ASSESSMENT OF CHANGES IN TOTAL PHOSPHORUS IN DECKER LAKE WEST, B.C. : A PALEOLIMNOLOGICAL ASSESSMENT (March 2005)

Prepared for: Ian Sharpe, Jeannette Lough and Julia Kokel: B.C. Ministry of Water, Land and Air Protection

Contractor: Dr. Brian Cumming, Associate Professor; Dr. Kathleen Laird, Research Associate
Paleoecological Environmental Assessment and Research Laboratory (PEARL)
Dept. of Biology, Queen's University, Kingston, ON, K7L 3N6,
Ph.: (613) 533-6153; FAX: (613) 533-6617; e-mail: cummingb@biology.queensu.ca

Supplier: Queen's University, Contact person: Dr. Brian Cumming

List of Figures and Appendices:

BACKGROUND

Sediment cores were retrieved from Decker Lake with a modified K-B corer (internal diameter ~6.35 cm) on February 7th, 2002 by A.J. Downie, Ian Sharpe, Mark West and Ian Wilson. Two cores were retrieved, one from the east basin at approximately 12 meters depth that was 32 cm in length, and a second from the west basin at approximately 15 meters depth that was 47 cm in length. Samples were sectioned into 1.0 cm intervals, which were stored at the Ministry and later shipped to Queen's University where they were stored in our coldroom at 4 °C. All the samples were weighed to determine the total wet weight of sediment prior to subsampling for ^{210}Pb, loss-on-ignition and diatom analyses. Twenty intervals were subsampled for diatoms from only Decker Lake West. Earlier ^{210}Pb analyses for Decker Lake East core suggested that the dating of this core would be problematic and with large uncertainties, thus no diatom analyses were carried out. For the Decker West sediment core, every two cm was sampled from 0 to 38.0 cm for diatom analyses. Seventeen intervals were prepared for ^{210}Pb analysis (see below) for Decker West using gamma spectroscopy at PEARL, Queen's University.

METHODS

^{210}Pb Dating and Percent Organic Matter

The wet weight of the sediment was determined for all the subsections of the core that were shipped to Queen's. Eighteen samples for Decker West (an additional 1 sample from the 17 for dating for determination of percent water and organic matter analysis) were dried in the freeze drier at PEARL (24 hr. cycle). Dry weight of the sediment and percent water was determined. Dry sediment was then precisely weighed into a plastic tube for gamma spectroscopy. These samples were then sealed with epoxy and allowed to sit for two weeks in order for ^{214}Bi to equalize for determination of supported ^{210}Pb used in estimating core chronology. Activities of ^{210}Pb, ^{137}Cs and supported ^{210}Pb (via ^{214}Bi) were determined for each sample. These activities were then used to estimate the chronology of the core.

The activities (in disintegrations per minute/gram) of ^{210}Pb, ^{137}Cs and ^{214}Bi were determined using the procedures outlined in Schelske et al. (1994). These values were converted into picoCuries/gram for use in the Binford program (see below). Unsupported ^{210}Pb was calculated by subtracting supported ^{210}Pb (via ^{214}Bi counts from all samples within each of the cores) from the total ^{210}Pb activity at each level. The sediment chronology and sedimentation rates were calculated using the constant rate of supply (CRS) model (Appleby and Oldfield, 1978) from the estimates of ^{210}Pb activities and estimates of cumulative dry mass (Binford, 1990). See Appendix B for a summary of ^{210}Pb calculations.

Percent organic matter was determined for eighteen samples from Decker West, including the 17 that were ^{210}Pb dated (Appendix A) using standard loss-on-ignition (LOI) methods (Dean, 1974). Briefly, a known quantity of dried sediment (recorded to four decimal places) was heated to 550°C for 2 hours. The difference between the dry weight of the sediment and the weight of sediment remaining after ignition was used to estimate the percent of organic matter in each sediment sample.

Diatom Preparation and Enumeration

Slides for diatom analysis were prepared using standard techniques (Cumming et al. 1995). Briefly, a small amount of wet sediment was suspended in a 50:50 (molar) mixture of sulfuric and nitric acid in a 20-ml glass vial for 24 hr. prior to being submersed at 70°C in a water bath for approximately 5 hr. The remaining sediment material was settled for a period of 24 hr, at which time the acid above the sample was removed. The sample was rinsed with distilled water and allowed to settle once again for 24 hrs. The procedure was repeated approximately 8 times until the sample was acid free (litmus test). The samples were settled onto coverslips in a series of four 100% dilutions, which when dry, were mounted onto glass slides using a high-resolution mounting media called Naphrax®. For each sample, at least 400 diatom valves were enumerated with a Leica DMRB microscope equipped with DIC optics at 1000X magnification (Numerical Aperature of objective = 1.3). These analyses were based on the references of Krammer and Lange-Bertalot (1986, 1988, 1991a,b), Patrick and Reimer (1966, 1975) and Cumming et al. (1995).

Absolute abundance of diatoms was determined for all samples analyzed for diatoms using methods outlined in Battarbee & Kneen (1982). Absolute abundances were determined by spiking each of the diatom samples, prior to settling on coverslips, with a known concentration of microspheres. The microspheres were enumerated along with the diatoms and used to calculate estimates of # diatoms per gram dry weight. Total diatom concentration (#/g dry weight x 10^8) provides a means of assessing whether there were any changes in diatom production during the time period analyzed.

Diatom-based Reconstructions of Total Phosphorus

Inferences of total phosphorus from the diatom assemblages in the core are based on a phosphorus model developed from 268 freshwater lakes from across British Columbia. This dataset includes lakes from several regions within British Columbia. This model is based on estimates of the optima of taxa from weighted-averaging regression on non-transformed relative percentage data. Square-root transformed data provides similar model results. The coefficient of determination (r^2) of this model is 0.62, and the bootstrapped r^2 is 0.51. This model is superior to the earlier models developed by Reavie et al. (1995) for several reasons including its better predictive ability and the larger number of samples which provide more analogs for downcore reconstructions.

The total phosphorus inferences (Figs. 1E) were critically assessed to determine if they tracked the main direction of variation in the diatom species assemblages (Figs. 1D). If the diatom-based phosphorus reconstructions match the main direction of variation in the diatom assemblages in the core, then we can be fairly confident that the diatoms are tracking changes that are related to phosphorus. If the correlation between the main direction of variation and the diatom-inferred phosphorus values is weak or nonexistent, then other environmental variables (e.g. water depth, conductivity, turbulence, etc), or interactions between environmental variables, are likely responsible for the observed changes in diatom assemblages.

Determination of the Main Direction of Variation

The main direction of variation in the diatom assemblages in the Decker West core was determined from the first axis scores from a principal components analysis (PCA) ordination using non-transformed species abundance data (Figs. 1D). A PCA was chosen to represent the main direction of variation of the diatom assemblages in these cores based on the small gradient length (< 1.5 standard deviation units) obtained in an initial detrended correspondence analysis

(DCA) ordination.

Cluster Analysis

Cluster analysis provides a means of grouping those samples that are most similar to each other. The program, TILIA and TGVIEW 2.02 (Grimm, unpublished), was used to provide a stratigraphic sequence (downcore) of the diatom assemblages and the cluster analyses. The cluster analyses were stratigraphical constrained in order to group the assemblages according to core depth (or core age) using non-transformed species data.

RESULTS AND DISCUSSION

^{210}Pb Profile, Sedimentation Rates and Organic Matter

The ^{210}Pb activity of the Decker West core was very low, but has a relatively good exponential decay with depth (Fig. 1A), with the exception of stable activity for the top two cm. and a low peak at 8 cm. The top 2 cm of the profile indicates relatively stable activity, which suggests either an increase in sedimentation rate or mixing of the core profile. Calculation of sediment accumulation (Fig. 1B) does not indicate a recent increase in the sedimentation rate. However, sedimentation rates are best estimated from several cores within a basin because sedimentation rates may vary across a basin. There is a large peak in sedimentation rates in the mid-1940s that may be associated with an erosional event corresponding roughly with the low in organic matter (Fig.1, see below). However, further cores would have to be analyzed to verify this pattern is seen across the basin.

A distinct peak in ^{137}Cs is a marker for 1963, since 1963 corresponds to the peak in atmospheric testing of nuclear weapons, and consequently fallout of isotopes such as ^{137}Cs. The ^{137}Cs peak in the Decker Lake West core likely occurs somewhere between 8-14 cm, which has an estimated ^{210}Pb date of 1973 to 1986 (see Appendix A). The highest ^{137}Cs activities for those samples analyzed were at 8 and 10 cm, however the real peak may occur below this point closer to 14 cm. But regardless of where the ^{137}Cs peak occurs between 10-14 cm there is not a good match between the ^{210}Pb and ^{137}Cs. Cesium may potentially be mobile in these lake sediments and thus not a good chronological marker for this lake.

Analysis of organic matter (OM) from the core indicates highly inorganic sediments with the organic component only comprising 8 to 15% of the sediments. There has been a small and steady increase in percent organics since a low in the mid-1930s from approximately 8 to 15%. Increases in organic matter can be attributed to several factors including increased in-lake production of organic matter, increased inwash of organic matter, or decreases in the load of inorganic matter to the lake.

Diatom Assemblage Changes and Analyses

One hundred thirteen taxa were documented in the core from Decker Lake West (Appendix C). However, the majority of these taxa are extremely rare. The meso-eutrophic planktonic taxon, *Aulacoseira subarctica* is present in high abundances throughout the past 110 years of the lake's history. Other sub-dominant taxa include the meso-eutrophic planktonics, *Aulacoseira ambigua*, small *Stephanodiscus* and *Cyclotella bodanica var. lemanica* and the benthic *Fragilaria pinnata* (Fig. 3).

Cluster analysis suggests two major periods of diatom assemblages in the past 110 years (Fig. 3). In Zone A, representing the time period from approximately 1910 to 1980 AD, the diatom assemblage is comprised primarily of the benthic taxa, *Fragilaria pinnata* and the mesotrophic to eutrophic planktonic taxa, *Cyclotella bodanica var. lemanica, Aulacoseira subarctica, Aulacoseira ambigua, Stephanodiscus minutulus* and *Stephanodiscus parvus.* Higher abundances of *Fragilaria pinnata* occur in Zone A1 (approximately 1910 to 1946), whereas higher abundances of the small eutrophic *Stephanodiscus* occur in the middle of Zone A2 (approximately 1946 to 1980). Interestingly, the more oligotrophic *Cyclotella stelligera* (TP optimum of 5.3 μgL^{-1}) also increases in relative abundance in Zone A2. Higher diatom concentration also occurs in Zone A2, further suggesting an increase in productivity during this time period. In Zone B, representing the time period from approximately 1982 to 2002 AD, there is a distinct increase in *Aulacoseira subarctica* and small increases in the eutrophic planktonic *Aulacoseira granulata* var. *angustissim*a and the mesotrophic planktonic *Tabellaria flocculosa.*

Diatom-inferred total phosphorus (TP) estimates indicate mid-summer mesotrophic to eutrophic conditions that vary between 21 to 28 μgL^{-1} (Fig. 1E) during the past 110 years of the lake's history. In Zone A1 (1910-1946 AD), TP estimates vary between 21 to 23 μgL^{-1}, in Zone A2 (1946-1980 AD) the TP estimates are approximately the same varying between to 22 to 24 μgL^{-1}. The increase in the more eutrophic small *Stephanodiscus* is offset by the increases in the oligotrophic *Cyclotella stelligera,* thus resulting in little overall change in the estimated TP values. In Zone B, there is a small, but distinct increase in TP, with levels reaching 24 to 28 μgL^{-1}. These increases would be largely driven by the increase in *Aulacoseira subarctica* and increases in the eutrophic *Aulacoseira granulata* var. *angustissim*a (TP optimum 44 μgL^{-1}). Total diatom concentration also remains high in Zone B. The correlation between the main direction of variation in taxa (i.e. PCA axis 1 scores, Fig. 1D) and the log TP inferences is high ($r = 0.78$) indicating that the changes seen in the diatom assemblages are consistent with the changes seen in the TP estimates. All dominant taxa, which are driving the reconstructions of TP, are well represented in our modern-day calibration set, thus providing evidence that the TP estimates are reliable.

SUMMARY

In summary, the diatom-inferred TP levels of Decker Lake West indicate a relatively productive lake during the past 110 years, which have increased slightly since 1980 AD. This is most notably seen with the increases in *Aulacoseira subartica* and the more eutrophic *Aulacoseira granulata* var. *angustissim*a in the most recent sediments (ca. 1995). Prior to 1980 there are small fluctuations in the dominant diatom taxa, but little change in the TP estimates.

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FIGURE CAPTIONS

Figure 1. Summary diagram for Decker Lake West showing: A) total ^{210}Pb activity; B) the sediment accumulation rate; C) the change in the percent of organic matter in the core; D) the main direction of variation in the diatom assemblage data; and E) diatom-based estimated of late-summer total phosphorus.

Figure 2. ^{210}Pb profile and ^{137}Cs profile for Decker Lake West.

Figure 3. Stratigraphy of the most abundant diatom taxa found in the sediment core from Decker Lake West (see Appendix C-1 for a complete list of taxa and the relative percentage data). The diatom taxa are arranged in order of increasing late-summer total phosphorus (TP) optima. TP optima are shown in parentheses.

Fɪɢ. 1

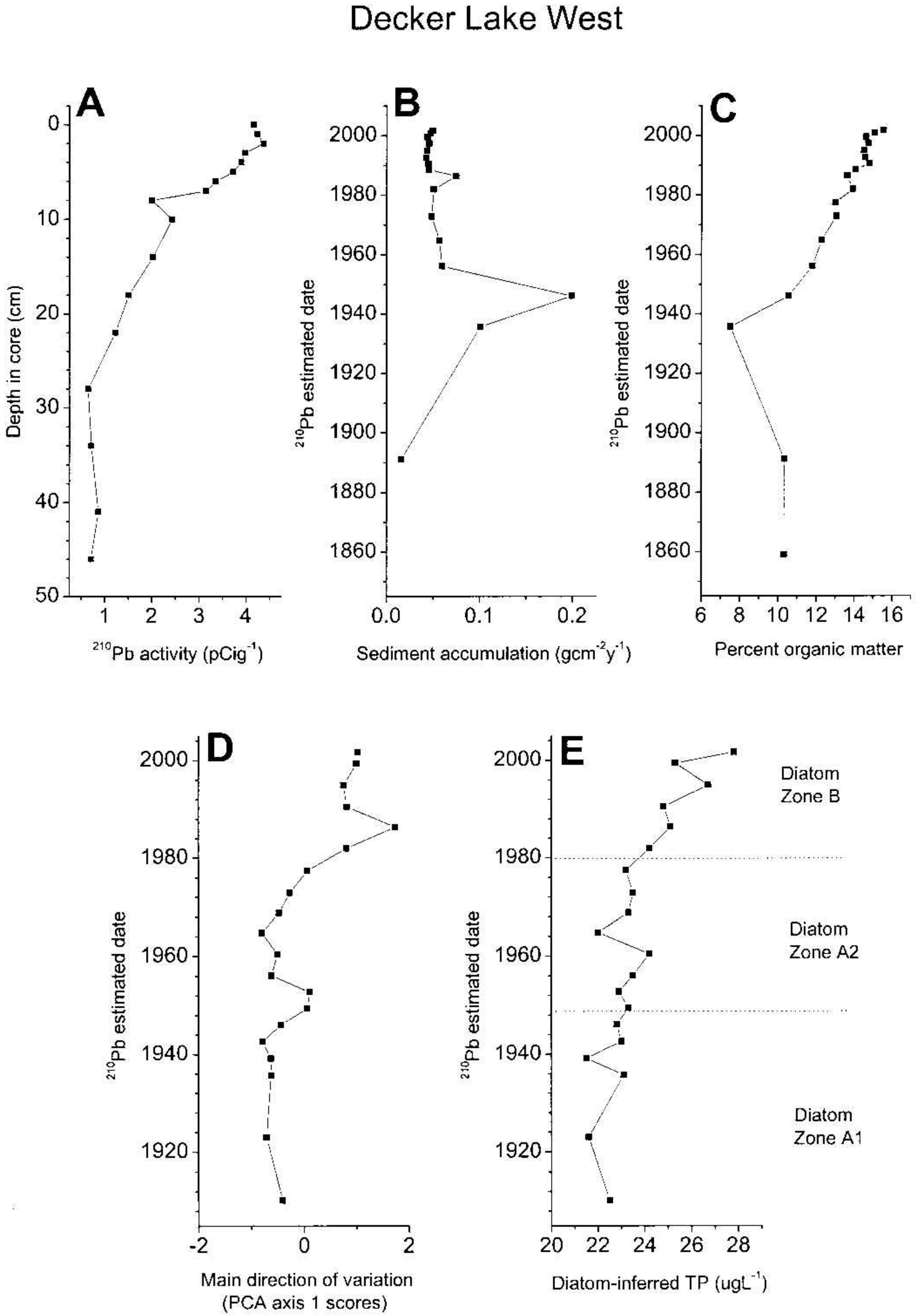

Decker Lake West
A
B
C
Depth in core (cm)
210Pb activity (pCig-1)
210Pb estimated date
Sediment accumulation (gcm-2y-1)
Percent organic matter
D
E
Main direction of variation
(PCA axis 1 scores)
Diatom-inferred TP (ugL-1)
Diatom
Zone B
Diatom
Zone A2
Diatom
Zone A1

FIG. 2

Decker Lake West

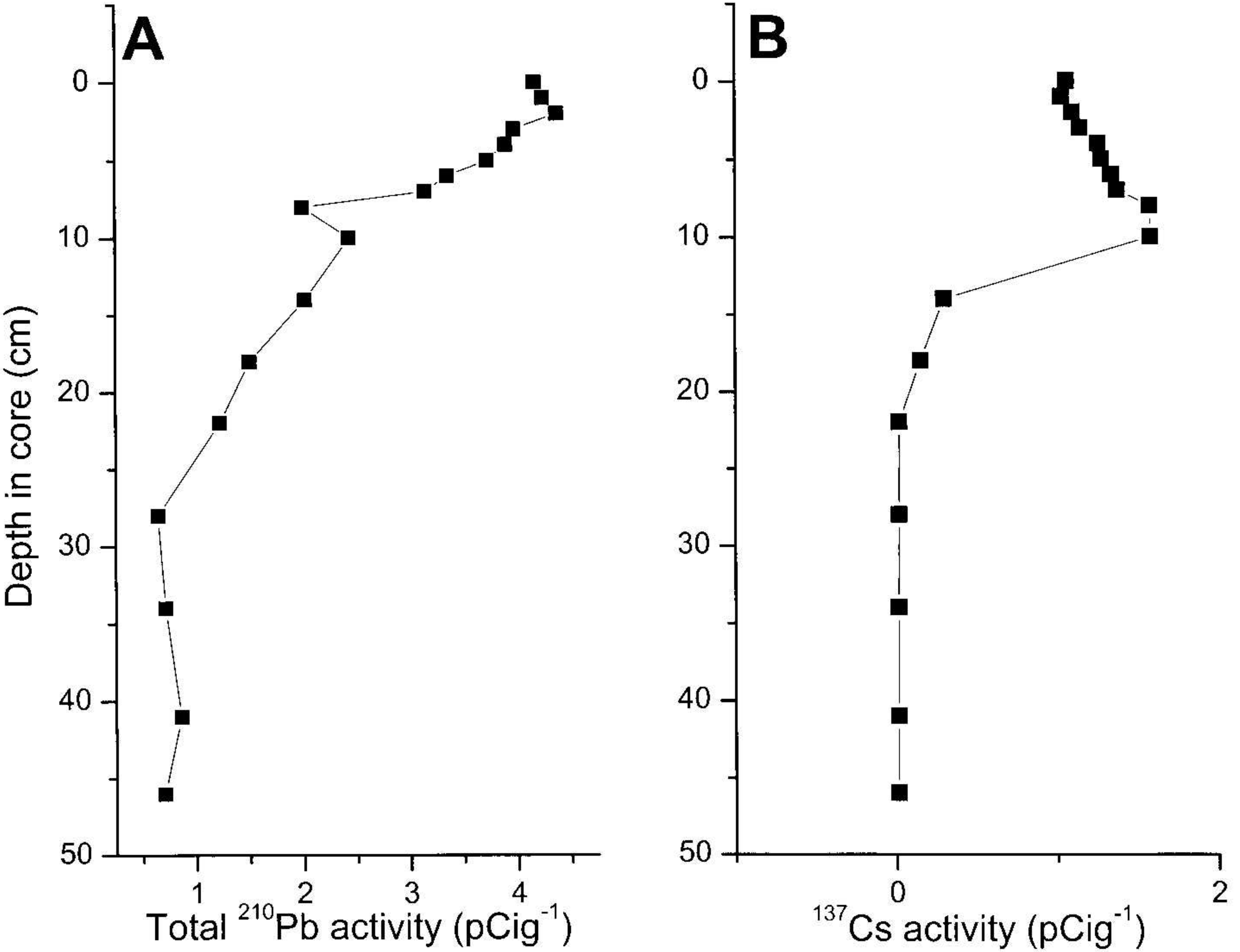
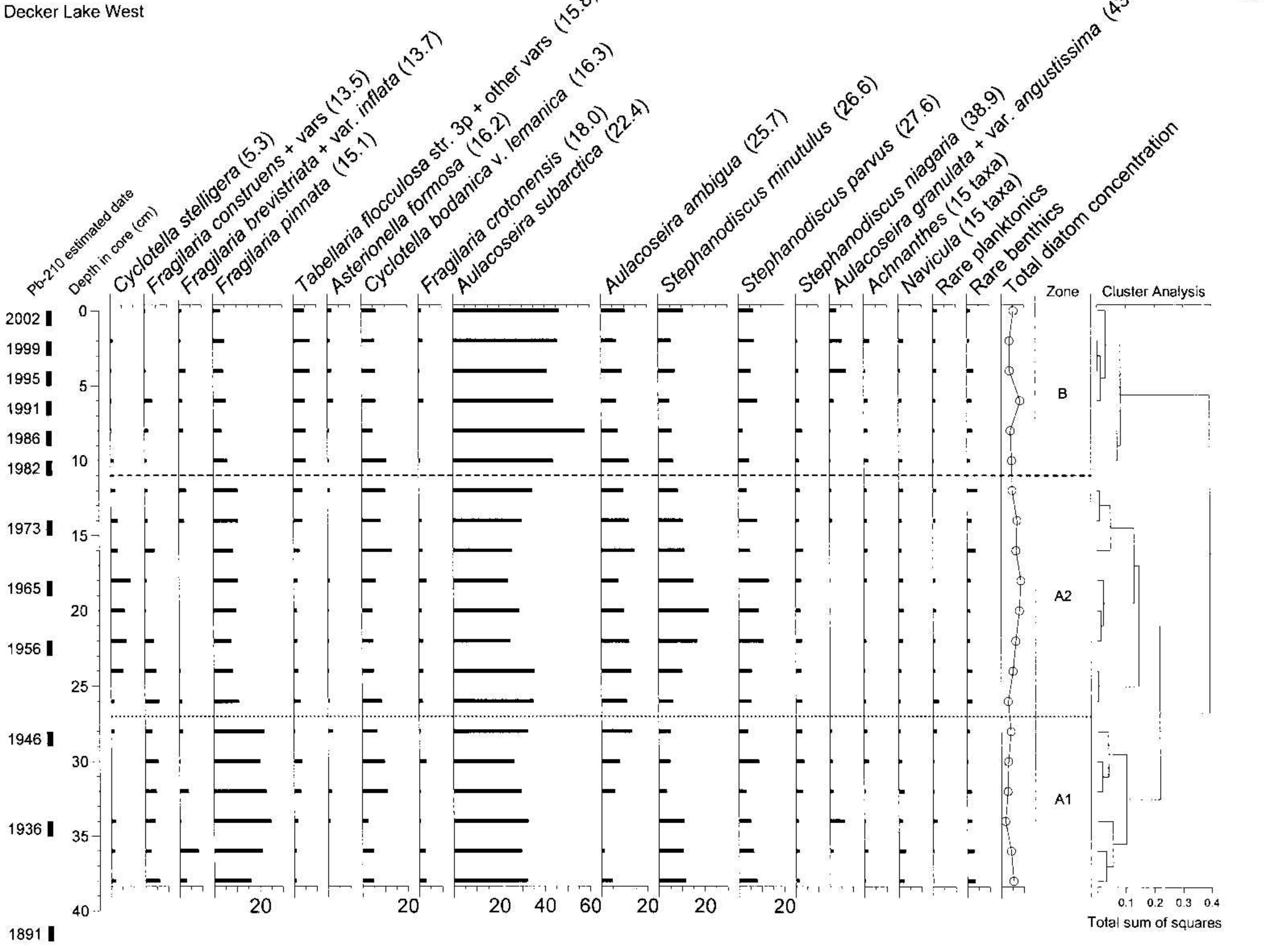


FIG. 3



Decker Lake West
Pb-210 estimated date
Depth in core (cm)
Cyclotella stelligera (5.3)
Fragilaria construens + vars (13.5)
Fragilaria brevistriata + var. inflata (13.7)
Fragilaria pinnata (15.1)
Tabellaria flocculosa str. 3p + other vars (15.8)
Asterionella formosa (16.2)
Cyclotella bodanica v. lemanica (16.3)
Fragilaria crotonensis (18.0)
Aulacoseira subarctica (22.4)
Aulacoseira ambigua (25.7)
Stephanodiscus minutulus (26.6)
Stephanodiscus parvus (27.6)
Stephanodiscus niagaria (38.9)
Aulacoseira granulata + var. angustissima (43.7)
Achnanthes (15 taxa)
Navicula (15 taxa)
Rare planktonics
Rare benthics
Total diatom concentration
Zone
Cluster Analysis
2002
1999
1995
1991
1986
1982
1973
1965
1956
1946
1936
1891
0
5
10
15
20
25
30
35
40
B
A2
A1
20
20
20
40
60
20
20
20
0.1
0.2
0.3
0.4
Total sum of squares

Appendix A

Summary File Decker Lake West

Pb210 and LOI summary

* = extrapoloted dates

INTTOP (cm)	INTBOT (cm)	137Cs (pCig-1)	Pb210Act (pCi/g)	Time (yr BP) Top	Time (yr BP) Bottom	estimated AD date	SEDRATE (g/cm2/yr)
0	1	1.0589	4.1596	0.00	1.04	2002	0.0493
1	2	1.0275	4.2380	1.04	1.75	2001	0.047
2	3	1.0955	4.3683	1.75	3.73	1999	0.0436
3	4	1.1409	3.9679	3.73	5.95	1997	0.0455
4	5	1.2554	3.8938	5.95	8.45	1995	0.0432
5	6	1.2745	3.7196	8.45	10.84	1993	0.0422
6	7	1.3389	3.3483	10.84	12.47	1991	0.0447
7	8	1.3744	3.1450	12.47	14.74	1989	0.0453
8	9	1.5766	1.9968	14.74	16.79	1986	0.0745
10	11	1.5830	2.4319	19.01	21.42	1982	0.0504
14	15	0.2977	2.0185	28.24	30.34	1973	0.0482
18	19	0.1535	1.5043	36.41	38.34	1965	0.0564
22	23	0.0196	1.2253	44.82	47.28	1956	0.0593
28	29	0.0182	0.6463	55.58	56.55	1946	0.1988
34	35	0.0168	0.7162	65.00	67.90	1936	0.1005
41	42	0.0155	0.8625	103.15	118.93	1891	0.0158
46	47	0.0141	0.7054				

INTTOP (cm)	INTBOT (cm)	estimated AD date	LOI(550C) %organic
0	1	2002	15.50926
1	2	2001	15.03958
2	3	1999	14.59175
3	4	1997	14.69253
4	5	1995	14.46741
5	6	1993	14.52756
6	7	1991	14.7621
7	8	1989	14.02272
8	9	1986	13.59578
10	11	1982	13.89325
12	13	1977	12.97395
14	15	1973	13.03808
18	19	1965	12.27926
22	23	1956	11.80556
28	29	1946	10.54435
34	35	1936	7.497071
41	42	1891	10.3211
46	47	*1859	10.31714

Diatom analyses

Depth (cm TOP	Depth (cm BOTTOM	estimated AD date	TP		PCA Axis 1	Diatom co (#/g dry w
0	1	2002		27.8	1.0114	5.30
2	3	1999		25.3	0.9902	3.57
4	5	1995		26.7	0.7467	3.71
6	7	1991		24.8	0.8081	8.33
8	9	1986		25.1	1.7346	4.06
10	11	1982		24.2	0.7943	4.67
12	13	1977		23.2	0.0583	4.82
14	15	1973		23.5	-0.2739	6.96
16	17	1969		23.3	-0.4795	6.52
18	19	1965		22.0	-0.7992	8.60
20	21	1960		24.2	-0.5101	7.96
22	23	1956		23.5	-0.6217	6.42
24	25	1953		22.9	0.1041	5.15
26	27	1949		23.3	0.0574	3.03
28	29	1946		22.8	-0.4426	4.27
30	31	1943		23.0	-0.7916	3.16
32	33	1939		21.5	-0.6325	2.87
34	35	1936		23.1	-0.6286	1.80
36	37	1923		21.6	-0.715	4.26
38	39	1910		22.5	-0.4106	5.34

Appendix B-1

Decker Lake - West **ROI - 210Pb - Counter 477** **Cored on Feb. 7th, 2002** **GAMMA COUNTER DATA**

Top Int (cm)	Bot Int (cm)	Mid pt	Date counted	counting ti (s)	mass g/dry wt	hieght in tube (mm)	Bkgr ROI1	210-Pb ROI2	Bkgr ROI3	Bkgr ROI4	226-Ra ROI5	Bkgr ROI6	Bkgr ROI7	137-Cs ROI8	Bkgr ROI9
0	1	0.5	11 Mar 04	80000	1.5006	34.46	361	1160	339	95	259	78	81	567	70
1	2	1.5	12 Mar 04	80000	1.2833	31.81	363	1063	280	99	283	66	78	511	76
2	3	2.5	13 Mar 04	80000	1.5229	33.33	337	1151	311	103	258	74	83	590	64
3	4	3.5	14 Mar 04	80000	1.4699	34.1	371	1114	312	74	251	92	74	587	72
4	5	4.5	15 Mar 04	80000	1.4968	33.3	333	1066	296	83	256	64	93	660	68
5	6	5.5	16 Mar 04	80000	1.472	33.65	367	1104	331	104	264	63	80	646	70
6	7	6.5	18 Mar 04	80000	1.5009	35.64	348	1010	307	89	262	90	83	681	80
7	8	7.5	19 Mar 04	80000	1.4898	34.13	313	972	320	73	282	80	111	714	65
8	9	8.5	20 Mar 04	80000	1.4875	34.65	355	903	348	103	279	89	98	780	70
10	11	10.5	21 Mar 04	80000	1.4926	34.09	346	932	331	105	245	74	92	788	75
14	15	14.5	22 Mar 04	80000	1.3522	34.6	351	811	278	87	238	78	53	230	71
18	19	18.5	23 Mar 04	80000	1.3538	34.93	298	731	307	92	243	83	55	171	61
22	23	22.5	24 Mar 04	80000	1.3386	33.59	303	690	289	82	266	79	72	151	71
28	29	28.5	25 Mar 04	80000	1.6042	32.6	355	711	306	94	300	75	66	112	67
34	35	34.5	26 Mar 04	80000	2.441	34.1	345	789	343	91	332	93	64	127	67
41	42	41.5	27 Mar 04	80000	1.719	34.51	340	709	287	80	275	77	60	132	72
46	47	46.5	28 Mar 04	80000	1.6279	35.07	343	729	331	74	274	81	67	130	56

Lake Name	Midpoint	corrected for efficiency & density **210Pb (dpm/g)**	**214Bi (dpm/g)**	corrected for sampling date **137Cs (dpm/g)**	210Pb error 1 std. dev. (dpm/g)	214Bi error 1 std. dev. (dpm/g)	137Cs error 1 std. dev. (dpm/g)	corrected for efficiency & density **210Pb (dps/g)**	**214Bi (dps/g)**	corrected for sampling date **137Cs (dps/g)**	210Pb error 1 std. dev. **(dps/g)**	214Bi error 1 std. dev. **(dps/g)**	137Cs error 1 std. dev. **(dps/g)**
Decker W	0.5	9.23	0.93	2.35	0.431	0.100	0.115	0.1539	0.0155	0.0392	0.0072	0.0017	0.0019
Decker W	1.5	9.41	1.51	2.28	0.459	0.139	0.121	0.1568	0.0252	0.0380	0.0077	0.0023	0.0020
Decker W	2.5	9.70	0.84	2.43	0.432	0.094	0.116	0.1616	0.0141	0.0405	0.0072	0.0016	0.0019
Decker W	3.5	8.81	0.93	2.53	0.424	0.101	0.121	0.1468	0.0156	0.0422	0.0071	0.0017	0.0020
Decker W	4.5	8.64	1.21	2.79	0.414	0.116	0.125	0.1441	0.0201	0.0465	0.0069	0.0019	0.0021
Decker W	5.5	8.26	1.08	2.83	0.410	0.110	0.127	0.1376	0.0180	0.0472	0.0068	0.0018	0.0021
Decker W	6.5	7.43	0.91	2.97	0.395	0.099	0.131	0.1239	0.0151	0.0495	0.0066	0.0017	0.0022
Decker W	7.5	6.98	1.48	3.05	0.379	0.130	0.132	0.1164	0.0246	0.0509	0.0063	0.0022	0.0022
Decker W	8.5	4.43	0.95	3.50	0.313	0.102	0.141	0.0739	0.0159	0.0583	0.0052	0.0017	0.0024
Decker W	10.5	5.40	0.68	3.51	0.338	0.084	0.141	0.0900	0.0113	0.0586	0.0056	0.0014	0.0024
Decker W	14.5	4.48	0.85	0.66	0.332	0.100	0.064	0.0747	0.0142	0.0110	0.0055	0.0017	0.0011
Decker W	18.5	3.34	0.79	0.34	0.298	0.095	0.046	0.0557	0.0131	0.0057	0.0050	0.0016	0.0008
Decker W	22.5	2.72	1.30	0.04	0.275	0.127	0.015	0.0453	0.0216	0.0007	0.0046	0.0021	0.0003
Decker W	28.5	1.43	1.37	-0.11	0.203	0.120	0.025	0.0239	0.0228	-0.0019	0.0034	0.0020	0.0004
Decker W	34.5	1.59	1.05	-0.02	0.158	0.086	0.009	0.0265	0.0175	-0.0003	0.0026	0.0014	0.0001
Decker W	41.5	1.91	1.17	-0.01	0.211	0.107	0.010	0.0319	0.0194	-0.0001	0.0035	0.0018	0.0002
Decker W	46.5	1.57	1.25	0.03	0.211	0.115	0.012	0.0261	0.0208	0.0005	0.0035	0.0019	0.0002

B-2

Decker Lake West - Pb210

CALCULATIONS FOR INPUT INTO BINFORD PROGRAM

1 dps= 1Becquerrel

INTTOP (cm)	INTBOT (cm)	Pb-210 (dps/g) activity	Std dev Pb-210 (dps/g)	214Bi (dps/g)	137Cs (dps/g)	137Cs (pCig-1)	Pb210 activity (pCig-1)	Std dev Pb-210 (pCig-1)	214Bi (pCig-1)	Rho (g cm-3)
0	1	0.1539	0.0072	0.0155	0.0392	1.0589	4.1596	0.1939	0.4194	0.0513
1	2	0.1568	0.0077	0.0252	0.0380	1.0275	4.2380	0.2068	0.6805	0.0332
2	3	0.1616	0.0072	0.0141	0.0405	1.0955	4.3683	0.1948	0.3801	0.0861
3	4	0.1468	0.0071	0.0156	0.0422	1.1409	3.9679	0.1911	0.4206	0.1011
4	5	0.1441	0.0069	0.0201	0.0465	1.2554	3.8938	0.1863	0.5435	0.1080
5	6	0.1376	0.0068	0.0180	0.0472	1.2745	3.7196	0.1846	0.4863	0.1006
6	7	0.1239	0.0066	0.0151	0.0495	1.3389	3.3483	0.1777	0.4082	0.0731
7	8	0.1164	0.0063	0.0246	0.0509	1.3744	3.1450	0.1708	0.6653	0.1029
8	9	0.0739	0.0052	0.0159	0.0583	1.5766	1.9968	0.1412	0.4299	0.1527
10	11	0.0900	0.0056	0.0113	0.0586	1.5830	2.4319	0.1523	0.3063	0.1216
14	15	0.0747	0.0055	0.0142	0.0110	0.2977	2.0185	0.1496	0.3844	0.1015
18	19	0.0557	0.0050	0.0131	0.0057	0.1535	1.5043	0.1340	0.3539	0.1085
22	23	0.0453	0.0046	0.0216	0.0007	0.0196	1.2253	0.1238	0.5847	0.1456
28	29	0.0239	0.0034	0.0228	-0.0019	-0.0515	0.6463	0.0914	0.6169	0.1929
34	35	0.0265	0.0026	0.0175	-0.0003	-0.0079	0.7162	0.0713	0.4718	0.2914
41	42	0.0319	0.0035	0.0194	-0.0001	-0.0024	0.8625	0.0953	0.5248	0.2445
46	47	0.0261	0.0035	0.0208	0.0005	0.0141	0.7054	0.0951	0.5633	0.1980

supported 0.484697
std dev 0.11096

BINFORD FILE INPUTS FOR CALCULATIONS OF DATES AND SEDIMENTATION RATES

Decker West
C1
17.00
0.1110

INTTOP (cm)	INTBOT (cm)	Pb210 Total (pCig-1)	Pb210 Unsup. (pCig-1)	Rho (g cm-3)	OM proportion	CUMTOP (g cm-2)	CUMBOT (g cm-2)	std Pb210 (pCig-1)
0	1	4.1596	3.6749	0.0513	0.155093	0.0000	0.0513	0.1939
1	2	4.2380	3.7533	0.0332	0.150396	0.0513	0.0845	0.2068
2	3	4.3683	3.8836	0.0861	0.145918	0.0845	0.1706	0.1948
3	4	3.9679	3.4832	0.1011	0.146925	0.1706	0.2717	0.1911
4	5	3.8938	3.4091	0.1080	0.144674	0.2717	0.3798	0.1863
5	6	3.7196	3.2349	0.1006	0.145276	0.3798	0.4804	0.1846
6	7	3.3483	2.8636	0.0731	0.147621	0.4804	0.5535	0.1777
7	8	3.1450	2.6603	0.1029	0.140227	0.5535	0.6564	0.1708
8	9	1.9968	1.5121	0.1527	0.135958	0.6564	0.8091	0.1412
10	11	2.4319	1.9472	0.1216	0.138932	0.9368	1.0584	0.1523
14	15	2.0185	1.5338	0.1015	0.130381	1.4689	1.5704	0.1496
18	19	1.5043	1.0196	0.1085	0.122793	1.9396	2.0481	0.1340
22	23	1.2253	0.7406	0.1456	0.118056	2.4572	2.6027	0.1238
28	29	0.6463	0.1616	0.1929	0.105443	3.4564	3.6494	0.0914
34	35	0.7162	0.2315	0.2914	0.074971	4.7547	5.0461	0.0713
41	42	0.8625	0.3778	0.2445	0.103211	6.1403	6.3848	0.0953
46	47	0.7054	0.2207	0.1980	0.103171	7.1819	7.3799	0.0951