIC1 model, 0.02 g/cm^2/yr using the CIC2 model, and 0.02 +/- 0.006 g/cm^2/yr using the CRS model.

The Kinosheo Lake peat had a mean specific gravity of 1.443 g/cm^3. The accumulation rate was calculated to be 0.19 cm/yr using the CIC1 model. The average mass accumulation rate was determined to be 0.01 g/cm^2/yr using the CIC1 model, 0.01 g/cm^2/yr using the CIC2 model, and 0.01 +/- 0.002 g/cm^2/yr using the CRS model.

For the Fort Simpson area peatland, the mean specific gravity of the ombrotrophic peat was determined to be 1.496 g/cm^3 and the minerotrophic peat 1.469 g/cm^3. For ombrotrophic peat, the average mass accumulation rate was 0.01 g/cm^2/yr using the CIC2 model and 0.01 +/- 0.003 g/cm^2/yr using the CRS model. Variability in accumulation rate was indicated. For the minerotrophic peat, results from the two models used for data analysis were not in agreement. The average mass accumulation rate was determined to be 0.01 g/cm^2/yr using the CIC2 model and

0.02 +/- 0.010 $g/cm^2/yr$ using the CRS model. Since variability in accumulation rate was indicated, more trust is placed in the CRS model results.

As with the dating of any type of material, ^{210}Pb dating of peat should be checked with evidence from other independent dating techniques (e.g. pollen analysis, bulk density or moss incremental methods).

ACKNOWLEDGMENTS

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APPENDICES

Appendix A1: Wet and Dry Weights for Detour Lake Bog Core

Surface area - 121.00 cm^2

Sample Number	Wet Weight (g)	Dry Weight (g)
1	85.40	8.08
2	30.20	3.21
3	37.36	3.92
4	44.07	4.22
5	62.71	5.81
6	45.89	4.18
7	46.98	3.57
8	63.90	5.32
9	50.85	4.46
10	80.19	7.17
11	57.28	5.15
12	55.09	4.71
13	57.05	4.70
14	44.39	3.52
15	52.47	4.22
16	58.02	4.77
17	56.35	4.61
18	46.76	4.02
19	59.50	4.77
20	59.86	4.73
21	73.64	5.59
22	63.36	4.55
23	91.37	6.65
24	37.34	2.84
25	96.26	9.99
26	54.11	4.19
27	116.18	9.05
28	84.46	7.50
29	113.92	9.14
30	71.73	6.03
31	49.59	4.57
32	28.64	2.46
33	53.82	4.41
34	57.65	4.56
35	51.55	4.26
36	56.13	4.47
37	97.87	7.92
38	28.62	2.17
39	58.23	4.43
40	74.95	5.82
41	45.96	3.75
42	53.85	4.42
43	31.16	2.57

Appendix A2: Wet and Dry Weights for Kinosheo Lake Bog Core

Surface area - 121.00 cm^2

Sample Number	Wet Weight (g)	Dry Weight (g)
1	24.43	1.90
2	43.70	4.00
3	54.94	3.47
4	63.11	2.98
5	47.14	2.25
6	53.28	2.52
7	56.10	2.58
8	47.83	2.18
9	60.83	3.82
10	41.45	1.99
11	52.40	2.59
12	69.93	3.52
13	68.41	3.20
14	54.74	2.58
15	45.37	2.27
16	69.74	3.82
17	75.11	3.39
18	64.50	2.79
19	57.05	2.43
20	94.63	4.15
21	80.35	3.47
22	50.43	2.13
23	68.06	3.16
24	65.74	2.98
25	44.16	2.14
26	94.40	4.87
27	99.52	6.46
28	100.30	5.68
29	68.71	3.51
30	83.00	4.18
31	85.94	4.95
32	68.65	3.69
33	66.27	3.63
34	64.97	3.53
35	61.10	3.61
36	125.58	8.17

Appendix A3: Wet and Dry Weights for Town Site Bog Core

Sample Number	Wet Weight (g)	Dry Weight (g)
1	3.00*	2.25*
2	2.92	2.08
3	7.98	5.37
4	10.62	7.25
5	11.56	6.93
6	8.01	4.91
7	9.02	5.46
8	6.60	4.00
9	7.55	4.84
10	10.37	6.04
11	13.26	7.37
12	15.11	7.66
13	7.04	3.25
14	6.55	2.87
15	7.46	2.93
16	20.79	8.10
17	6.00	1.80
18	26.67	8.52
19	21.11	7.10
20	28.20	9.64
21	34.30	11.86
22	15.31	5.35
23	36.55	12.44
24	32.73	11.24
25	39.17	13.34
26	45.47	16.18
27	43.29	12.99
28	32.03	9.18
29	34.05	9.99
30	46.88	13.72
31	41.86	12.06
32	22.66	6.38
33	50.37	14.26
34	54.22	14.98
35	23.69	6.62
36	35.14	9.44
37	26.40	7.43
38	24.23	7.05
39	23.98	6.97
40	20.02	5.79
41	32.83	9.46
42	21.40	5.98
43	23.81	7.00
44	24.07	6.91
45	26.55	7.34

* Estimated values where no data available

Appendix A4: Wet and Dry Weights for Town Site Fen Core

Sample Number	Wet Weight (g)	Dry Weight (g)
1	25.00*	4.00*
2	22.08	3.96
3	35.65	5.95
4	34.09	5.51
5	19.60	3.17
6	16.58	2.70
7	25.90	3.99
8	17.75	3.03
9	24.69	3.65
10	25.94	3.74
11	28.60	4.04
12	30.00*	4.54
13	30.15	3.90
14	30.00*	3.75
15	40.05	4.35
16	29.41	3.11
17	36.62	3.77
18	23.68	2.49
19	27.86	3.24
20	19.53	2.18
21	25.63	2.90
22	17.59	1.98
23	22.00*	2.47
24	31.18	3.58
25	27.00*	3.08
26	30.79	3.93
27	23.22	3.05
28	38.73	5.29
29	24.19	3.29
30	33.44	4.59
31	28.22	3.88
32	28.40	3.93
33	34.69	4.88
34	28.18	3.92
35	32.46	4.46
36	41.37	5.69
37	36.13	5.08
38	41.55	6.14
39	31.17	4.56
40	35.24	5.35
41	46.05	6.83
42	30.79	4.69
43	29.98	3.98
44	29.98	3.90
45	50.56	5.69

* Estimated values where no data available.

Sample Number	Wet Weight (g)	Dry Weight (g)
46	58.20	8.19
47	56.96	8.08
48	63.09	9.02
49	61.08	8.95
50	66.23	9.92
51	66.93	10.06
52	65.33	10.11
53	73.91	11.81
54	75.92	12.23
55	80.20	12.61
56	84.17	12.94
57	80.17	12.02
58	77.10	11.45
59	82.97	11.91
60	82.56	11.72
61	84.31	11.58

Appendix B1: Calculation of porosity and uncompacted depths, given sample wet and dry weights after Delorme (1991), and specific gravity for the Detour Lake Bog core.

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
1	85.40	8.08	0.07	77.32	5.16	82.48	0.68	0.68	0.34	93.75	0.93	0.93	0.47
2	30.20	3.21	0.09	26.99	2.04	29.03	0.24	0.92	0.80	92.96	0.65	1.58	1.26
3	37.36	3.92	0.13	33.44	2.49	35.93	0.30	1.22	1.07	93.08	0.68	2.26	1.92
4	44.07	4.22	0.16	39.85	2.67	42.52	0.35	1.57	1.39	93.72	0.61	2.87	2.57
5	62.71	5.81	0.21	56.90	3.67	60.57	0.50	2.07	1.82	93.95	0.71	3.58	3.23
6	45.89	4.18	0.24	41.71	2.66	44.37	0.37	2.44	2.25	94.00	0.57	4.15	3.87
7	46.98	3.57	0.27	43.41	2.29	45.70	0.38	2.81	2.63	94.98	0.38	4.53	4.34
8	63.90	5.32	0.32	58.58	3.45	62.03	0.51	3.33	3.07	94.44	0.62	5.15	4.84
9	50.85	4.46	0.35	46.39	2.92	49.31	0.41	3.74	3.53	94.08	0.59	5.74	5.45
10	80.19	7.17	0.41	73.02	4.74	77.76	0.64	4.38	4.06	93.91	0.86	6.60	6.17
11	57.28	5.15	0.46	52.13	3.42	55.55	0.46	4.84	4.61	93.84	0.69	7.29	6.95
12	55.09	4.71	0.49	50.38	3.14	53.52	0.44	5.28	5.06	94.13	0.62	7.91	7.60
13	57.05	4.70	0.53	52.35	3.15	55.50	0.46	5.74	5.51	94.32	0.59	8.50	8.21
14	44.39	3.52	0.56	40.87	2.37	43.24	0.36	6.10	5.92	94.51	0.46	8.96	8.73
15	52.47	4.22	0.60	48.25	2.86	51.11	0.42	6.52	6.31	94.41	0.54	9.50	9.23
16	58.02	4.77	0.64	53.25	3.23	56.48	0.47	6.98	6.75	94.28	0.61	10.11	9.81
17	56.35	4.61	0.67	51.74	3.12	54.86	0.45	7.44	7.21	94.31	0.59	10.70	10.41
18	46.76	4.02	0.71	42.74	2.72	45.46	0.38	7.81	7.63	94.02	0.57	11.27	10.99
19	59.50	4.77	0.75	54.73	3.22	57.95	0.48	8.29	8.05	94.44	0.59	11.86	11.57
20	59.86	4.73	0.79	55.13	3.20	58.33	0.48	8.77	8.53	94.52	0.58	12.44	12.15
21	73.64	5.59	0.83	68.05	3.77	71.82	0.59	9.37	9.07	94.75	0.64	13.08	12.76
22	63.36	4.55	0.87	58.81	3.07	61.88	0.51	9.88	9.62	95.05	0.50	13.58	13.33
23	91.37	6.65	0.93	84.72	4.47	89.19	0.74	10.62	10.25	94.98	0.74	14.32	13.95
24	37.34	2.84	0.95	34.50	1.91	36.41	0.30	10.92	10.77	94.76	0.35	14.67	14.50
25	96.26	9.99	1.03	86.27	6.70	92.97	0.77	11.69	11.30	92.79	1.21	15.88	15.28
26	54.11	4.19	1.07	49.92	2.81	52.73	0.44	12.12	11.90	94.66	0.50	16.38	16.13
27	116.18	9.05	1.14	107.13	6.09	113.22	0.94	13.06	12.59	94.62	1.01	17.39	16.89
28	84.46	7.50	1.20	76.96	5.05	82.01	0.68	13.74	13.40	93.84	0.91	18.30	17.85
29	113.92	9.14	1.28	104.78	6.17	110.95	0.92	14.65	14.19	94.44	1.03	19.33	18.82
30	71.73	6.03	1.33	65.70	4.08	69.78	0.58	15.23	14.94	94.16	0.74	20.07	19.70
31	49.59	4.57	1.37	45.02	3.10	48.12	0.40	15.63	15.43	93.57	0.68	20.75	20.41

Appendix B1: Calculation of porosity and uncompacted depths, given sample wet and dry weights (after Delorme (1991)), (continued) and specific gravity for the Detour Lake Bog core.

Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
32	28.64	2.46	1.39	26.18	1.67	27.85	0.23	15.86	15.74	94.00	0.43	21.18	20.97
33	53.82	4.41	1.42	49.41	3.00	52.41	0.43	16.29	16.07	94.28	0.58	21.76	21.47
34	57.65	4.56	1.46	53.09	3.11	56.20	0.46	16.75	16.52	94.47	0.57	22.33	22.05
35	51.55	4.26	1.50	47.29	2.91	50.20	0.41	17.17	16.96	94.21	0.57	22.90	22.62
36	56.13	4.47	1.53	51.66	3.06	54.72	0.45	17.62	17.40	94.41	0.57	23.47	23.19
37	97.87	7.92	1.60	89.95	5.44	95.39	0.79	18.41	18.02	94.30	0.93	24.40	23.94
38	28.62	2.17	1.62	26.45	1.50	27.95	0.23	18.64	18.52	94.65	0.30	24.70	24.55
39	58.23	4.43	1.65	53.80	3.06	56.86	0.47	19.11	18.88	94.61	0.55	25.25	24.98
40	74.95	5.82	1.70	69.13	4.04	73.17	0.60	19.72	19.41	94.48	0.71	25.96	25.61
41	45.96	3.75	1.73	42.21	2.59	44.80	0.37	20.09	19.90	94.21	0.53	26.49	26.23
42	53.85	4.42	1.77	49.43	3.05	52.48	0.43	20.52	20.30	94.19	0.60	27.09	26.79
43	31.16	2.57	1.79	28.59	1.77	30.36	0.25	20.77	20.64	94.18	0.41	27.50	27.30

Appendix B2: Calculation of porosity and uncompacted depths, given sample wet and dry weights (after Delorme (1991)), and specific gravity for theKinosheo Lake Bog core.

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
1	24.43	1.90	0.02	22.53	1.48	24.01	0.22	0.22	0.11	93.83	1.08	1.08	0.54
2	43.70	4.00	0.05	39.70	2.99	42.69	0.39	0.61	0.41	92.99	1.50	2.58	1.83
3	54.94	3.47	0.09	51.47	2.49	53.96	0.49	1.10	0.85	95.38	0.88	3.46	3.02
4	63.11	2.98	0.11	60.13	2.06	62.19	0.57	1.66	1.38	96.69	0.56	4.02	3.74
5	47.14	2.25	0.13	44.89	1.55	46.44	0.42	2.08	1.87	96.66	0.43	4.45	4.24
6	53.28	2.52	0.16	50.76	1.74	52.50	0.48	2.56	2.32	96.69	0.47	4.92	4.69
7	56.10	2.58	0.18	53.52	1.78	55.29	0.50	3.06	2.81	96.78	0.47	5.39	5.16
8	47.83	2.18	0.20	45.65	1.50	47.15	0.43	3.49	3.28	96.82	0.39	5.78	5.58
9	60.83	3.82	0.23	57.01	2.62	59.63	0.54	4.04	3.76	95.60	0.87	6.65	6.21
10	41.45	1.99	0.25	39.46	1.37	40.83	0.37	4.41	4.22	96.66	0.38	7.03	6.84
11	52.40	2.59	0.28	49.81	1.78	51.59	0.47	4.88	4.64	96.56	0.50	7.53	7.28
12	69.93	3.52	0.31	66.41	2.43	68.84	0.63	5.50	5.19	96.47	0.69	8.22	7.87
13	68.41	3.20	0.34	65.21	2.20	67.41	0.61	6.11	5.81	96.73	0.60	8.82	8.52
14	54.74	2.58	0.36	52.16	1.77	53.93	0.49	6.60	6.36	96.71	0.48	9.30	9.06
15	45.37	2.27	0.38	43.10	1.56	44.66	0.41	7.01	6.81	96.52	0.45	9.75	9.52
16	69.74	3.82	0.42	65.92	2.61	68.53	0.62	7.63	7.32	96.19	0.77	10.52	10.13
17	75.11	3.39	0.45	71.72	2.32	74.04	0.67	8.31	7.97	96.87	0.62	11.14	10.83
18	64.50	2.79	0.47	61.71	1.91	63.61	0.58	8.88	8.60	97.00	0.48	11.62	11.38
19	57.05	2.43	0.49	54.62	1.66	56.28	0.51	9.40	9.14	97.05	0.40	12.02	11.82
20	94.63	4.15	0.53	90.48	2.84	93.32	0.85	10.24	9.82	96.96	0.76	12.78	12.40
21	80.35	3.47	0.56	76.88	2.37	79.25	0.72	10.97	10.60	97.01	0.62	13.40	13.09
22	50.43	2.13	0.58	48.30	1.45	49.75	0.45	11.42	11.19	97.08	0.33	13.73	13.56
23	68.06	3.16	0.61	64.90	2.15	67.05	0.61	12.03	11.72	96.79	0.58	14.31	14.02
24	65.74	2.98	0.64	62.76	2.02	64.78	0.59	12.62	12.32	96.88	0.53	14.84	14.57
25	44.16	2.14	0.66	42.02	1.45	43.47	0.40	13.01	12.81	96.66	0.40	15.24	15.04
26	94.40	4.87	0.70	89.53	3.31	92.84	0.84	13.85	13.43	96.44	0.92	16.16	15.70
27	99.52	6.46	0.76	93.06	4.38	97.44	0.89	14.74	14.30	95.50	1.24	17.40	16.78
28	100.30	5.68	0.81	94.62	3.85	98.47	0.90	15.64	15.19	96.09	1.07	18.47	17.93
29	68.71	3.51	0.84	65.20	2.38	67.58	0.61	16.25	15.94	96.48	0.67	19.14	18.80

Appendix B2: Calculation of porosity and uncompacted depths, given sample wet and dry weights (after Delorme (1991)),
(continued) and specific gravity for the Kinosheo Lake Bog core.

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
30	83.00	4.18	0.88	78.82	2.83	81.65	0.74	16.99	16.62	96.53	0.79	19.93	19.53
31	85.94	4.95	0.93	80.99	3.36	84.34	0.77	17.76	17.38	96.02	0.96	20.89	20.41
32	68.65	3.69	0.96	64.96	2.50	67.46	0.61	18.37	18.07	96.29	0.73	21.62	21.25
33	66.27	3.63	0.99	62.64	2.47	65.11	0.59	18.96	18.67	96.21	0.73	22.35	21.98
34	64.97	3.53	1.03	61.44	2.41	63.85	0.58	19.55	19.25	96.23	0.72	23.07	22.71
35	61.10	3.61	1.06	57.49	2.47	59.96	0.55	20.09	19.82	95.88	0.78	23.85	23.46
36	125.58	8.17	1.13	117.41	5.61	123.02	1.12	21.21	20.65	95.44	1.49	25.34	24.59

Appendix B3: Calculation of porosity and uncompacted depths, given sample wet and dry weights (after Delorme (1991)), and specific gravity for the Town Site Bog core.

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
1	3.00 *	2.25*	0.03	0.75	1.50	2.25	0.03	0.03	0.01	33.28	1.58	1.58	0.79
2	2.92	2.08	0.05	0.84	1.39	2.23	0.03	0.06	0.04	37.66	1.41	2.99	2.29
3	7.98	5.37	0.12	2.61	3.59	6.20	0.08	0.13	0.09	42.10	1.29	4.28	3.64
4	10.62	7.25	0.21	3.37	4.85	8.22	0.10	0.24	0.18	41.02	1.36	5.64	4.96
5	11.56	6.93	0.30	4.63	4.63	9.26	0.12	0.35	0.29	49.99	1.03	6.67	6.16
6	8.01	4.91	0.36	3.10	3.28	6.38	0.08	0.43	0.39	48.58	1.04	7.71	7.19
7	9.02	5.46	0.43	3.56	3.65	7.21	0.09	0.52	0.48	49.38	1.02	8.73	8.22
8	6.60	4.00	0.48	2.60	2.67	5.27	0.07	0.59	0.55	49.30	1.00	9.73	9.23
9	7.55	4.84	0.54	2.71	3.24	5.95	0.07	0.66	0.62	45.58	1.15	10.88	10.31
10	10.37	6.04	0.61	4.33	4.04	8.37	0.10	0.77	0.71	51.75	0.95	11.83	11.36
11	13.26	7.37	0.71	5.89	4.93	10.82	0.14	0.90	0.83	54.46	0.88	12.71	12.27
12	15.11	7.66	0.80	7.45	5.12	12.57	0.16	1.06	0.98	59.27	0.71	13.42	13.07
13	7.04	3.25	0.84	3.79	2.17	5.96	0.07	1.13	1.10	63.57	0.47	13.89	13.66
14	6.55	2.87	0.88	3.68	1.92	5.60	0.07	1.20	1.17	65.73	0.38	14.27	14.08
15	7.46	2.93	0.92	4.53	1.96	6.49	0.08	1.28	1.24	69.82	0.23	14.50	14.39
16	20.79	8.10	1.02	12.69	5.41	18.10	0.23	1.51	1.40	70.09	0.37	14.87	14.69
17	6.00	1.80	1.04	4.20	1.20	5.40	0.07	1.58	1.54	77.73	-0.08	14.79	14.83
18	26.67	8.52	1.15	18.15	5.69	23.84	0.30	1.88	1.73	76.12	0.21	15.00	14.90
19	21.11	7.10	1.23	14.01	4.75	18.76	0.23	2.11	1.99	74.70	0.20	15.20	15.10
20	28.20	9.64	1.35	18.56	6.44	25.00	0.31	2.42	2.27	74.23	0.30	15.50	15.35
21	34.30	11.86	1.50	22.44	7.93	30.37	0.38	2.80	2.61	73.90	0.38	15.88	15.69
22	15.31	5.35	1.57	9.96	3.58	13.54	0.17	2.97	2.89	73.58	0.18	16.06	15.97
23	36.55	12.44	1.73	24.11	8.31	32.42	0.41	3.38	3.18	74.36	0.39	16.45	16.26
24	32.73	11.24	1.87	21.49	7.51	29.00	0.36	3.74	3.56	74.10	0.35	16.80	16.63

* estimated values

Appendix B3: Calculation of porosity and uncompacted depths, given sample wet and dry weights (after Delorme (1991)),
(continued) and specific gravity for the Town Site Bog core.

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
25	39.17	13.34	2.03	25.83	8.92	34.75	0.43	4.17	3.96	74.34	0.41	17.21	17.01
26	45.47	16.18	2.23	29.29	10.81	40.10	0.50	4.68	4.43	73.03	0.53	17.74	17.48
27	43.29	12.99	2.40	30.30	8.68	38.98	0.49	5.16	4.92	77.73	0.34	18.08	17.91
28	32.03	9.18	2.51	22.85	6.14	28.99	0.36	5.53	5.34	78.83	0.17	18.25	18.17
29	34.05	9.99	2.64	24.06	6.68	30.74	0.38	5.91	5.72	78.28	0.21	18.46	18.36
30	46.88	13.72	2.81	33.16	9.17	42.33	0.53	6.44	6.17	78.34	0.36	18.82	18.64
31	41.86	12.06	2.96	29.80	8.06	37.86	0.47	6.91	6.68	78.71	0.29	19.11	18.97
32	22.66	6.38	3.04	16.28	4.26	20.54	0.26	7.17	7.04	79.24	0.05	19.16	19.14
33	50.37	14.26	3.22	36.11	9.53	45.64	0.57	7.74	7.45	79.12	0.37	19.53	19.35
34	54.22	14.98	3.40	39.24	10.01	49.25	0.62	8.36	8.05	79.67	0.39	19.92	19.73
35	23.69	6.62	3.49	17.07	4.42	21.49	0.27	8.62	8.49	79.41	0.06	19.98	19.95
36	35.14	9.44	3.61	25.70	6.31	32.01	0.40	9.02	8.82	80.29	0.15	20.13	20.06
37	26.40	7.43	3.70	18.97	4.97	23.94	0.30	9.32	9.17	79.25	0.09	20.22	20.18
38	24.23	7.05	3.79	17.18	4.71	21.89	0.27	9.60	9.46	78.48	0.10	20.32	20.27
39	23.98	6.97	3.87	17.01	4.66	21.67	0.27	9.87	9.73	78.50	0.09	20.41	20.37
40	20.02	5.79	3.95	14.23	3.87	18.10	0.23	10.09	9.98	78.62	0.04	20.45	20.43
41	32.83	9.46	4.06	23.37	6.32	29.69	0.37	10.46	10.28	78.71	0.18	20.63	20.54
42	21.40	5.98	4.14	15.42	4.00	19.42	0.24	10.71	10.59	79.41	0.03	20.66	20.65
43	23.81	7.00	4.23	16.81	4.68	21.49	0.27	10.98	10.84	78.23	0.10	20.76	20.71
44	24.07	6.91	4.31	17.16	4.62	21.78	0.27	11.25	11.11	78.79	0.08	20.84	20.80
45	26.55	7.34	4.40	19.21	4.91	24.12	0.30	11.55	11.40	79.66	0.08	20.92	20.88

Appendix B4: Calculation of porosity and uncompacted depths, given sample wet and dry weights (after Delorme (1991)), and specific gravity for the Town Site Fen core

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
1	25.00*	4.00*	0.06	21.00	2.72	23.72	0.36	0.36	0.18	88.52	0.79	0.79	0.40
2	22.08	3.96	0.12	18.12	2.69	20.81	0.32	0.69	0.53	87.05	0.93	1.72	1.26
3	35.65	5.95	0.21	29.70	4.05	33.75	0.52	1.20	0.94	88.00	1.01	2.73	2.23
4	34.09	5.51	0.30	28.58	3.75	32.33	0.50	1.70	1.45	88.40	0.94	3.67	3.20
5	19.60	3.17	0.35	16.43	2.16	18.59	0.29	1.99	1.84	88.39	0.73	4.40	4.04
6	16.58	2.70	0.39	13.88	1.84	15.72	0.24	2.23	2.11	88.31	0.70	5.10	4.75
7	25.90	3.99	0.45	21.91	2.72	24.63	0.38	2.61	2.42	88.97	0.75	5.85	5.48
8	17.75	3.03	0.50	14.72	2.06	16.78	0.26	2.87	2.74	87.71	0.79	6.64	6.25
9	24.69	3.65	0.55	21.04	2.48	23.52	0.36	3.23	3.05	89.44	0.68	7.32	6.98
10	25.94	3.74	0.61	22.20	2.55	24.75	0.38	3.61	3.42	89.71	0.66	7.98	7.65
11	28.60	4.04	0.67	24.56	2.75	27.31	0.42	4.03	3.82	89.93	0.67	8.65	8.32
12	30.00*	4.54	0.74	25.46	3.09	28.55	0.44	4.47	4.25	89.18	0.79	9.44	9.05
13	30.15	3.90	0.80	26.25	2.65	28.90	0.44	4.91	4.69	90.82	0.59	10.03	9.74
14	30.00*	3.75	0.86	26.25	2.55	28.80	0.44	5.36	5.13	91.14	0.55	10.58	10.31
15	40.05	4.35	0.93	35.70	2.96	38.66	0.59	5.95	5.65	92.34	0.55	11.13	10.86
16	29.41	3.11	0.98	26.30	2.12	28.42	0.44	6.39	6.17	92.55	0.36	11.49	11.31
17	36.62	3.77	1.03	32.85	2.57	35.42	0.54	6.93	6.66	92.76	0.45	11.94	11.72
18	23.68	2.49	1.07	21.19	1.69	22.88	0.35	7.29	7.11	92.60	0.27	12.21	12.08
19	27.86	3.24	1.12	24.62	2.20	26.82	0.41	7.70	7.49	91.78	0.44	12.65	12.43
20	19.53	2.18	1.15	17.35	1.48	18.83	0.29	7.99	7.84	92.12	0.27	12.92	12.79
21	25.63	2.90	1.20	22.73	1.97	24.70	0.38	8.37	8.18	92.01	0.38	13.30	13.11
22	17.59	1.98	1.23	15.61	1.35	16.96	0.26	8.63	8.50	92.05	0.25	13.55	13.43
23	22.00*	2.47	1.27	19.53	1.68	21.21	0.33	8.95	8.79	92.08	0.31	13.86	13.71
24	31.18	3.58	1.32	27.60	2.44	30.04	0.46	9.42	9.19	91.89	0.47	14.33	14.10
25	27.00*	3.08	1.37	23.92	2.10	26.02	0.40	9.82	9.62	91.94	0.40	14.73	14.53
26	30.79	3.93	1.43	26.86	2.67	29.53	0.45	10.27	10.04	90.94	0.58	15.31	15.02

Appendix B4: Calculation of porosity and uncompacted depths, given sample wet and dry weights (after Delorme (1991)), (continued) and specific gravity for the Town Site Fen core

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
27	23.22	3.05	1.48	20.17	2.08	22.25	0.34	10.61	10.44	90.67	0.50	15.81	15.56
28	38.73	5.29	1.56	33.44	3.60	37.04	0.57	11.18	10.90	90.28	0.78	16.59	16.20
31	28.22	3.88	1.74	24.34	2.64	26.98	0.42	12.45	12.24	90.21	0.63	18.49	18.18
32	28.40	3.93	1.80	24.47	2.67	27.14	0.42	12.86	12.66	90.15	0.64	19.13	18.81
33	34.69	4.88	1.88	29.81	3.32	33.13	0.51	13.37	13.12	89.98	0.76	19.89	19.51
34	28.18	3.92	1.94	24.26	2.67	26.93	0.41	13.79	13.58	90.09	0.65	20.54	20.22
35	32.46	4.46	2.00	28.00	3.04	31.04	0.48	14.27	14.03	90.22	0.70	21.24	20.89
36	41.37	5.69	2.09	35.68	3.87	39.55	0.61	14.87	14.57	90.21	0.83	22.07	21.66
37	36.13	5.08	2.17	31.05	3.46	34.51	0.53	15.41	15.14	89.98	0.78	22.85	22.46
38	41.55	6.14	2.26	35.41	4.18	39.59	0.61	16.01	15.71	89.44	0.92	23.77	23.31
39	31.17	4.56	2.33	26.61	3.10	29.71	0.46	16.47	16.24	89.56	0.76	24.53	24.15
40	35.24	5.35	2.42	29.89	3.64	33.53	0.52	16.99	16.73	89.14	0.87	25.40	24.97
41	46.05	6.83	2.52	39.22	4.65	43.87	0.67	17.66	17.32	89.40	0.99	26.39	25.90
42	30.79	4.69	2.59	26.10	3.19	29.29	0.45	18.11	17.89	89.10	0.81	27.20	26.80
43	29.98	3.98	2.66	26.00	2.71	28.71	0.44	18.55	18.33	90.57	0.62	27.82	27.51
44	29.98	3.90	2.72	26.08	2.65	28.73	0.44	19.00	18.78	90.76	0.59	28.41	28.12
45	50.56	5.69	2.80	44.87	3.87	48.74	0.75	19.75	19.37	92.06	0.74	29.15	28.78
46	58.20	8.19	2.93	50.01	5.57	55.58	0.86	20.60	20.17	89.97	1.10	30.25	29.70
47	56.96	8.08	3.05	48.88	5.50	54.38	0.84	21.44	21.02	89.89	1.10	31.35	30.80
48	63.09	9.02	3.19	54.07	6.14	60.21	0.93	22.36	21.90	89.80	1.20	32.55	31.95
49	61.08	8.95	3.33	52.13	6.09	58.22	0.90	23.26	22.81	89.54	1.20	33.75	33.15
50	66.23	9.92	3.48	56.31	6.75	63.06	0.97	24.23	23.75	89.29	1.30	35.05	34.40
51	66.93	10.06	3.64	56.87	6.85	63.72	0.98	25.21	24.72	89.25	1.32	36.37	35.71
52	65.33	10.11	3.79	55.22	6.88	62.10	0.96	26.17	25.69	88.92	1.34	37.71	37.04
53	73.91	11.81	3.97	62.10	8.04	70.14	1.08	27.24	26.71	88.54	1.51	39.22	38.47

Appendix B4: Calculation of porosity and uncompacted depths, given sample wet and dry weights (continued) (after Delorme (1991)), and specific gravity for Town Site Fen core

Slice Number	Wet Wt. (g)	Dry Wt. (g)	Cum. Dry wt (g/cm^2)	Water Cont. (cm^3)	Samp. Vol. (cm^3)	Total Vol. (cm^3)	Comp. Thick (cm)	Comp. Depth (cm)	Comp. Mid-pt (cm)	Sample Poros. (%)	Uncomp Thick. (cm)	Uncomp Depth (cm)	Uncomp Mid-pt (cm)
54	75.92	12.23	4.16	63.69	8.32	72.01	1.11	28.35	27.80	88.44	1.55	40.77	40.00
55	80.20	12.61	4.36	67.59	8.58	76.17	1.17	29.52	28.94	88.73	1.58	42.35	41.56
56	84.17	12.94	4.56	71.23	8.81	80.04	1.23	30.76	30.14	89.00	1.60	43.95	43.15
57	80.17	12.02	4.74	68.15	8.18	76.33	1.17	31.93	31.34	89.28	1.51	45.46	44.71
58	77.10	11.45	4.92	65.65	7.79	73.44	1.13	33.06	32.50	89.39	1.45	46.91	46.19
59	82.97	11.91	5.10	71.06	8.11	79.17	1.22	34.28	33.67	89.76	1.49	48.40	47.66
60	82.56	11.72	5.28	70.84	7.98	78.82	1.21	35.49	34.88	89.88	1.47	49.87	49.14
61	84.31	11.58	5.46	72.73	7.88	80.61	1.24	36.73	36.11	90.22	1.46	51.33	50.60

Appendix C. Specific Gravity Determination.

The specific gravities (g/cm^3) of the peat were determined using an automated Accupyc pycnometer (Micromertics, 1992)

Core	Slice Number	Number of Tests	Uncomp Mid Depth (cm)	Specific Gravity	Mean
Detour L. Bog	1	5	0.47	1.567 ± 0.005	
Detour L. Bog	5	5	3.23	1.585 ± 0.005	
Detour L. Bog	10	5	6.17	1.513 ± 0.004	
Detour L. Bog	15	5	9.23	1.476 ± 0.003	
Detour L. Bog	20	5	12.15	1.480 ± 0.003	
Detour L. Bog	25	5	15.28	1.491 ± 0.002	
Detour L. Bog	30	5	19.70	1.479 ± 0.001	
Detour L. Bog	35	5	22.62	1.465 ± 0.002	
Detour L. Bog	40	5	25.61	1.441 ± 0.002	
Detour L. Bog	43	5	27.30	1.454 ± 0.003	1.500 ± 0.045
Kinosheo L. Bog	1	5	0.54	1.282 ± 0.024	
Kinosheo L. Bog	4	4	3.74	1.448 ± 0.018	
Kinosheo L. Bog	8	4	5.58	1.452 ± 0.003	
Kinosheo L. Bog	12	5	7.87	1.450 ± 0.006	
Kinosheo L. Bog	16	5	10.13	1.462 ± 0.001	
Kinosheo L. Bog	20	4	12.40	1.462 ± 0.004	
Kinosheo L. Bog	24	5	14.57	1.473 ± 0.007	
Kinosheo L. Bog	28	5	17.93	1.474 ± 0.005	
Kinosheo L. Bog	32	5	21.25	1.476 ± 0.004	
Kinosheo L. Bog	36	4	24.59	1.456 ± 0.002	1.443 ± 0.055
Town Site Bog	1	5	0.03	1.372 ± 0.004	
Town Site Bog	5	5	0.30	1.312 ± 0.002	
Town Site Bog	10	5	0.61	1.406 ± 0.002	
Town Site Bog	15	5	0.92	1.445 ± 0.002	
Town Site Bog	20	5	1.35	1.548 ± 0.011	
Town Site Bog	25	5	2.03	1.721 ± 0.002	
Town Site Bog	30	5	2.81	1.575 ± 0.001	
Town Site Bog	35	5	3.49	1.522 ± 0.001	
Town Site Bog	39	5	3.87	1.572 ± 0.002	
Town Site Bog	45	5	4.40	1.488 ± 0.003	1.496 ± 0.003
Town Site Fen	1	5	0.06	1.431 ± 0.002	
Town Site Fen	5	5	0.35	1.491 ± 0.003	
Town Site Fen	10	5	0.61	1.484 ± 0.002	
Town Site Fen	15	5	0.93	1.482 ± 0.002	
Town Site Fen	20	5	1.15	1.472 ± 0.003	
Town Site Fen	25	5	1.37	1.441 ± 0.003	
Town Site Fen	30	5	1.68	1.470 ± 0.001	
Town Site Fen	40	5	2.42	1.471 ± 0.001	
Town Site Fen	50	5	3.48	1.479 ± 0.001	
Town Site Fen	60	5	5.28	1.472 ± 0.001	1.469 ± 0.001

Appendix D1. Lead Accumulation Rate Analysis, CIC1 Model, Detour Lake Bog Core

ln (A - A') = ln (19.4122) - 0.1120 (Z) R = -0.9441

where (A - A') = unsupported ^{210}Pb in pCi/g,
and Z = uncompacted depth in cm.
based on data from lines 2 to 19

Specific Gravity = 1.500 g/cm P/ω = 19.4122 ω = 0.021

The initial porosity at the peat/air interface is 95%

Atmospheric flux rate at the time of collection 1994.642 is 0.898 dpm/cm^2/yr or 0.404 pCi/cm^2/yr

Supported ^{226}Ra activity = 1.476 pCi/g or 3.276 dpm/g

Accumulation Rate = 0.278 cm/yr

Mass Accumulation Rate = 0.021 g/cm^2/yr

SUMMARY OF ^{210}Pb ANALYSES

Uncomp Depth (cm)	Porosity	Total 210Pb (dpm/g)	Total 210Pb (pCi/g)	Unsupp. 210Pb (dpm/g)	Unsupp. 210Pb (pCi/g)	Accum. Rate (cm/yr)	Year (*)
1.92	0.9308	41.322	18.614	38.046	17.138	0.4551	1990
2.57	0.9372	38.994	17.565	35.718	16.089	0.3856	1988
3.87	0.9400	32.864	14.804	29.588	13.328	0.3567	1984
4.34	0.9498	27.437	12.359	24.161	10.883	0.2768	1979
4.84	0.9444	21.211	9.555	17.935	8.079	0.3038	1979
5.45	0.9408	21.182	9.541	17.906	8.066	0.3377	1979
6.17	0.9391	21.205	9.552	17.929	8.076	0.3066	1975
6.95	0.9384	19.095	8.601	15.819	7.126	0.3383	1974
7.60	0.9413	18.989	8.554	15.713	7.078	0.3335	1972
8.21	0.9432	22.914	10.322	19.638	8.846	0.3137	1968
8.73	0.9451	21.840	9.838	18.564	8.362	0.3234	1968
9.23	0.9441	22.411	10.095	19.135	8.619	0.3196	1966
12.15	0.9452	20.507	9.237	17.231	7.762	0.3064	1955
15.28	0.9279	15.959	7.189	12.683	5.713	0.3028	1944
19.70	0.9416	9.206	4.147	5.930	2.671	0.3035	1930
20.97	0.9400	8.111	3.654	4.835	2.178	0.4329	1946
22.62	0.9421	5.121	2.307	1.845	0.831	0.3336	1927
23.94	0.9430	5.736	2.584	2.460	1.108	0.2869	1911
25.61	0.9448	3.276	1.476	0.000	0.000	0.2978	1909
27.30	0.9418	4.501	2.028	1.225	0.552	0.3915	1925

(*) Year calculated using the accumulation rate of the sample.

Appendix D2. Lead Accumulation Rate Analysis, CIC1 Model, Kinosheo Lake Bog Core.

ln (A - A') = ln (30.0000) - 0.1664 (Z) R = -0.950

where (A - A') = unsupported ^{210}Pb in pCi/g,
and Z = uncompacted depth in cm.
based on data from lines 1 to 18

Specific Gravity = 1.443 g/cm^3 P/ω = 30.0000 ω = 0.009

The initial porosity at the peat/air interface is 96.68%

Atmospheric flux rate at the time of collection 1994.637 is 0.597 dpm/cm^2/yr or 0.269 pCi/cm^2/yr

Supported ^{226}Ra activity = 0.983 pCi/g or 2.181 dpm/g

Accumulation Rate = 0.187 cm/yr

Mass Accumulation Rate = 0.009 g/cm^2/yr

SUMMARY OF ^{210}Pb ANALYSES

Uncomp Depth (cm)	Porosity	Total 210Pb (dpm/g)	Total 210Pb (pCi/g)	Unsupp. 210Pb (dpm/g)	Unsupp. 210Pb (pCi/g)	Accum. Rate (cm/yr)	Year (*)
0.54	0.9383	37.688	16.977	35.507	15.994	0.4942	1995
1.83	0.9299	35.225	15.867	33.044	14.884	0.3408	1989
3.02	0.9538	39.168	17.643	36.987	16.661	0.2414	1982
3.74	0.9669	39.493	17.790	37.312	16.807	0.1843	1974
4.69	0.9669	35.785	16.119	33.604	15.137	0.1837	1969
5.58	0.9682	34.574	15.574	32.393	14.591	0.1771	1963
6.84	0.9666	24.813	11.177	22.632	10.194	0.1910	1959
7.87	0.9647	21.812	9.825	19.631	8.843	0.1927	1954
9.06	0.9671	19.686	8.868	17.505	7.885	0.1849	1946
10.13	0.9619	14.454	6.511	12.273	5.528	0.2025	1945
11.38	0.9700	13.739	6.189	11.558	5.206	0.1713	1928
12.40	0.9696	13.736	6.187	11.555	5.205	0.1827	1927
13.56	0.9708	11.689	5.265	9.508	4.283	0.1560	1908
14.57	0.9688	11.528	5.193	9.347	4.210	0.1788	1913
15.70	0.9644	8.285	3.732	6.104	2.749	0.1911	1912
17.93	0.9609	6.147	2.769	3.965	1.786	0.1889	1900
19.53	0.9653	3.956	1.782	1.775	0.799	0.1911	1892
21.25	0.9629	2.990	1.347	0.809	0.364		
24.59	0.9544	2.182	0.983	0.000	0.000		

(*) Year calculated using the accumulation rate of the sample.

Appendix E1. Lead Accumulation Rate Analysis, CIC2 Model, Detour Lake Bog Core

ln (A - A') = ln (18.3930) - 1.6727 (X) R = -0.944

where (A - A') = unsupported ^{210}Pb in pCi/g,
and X = cumulative dry weight in g/cm
based on data from lines 2 to 19

Specific Gravity = 1.500 g/cm^3 P/ω = 18.393 ω = 0.019

The initial porosity at the peat/air interface is 95%

Atmospheric flux rate at the time of collection 1994.642 is 0.760 dpm/cm^2/yr or 0.342 pCi/cm^2/yr

Supported ^{226}Ra activity = 1.476 pCi/g or 3.276 dpm/g

Mass Accumulation Rate = 0.019 g/cm^2/yr

SUMMARY OF 210Pb ANALYSES

Mid-Samp Cum. Dry Wt. g/cm2	Porosity	Total 210Pb dpm/g	Total 210Pb pCi/g	Unsupp. 210Pb dpm/g	Unsupp. 210Pb pCi/g	Years (*)
0.11	0.931	41.322	18.614	38.046	17.138	1989
0.14	0.937	38.994	17.565	35.718	16.089	1987
0.22	0.940	32.864	14.804	29.588	13.328	1983
0.25	0.950	27.437	12.359	24.161	10.883	1981
0.3	0.944	21.211	9.555	17.935	8.079	1979
0.33	0.941	21.182	9.541	17.906	8.066	1977
0.38	0.939	21.205	9.552	17.929	8.076	1974
0.44	0.938	19.095	8.601	15.819	7.126	1971
0.48	0.941	18.989	8.554	15.713	7.078	1969
0.51	0.943	22.914	10.322	19.638	8.846	1967
0.54	0.945	21.840	9.838	18.564	8.362	1965
0.58	0.944	22.411	10.095	19.135	8.619	1963
0.77	0.945	20.507	9.237	17.231	7.762	1953
0.99	0.928	15.959	7.189	12.683	5.713	1941
1.31	0.942	9.206	4.147	5.930	2.671	1925
1.38	0.940	8.111	3.654	4.835	2.178	1920
1.48	0.942	5.121	2.307	1.845	0.831	1915
1.57	0.943	5.736	2.584	2.460	1.108	1911
1.67	0.945	3.276	1.476	0.000	0.000	1905
1.78	0.942	4.501	2.028	1.225	0.552	1899

(*) Year calculated using the mass accumulation rate of the sample.

Appendix E2. Lead Accumulation Rate Analysis, CIC2 Model, Kinosheo Lake Bog Core

ln (A - A') = ln (24.0845) - 3.5678 (X) R = -0.958

where (A - A') = unsupported ^{210}Pb in pCi/g,
and X = cumulative dry weight in g/cm^2
based on data from lines 1 to 18

Specific Gravity = 1.443 g/cm^3 P/ω = 24.0845 ω = 0.009

The initial porosity at the peat/air interface is 96.68%

Atmospheric flux rate at the time of collection 1994.637 is 0.466 dpm/cm^2/yr or 0.210 pCi/cm^2/yr

Supported ^{226}Ra activity = 0.983 pCi/g or 2.181 dpm/g

Mass Accumulation Rate = 0.009 g/cm^2/yr

SUMMARY OF 210Pb ANALYSES

Mid-Samp Cum. Dry Wt. g/cm2	Porosity	Total 210Pb dpm/g	Total 210Pb pCi/g	Unsupp. 210Pb dpm/g	Unsupp. 210Pb pCi/g	Years (*)
0.01	0.9383	37.688	16.977	35.507	15.994	1995
0.04	0.9299	35.225	15.867	33.044	14.884	1991
0.07	0.9538	39.168	17.643	36.987	16.661	1987
0.10	0.9669	39.493	17.790	37.312	16.807	1983
0.14	0.9669	35.785	16.119	33.604	15.137	1978
0.19	0.9682	34.574	15.574	32.393	14.591	1973
0.24	0.9666	24.813	11.177	22.632	10.194	1967
0.30	0.9647	21.812	9.825	19.631	8.843	1961
0.35	0.9671	19.686	8.868	17.505	7.885	1955
0.40	0.9619	14.454	6.511	12.273	5.528	1949
0.46	0.9700	13.739	6.189	11.558	5.206	1942
0.51	0.9696	13.736	6.187	11.555	5.205	1936
0.57	0.9708	11.689	5.265	9.508	4.283	1929
0.63	0.9688	11.528	5.193	9.347	4.210	1923
0.68	0.9644	8.285	3.732	6.104	2.749	1917
0.78	0.9609	6.147	2.769	3.965	1.786	1905
0.86	0.9653	3.956	1.782	1.775	0.799	1896
0.94	0.9629	2.990	1.347	0.809	0.364	1886
1.10	0.9544	2.182	0.983	0.000	0.000	

(*) Year calculated using the mass accumulation rate of the sample.

Appendix E3. Lead Accumulation Rate Analysis, CIC2 Model, Town Site Bog Core

ln (A - A') = ln (18.3809) - 3.4871 (X) R = -0.911

where (A - A') = unsupported ^{210}Pb in pCi/g,
and X = cumulative dry weight in g/cm^2
based on data from lines 1 to 16

Specific Gravity = 1.496 g/cm^3 P/ω = 18.381 ω = 0.009

The initial porosity at the peat/air interface is 73.83%

Atmospheric flux rate at the time of collection 1995.567 is 0.364 dpm/cm^2/yr or 0.1641 pCi/cm^2/yr

Supported ^{226}Ra activity = 0.201 pCi/g or 0.465 dpm/g

Mass Àccumulation Rate = 0.009 g/cm^2/yr

SUMMARY OF 210Pb ANALYSES

Mid-Samp Cum. Dry Wt. g/cm2	Porosity	Total 210Pb dpm/g	Total 210Pb pCi/g	Unsupp. 210Pb dpm/g	Unsupp. 210Pb pCi/g	Years (*)
0.01	0.3328	41.4060	18.6510	40.9410	18.4420	1996
0.04	0.3766	25.5540	11.5110	25.0890	11.3010	1991
0.09	0.4210	19.6960	8.8720	19.2310	8.6630	1986
0.16	0.4102	17.5900	7.9230	17.1250	7.7140	1977
0.25	0.4999	14.1700	6.3830	13.7050	6.1740	1967
0.33	0.4858	14.5440	6.5510	14.0790	6.3420	1959
0.45	0.4930	14.1100	6.3560	13.6450	6.1460	1945
0.51	0.4558	11.1660	5.0300	10.7010	4.8200	1938
0.58	0.5175	11.8170	5.3230	11.3520	5.1140	1931
0.66	0.5446	7.7230	3.4790	7.2580	3.2690	1922
0.75	0.5927	4.8870	2.2010	4.4220	1.9920	1911
0.82	0.6357	1.3330	0.6000	0.8680	0.3910	1904
0.86	0.6573	4.2340	1.9070	3.7690	1.6980	1899
0.90	0.6982	1.4180	0.6390	0.9530	0.4290	1895
0.97	0.7009	2.5560	1.1510	2.0910	0.9420	1887
1.10	0.7612	0.8270	0.3730	0.3620	0.1630	
1.29	0.7423	0.4650	0.2090	0.0000	0.0000	
2.72	0.7834	0.5350	0.2410	0.0700	0.0320	
4.27	0.7879	0.8510	0.3830	0.3860	0.1740	

(*) Year calculated using the mass accumulation rate of the sample.

Appendix E4. Lead Accumulation Rate Analysis, CIC2 Model, Town Site Fen Core

ln (A - A') = ln (69.9826) - 4.9770 (X) R = -0.983

where (A - A') = unsupported ^{210}Pb in pCi/g,
and X = cumulative dry weight in g/cm^2
based on data from lines 5 to 20

Specific Gravity = 1.496 g/cm^3 P/ω = 69.983 ω = 0.006

The initial porosity at the peat/air interface is 91.97%

Atmospheric flux rate at the time of collection 1995.613 is 0.972 dpm/cm^2/yr or 0.438 pCi/cm^2/yr

Supported ^{226}Ra activity = 0.232 pCi/g or 0.438 dpm/g

Mass Accumulation Rate = 0.006 g/cm^2/yr

SUMMARY OF 210Pb ANALYSES

Mid-Samp Cum. Dry Wt. g/cm2	Porosity	Total 210Pb dpm/g	Total 210Pb pCi/g	Unsupp. 210Pb dpm/g	Unsupp. 210Pb pCi/g	Years (*)
0.32	0.8839	22.045	9.930	21.530	9.698	1996
0.37	0.8831	19.629	8.842	19.114	8.610	1996
0.42	0.8897	16.493	7.429	15.978	7.197	1996
0.47	0.8771	14.122	6.361	13.607	6.129	1996
0.52	0.8944	12.828	5.778	12.313	5.546	1996
0.58	0.8971	12.257	5.521	11.742	5.289	1996
0.64	0.8993	9.764	4.398	9.249	4.166	1996
0.71	0.8918	6.237	2.809	5.722	2.578	1996
0.77	0.9082	5.033	2.267	4.518	2.035	1996
0.83	0.9114	3.396	1.530	2.881	1.298	1996
0.89	0.9234	2.849	1.283	2.334	1.051	1996
0.96	0.9255	1.961	0.883	1.446	0.651	1996
1.00	0.9276	1.300	0.586	0.785	0.354	
1.05	0.9260	1.388	0.625	0.873	0.393	
1.10	0.9178	0.971	0.437	0.456	0.206	
1.13	0.9212	0.948	0.427	0.433	0.195	
5.19	0.8988	0.515	0.232	0.000	0.000	

(*) Year calculated using the mass accumulation rate of the sample.

Appendix F1. Lead Accumulation Rate Analysis, CRS Model, Detour Lake Bog Core

Depth Uncomp Mid-Pt (cm)	Cum. Dry Wt (g/cm^2)	Mid-Slice Cum. Dry Wt (g/cm^2)	Unsupp. Activity (pCi/g)	Area (pCi/cm^2)	Cum. Area (pCi/cm^2)	Time (years before 1994)	Cum. Avg Mass Acc Rate ($g/cm^2/yr$)	Date	Mass AccRate ($g/cm^2/yr$)
1.26	0.00	0.08	14.188	1.135	1.135	3.270	0.024	1991	0.024
1.92	0.09	0.11	14.188	0.470	1.605	4.728	0.023	1989	0.021
2.57	0.13	0.14	17.138	0.581	2.186	6.629	0.022	1988	0.018
3.87	0.16	0.22	16.089	1.177	3.363	10.858	0.021	1983	0.019
4.34	0.24	0.25	13.328	0.363	3.726	12.284	0.021	1982	0.021
4.84	0.27	0.30	10.883	0.379	4.105	13.844	0.021	1980	0.026
5.45	0.32	0.33	8.079	0.323	4.428	15.235	0.022	1979	0.029
6.17	0.35	0.38	8.066	0.363	4.792	16.875	0.023	1977	0.027
6.95	0.41	0.44	8.076	0.418	5.210	18.872	0.023	1975	0.028
7.60	0.46	0.48	7.126	0.284	5.494	20.304	0.023	1974	0.028
8.21	0.49	0.51	7.078	0.279	5.772	21.773	0.023	1972	0.024
8.73	0.53	0.54	8.846	0.301	6.073	23.441	0.023	1971	0.021
9.23	0.56	0.58	8.362	0.297	6.371	25.176	0.023	1969	0.020
12.15	0.60	0.77	8.619	1.556	7.927	36.205	0.021	1958	0.017
15.28	0.79	0.99	7.762	1.482	9.409	52.094	0.019	1942	0.014
19.70	1.03	1.31	5.713	1.320	10.730	79.210	0.016	1915	0.012
20.97	1.33	1.38	2.671	0.182	10.911	85.686	0.016	1908	0.012
22.62	1.39	1.48	2.178	0.150	11.062	92.250	0.016	1902	0.015
23.94	1.50	1.57	0.831	0.082	11.144	96.510	0.016	1898	0.020
25.61	1.60	1.67	1.108	0.061	11.205	100.069	0.017	1894	0.031
							0.021	Average	0.021
							0.003	Std. Dev.	0.006

Based on data from lines 1 to 21
Total Area equals 11.72537

Atmospheric flux rate at the time of collection 1994.642 is 0.36 $pCi/cm^2/yr$.

Appendix F2. Lead Accumulation Rate Analysis, CRS Model, Kinosheo Lake Bog Core

Depth Uncomp Mid-Pt (cm)	Cum. Dry Wt (g/cm^2)	Mid-Slice Cum. Dry Wt (g/cm^2)	Unsupp. Activity (pCi/g)	Area (pCi/cm^2)	Cum. Area (pCi/cm^2)	Time (years before 1994)	Cum. Avg Mass Acc Rate ($g/cm^2/yr$)	Date	Mass AccRate ($g/cm^2/yr$)
0.54	0.02	0.01	15.994	0.160	0.160	0.784	0.013	1993	0.013
1.83	0.05	0.04	15.994	0.386	0.546	2.760	0.013	1991	0.013
3.02	0.09	0.07	14.884	0.552	1.098	5.816	0.012	1988	0.011
3.74	0.11	0.10	16.661	0.502	1.600	8.871	0.011	1985	0.010
4.69	0.16	0.14	16.807	0.719	2.319	13.824	0.010	1980	0.009
5.58	0.20	0.19	15.137	0.669	2.988	19.240	0.010	1975	0.008
6.84	0.25	0.24	14.591	0.620	3.607	25.230	0.010	1969	0.008
7.87	0.31	0.30	10.194	0.524	4.131	31.339	0.009	1963	0.009
9.06	0.36	0.35	8.843	0.460	4.591	37.873	0.009	1956	0.008
10.13	0.42	0.40	7.885	0.335	4.926	43.644	0.009	1950	0.009
11.38	0.47	0.46	5.528	0.322	5.248	50.373	0.009	1944	0.009
12.40	0.53	0.51	5.206	0.260	5.508	57.077	0.009	1937	0.007
13.56	0.58	0.57	5.205	0.285	5.793	66.481	0.009	1928	0.006
14.57	0.64	0.63	4.283	0.234	6.027	76.992	0.008	1917	0.005
15.70	0.70	0.68	4.210	0.191	6.218	89.249	0.008	1905	0.004
17.93	0.81	0.78	2.749	0.238	6.456	116.968	0.007	1877	0.004
19.53	0.88	0.86	1.786	0.097	6.553	143.187	0.006	1851	0.003
21.25	0.96	0.94	0.799	0.049	6.602	176.334	0.005	1818	0.003
							0.009	Average	0.007
							0.003	Std. Dev.	0.006

Based on data from lines 1 to 19
Total Area equals 6.62985

Atmospheric flux rate at the time of collection 1994.637 is 0.21 $pCi/cm^2/yr$

Appendix F3. Lead Accumulation Rate Analysis, CRS Model, Town Site Bog Core

Depth Uncomp Mid-Pt (cm)	Cum. Dry Wt (g/cm^2)	Mid-Slice Cum. Dry Wt (g/cm^2)	Unsupp. Activity (pCi/g)	Area (pCi/cm^2)	Cum. Area (pCi/cm^2)	Time (years before 1994)	Cum. Avg Mass Acc Rate (g/cm^2/yr)	Date	Mass AccRate (g/cm^2/yr)
0.79	0.03	0.01	18.442	0.277	0.277	1.764	0.009	1993	0.009
2.29	0.05	0.04	18.442	0.372	0.648	4.300	0.009	1991	0.010
3.64	0.12	0.09	11.301	0.449	1.098	7.656	0.011	1987	0.013
4.96	0.21	0.16	8.663	0.655	1.753	13.281	0.012	1982	0.014
6.16	0.30	0.25	7.714	0.625	2.378	19.756	0.013	1975	0.014
7.19	0.36	0.33	6.174	0.469	2.847	25.654	0.013	1969	0.013
9.23	0.48	0.45	6.342	0.781	3.627	38.767	0.012	1956	0.010
10.31	0.54	0.51	6.146	0.302	3.929	45.726	0.011	1949	0.008
11.36	0.61	0.58	4.820	0.323	4.252	55.355	0.010	1940	0.007
12.27	0.71	0.66	5.114	0.356	4.608	71.006	0.009	1924	0.005
13.07	0.80	0.75	3.269	0.250	4.858	89.655	0.008	1905	0.005
13.66	0.84	0.82	1.992	0.077	4.936	98.636	0.008	1896	0.007
14.08	0.88	0.86	0.391	0.042	4.977	104.777	0.008	1890	0.007
14.39	0.92	0.90	1.698	0.043	5.020	112.534	0.008	1883	0.005
14.69	1.02	0.97	0.429	0.048	5.068	124.368	0.008	1871	0.006
14.90	1.15	1.10	0.942	0.069	5.137	157.273	0.007	1838	0.004
							0.009	Average	0.008
							0.001	Std.Dev.	0.003

Based on data from lines 1 to 17

Total Area equals 5.1761

Atmospheric Flux Rate at the time of collection 1995.567 is 0.16 pCi/cm^2/yr

Appendix F4. Lead Accumulation Rate Analysis, CRS Model, Town Site Fen Core

Depth Uncomp Mid-Pt (cm)	Cum. Dry Wt (g/cm^2)	Mid-Slice Cum. Dry Wt (g/cm^2)	Unsupp. Activity (pCi/g)	Area (pCi/cm^2)	Cum. Area (pCi/cm^2)	Time (years before 1994)	Cum. Avg Mass Acc Rate ($g/cm^2/yr$)	Date	Mass AccRate ($g/cm^2/yr$)
4.0	0.4	0.3	9.698	3.152	3.152	22.518	0.014	1973	0.014
4.8	0.4	0.4	9.698	0.412	3.564	27.094	0.014	1968	0.010
5.5	0.5	0.4	8.610	0.395	3.959	32.196	0.013	1963	0.010
6.3	0.5	0.5	7.197	0.366	4.326	37.730	0.013	1957	0.010
7.0	0.6	0.5	6.129	0.292	4.617	43.020	0.012	1952	0.009
7.7	0.6	0.6	5.546	0.298	4.915	49.505	0.012	1946	0.009
8.3	0.7	0.6	5.289	0.284	5.199	57.150	0.011	1938	0.008
9.1	0.7	0.7	4.166	0.219	5.418	64.626	0.011	1930	0.009
9.7	0.8	0.8	2.578	0.150	5.568	70.970	0.011	1924	0.010
10.3	0.9	0.8	2.035	0.100	5.668	76.026	0.011	1919	0.012
10.9	0.9	0.9	1.298	0.076	5.744	80.506	0.011	1915	0.015
11.3	1.0	1.0	1.052	0.051	5.796	83.895	0.011	1911	0.018
11.7	1.0	1.0	0.651	0.025	5.821	85.703	0.012	1909	0.028
12.1	1.1	1.1	0.354	0.017	5.837	86.971	0.012	1908	0.035
12.4	1.1	1.1	0.393	0.013	5.851	88.026	0.012	1907	0.043
							0.012	Average	0.016
							0.001	Std.Dev.	0.010

Based on data from lines 5 to 20

Total Area equals 6.25465

Atmospheric Flux Rate at the time of collection 1995.613 is 0.19 $pCi/cm^2/yr$

Appendix G1. Mean Date Calculated for Each Core Slice, Detour Lake Bog Core

Slice Number	Uncompacted Mid Depth (cm)	Cum. Dry Wt. (g/cm^2)	Cum. Dry Wt. Mid-sample (g/cm^2)	CIC1 Year	CIC2 Year	CRS* Year
1	0.47	0.07	0.04	1993 ± 3	1993 ± 4	1989
2	1.26	0.09	0.08	1990 ± 2	1990 ± 1	1988
3	1.92	0.13	0.11	1988 ± 2	1989 ± 2	1988
4	2.57	0.16	0.14	1985 ± 2	1987 ± 2	1987
5	3.23	0.21	0.19	1983 ± 3	1985 ± 3	1986
6	3.87	0.24	0.22	1981 ± 2	1983 ± 2	1985
7	4.34	0.27	0.25	1979 ± 1	1981 ± 2	1984
8	4.84	0.32	0.30	1977 ± 2	1979 ± 3	1982
9	5.45	0.35	0.33	1975 ± 2	1977 ± 2	1981
10	6.17	0.41	0.38	1972 ± 3	1974 ± 3	1978
11	6.95	0.46	0.44	1970 ± 2	1971 ± 3	1976
12	7.60	0.49	0.48	1967 ± 2	1969 ± 2	1973
13	8.21	0.53	0.51	1965 ± 2	1967 ± 2	1972
14	8.73	0.56	0.54	1963 ± 2	1965 ± 2	1970
15	9.23	0.60	0.58	1961 ± 2	1963 ± 2	1968
16	9.81	0.64	0.62	1959 ± 2	1961 ± 2	1965
17	10.41	0.67	0.65	1957 ± 2	1959 ± 2	1963
18	10.99	0.71	0.69	1955 ± 2	1958 ± 2	1961
19	11.57	0.75	0.73	1953 ± 2	1955 ± 2	1958
20	12.15	0.79	0.77	1951 ± 2	1953 ± 2	1955
21	12.76	0.83	0.81	1949 ± 2	1951 ± 2	1953
22	13.33	0.87	0.85	1947 ± 2	1949 ± 2	1950
23	13.95	0.93	0.90	1944 ± 3	1946 ± 3	1946
24	14.50	0.95	0.94	1942 ± 1	1944 ± 1	1943
25	15.28	1.03	0.99	1940 ± 4	1941 ± 4	1940
26	16.13	1.07	1.05	1937 ± 2	1938 ± 2	1935
27	16.89	1.14	1.11	1934 ± 4	1935 ± 4	1931
28	17.85	1.20	1.17	1930 ± 3	1932 ± 3	1926
29	18.82	1.28	1.24	1927 ± 4	1928 ± 4	1921
30	19.70	1.33	1.31	1924 ± 3	1925 ± 3	1916
31	20.41	1.37	1.35	1921 ± 3	1922 ± 2	1913
32	20.97	1.39	1.38	1919 ± 2	1920 ± 1	1911
33	21.47	1.42	1.40	1917 ± 2	1919 ± 2	1909
34	22.05	1.46	1.44	1915 ± 2	1917 ± 2	1907
35	22.62	1.50	1.48	1913 ± 2	1915 ± 2	1904
36	23.19	1.53	1.51	1911 ± 2	1913 ± 2	1902
37	23.94	1.60	1.57	1908 ± 3	1911 ± 4	1898
38	24.55	1.62	1.61	1906 ± 1	1908 ± 1	1895
39	24.98	1.65	1.63	1905 ± 2	1907 ± 2	1894
40	25.61	1.70	1.67	1902 ± 3	1905 ± 3	1892
41	26.23	1.73	1.72	1900 ± 2	1902 ± 2	1889
42	26.79	1.77	1.75	1898 ± 2	1901 ± 2	1887
43	27.30	1.79	1.78	1896 ± 2	1899 ± 1	1886

* Calculation based on a Multiple Linear Regression with an R^2 of 0.9970 and a Standard Error of 1.8660.

Appendix G2. Mean Date Calculated for Each Core Slice, Kinosheo Lake Bog Core

Slice Number	Uncompacted Mid Depth (cm)	Cum. Dry Wt. (g/cm^2)	Cum. Dry Wt. Mid-sample (g/cm^2)	CIC1 Year	CIC2 Year	CRS* Year
1	0.54	0.02	0.01	1992 ± 6	1993 ± 2	1993
2	1.83	0.05	0.04	1985 ± 8	1991 ± 3	1989
3	3.02	0.09	0.07	1978 ± 5	1987 ± 5	1985
4	3.74	0.11	0.10	1975 ± 3	1983 ± 2	1982
5	4.24	0.13	0.12	1972 ± 2	1981 ± 2	1979
6	4.69	0.16	0.14	1970 ± 3	1978 ± 3	1977
7	5.16	0.18	0.17	1967 ± 3	1975 ± 2	1974
8	5.58	0.20	0.19	1965 ± 2	1973 ± 2	1972
9	6.21	0.23	0.22	1961 ± 5	1970 ± 4	1969
10	6.84	0.25	0.24	1958 ± 2	1967 ± 2	1967
11	7.28	0.28	0.26	1956 ± 3	1964 ± 3	1965
12	7.87	0.31	0.30	1953 ± 4	1961 ± 3	1961
13	8.52	0.34	0.32	1949 ± 3	1957 ± 4	1959
14	9.06	0.36	0.35	1946 ± 3	1955 ± 2	1956
15	9.52	0.38	0.37	1944 ± 2	1952 ± 2	1953
16	10.13	0.42	0.40	1940 ± 4	1949 ± 5	1950
17	10.83	0.45	0.44	1937 ± 3	1945 ± 4	1945
18	11.38	0.47	0.46	1934 ± 3	1942 ± 2	1942
19	11.82	0.49	0.48	1931 ± 2	1940 ± 2	1939
20	12.40	0.53	0.51	1928 ± 4	1936 ± 5	1935
21	13.09	0.56	0.54	1925 ± 3	1932 ± 4	1930
22	13.56	0.58	0.57	1922 ± 2	1929 ± 2	1925
23	14.02	0.61	0.60	1920 ± 3	1926 ± 3	1920
24	14.57	0.64	0.63	1917 ± 3	1923 ± 3	1914
25	15.04	0.66	0.65	1914 ± 2	1920 ± 2	1909
26	15.70	0.70	0.68	1911 ± 5	1917 ± 5	1903
27	16.78	0.76	0.73	1905 ± 7	1911 ± 7	1890
28	17.93	0.81	0.78	1899 ± 6	1905 ± 6	
29	18.80	0.84	0.82	1894 ± 4	1900 ± 4	
30	19.53	0.88	0.86	1890 ± 4	1896 ± 5	
31	20.41	0.93	0.90	1886 ± 5	1891 ± 6	
32	21.25	0.96	0.94		1886 ± 3	

* Calculation based on a Multiple Linear Regression with an R^2 of 0.9995 and a Standard Error of 1.0819.

Appendix G3. Mean Date Calculated for Each Core Slice, Town Site Bog Core.

Slice Number	Uncompacted Mid Depth (cm)	Cum. Dry Wt. (g/cm^2)	Cum. Dry Wt. Mid-sample (g/cm^2)	CIC2 Year	CIC2 Std Dev	CRS Year
1	0.79	0.03	0.01	1994	3	1993
2	2.29	0.05	0.04	1991	2	1991
3	3.64	0.12	0.09	1986	8	1987
4	4.96	0.21	0.16	1977	10	1982
5	6.16	0.30	0.25	1967	10	1975
6	7.19	0.36	0.33	1959	7	1969
7	8.22	0.43	0.40	1951	8	1963
8	9.23	0.48	0.45	1945	6	1956
9	10.31	0.54	0.51	1938	7	1949
10	11.36	0.61	0.58	1931	8	1940
11	12.27	0.71	0.66	1922	11	1924
12	13.07	0.80	0.75	1911	10	1905
13	13.66	0.84	0.82	1904	5	1896
14	14.08	0.88	0.86	1899	4	1890
15	14.39	0.92	0.90	1895	4	1883
16	14.69	1.02	0.97	1887	11	

Appendix G4. Mean Date Calculated for Each Core Slice, Town Site Fen Core.

Slice Number	Uncompacted Mid Depth (cm)	Cum. Dry Wt. (g/cm^2)	Cum. Dry Wt. Mid-sample (g/cm^2)	CIC2 Year	CIC2 Std Dev	CRS Year	CRS-MLR Year*
1	0.40	0.06	0.03	1991	10		1987*
2	1.26	0.12	0.09	1981	10		1987*
3	2.23	0.21	0.16	1969	14		1983*
4	3.20	0.30	0.25	1955	14		1977*
5	4.04	0.35	0.32	1944	8	1973	1973
6	4.75	0.39	0.37	1936	6	1968	1968
7	5.48	0.45	0.42	1928	10	1963	1963
8	6.25	0.50	0.47	1920	8	1957	1957
9	6.98	0.55	0.52	1912	8	1952	1952
10	7.65	0.61	0.58	1903	10	1946	1946
11	8.32	0.67	0.64	1893	10	1938	1938
12	9.05	0.74	0.71			1930	1930
13	9.74	0.80	0.77			1924	1924
14	10.31	0.86	0.83			1919	1919
15	10.86	0.93	0.89			1915	1915
16	11.31	0.98	0.96			1911	1911
17	11.72	1.03	1.00			1909	1909
18	12.08	1.07	1.05			1908	1908
19	12.43	1.12	1.10			1907	1907

* Calculation based on a Multiple Linear Regression with an R^2 of 0.9993 and a Standard Error of 0.6300.