

**Paleolimnological evidence of the effects of recent cultural eutrophication
and climatic variability during the last 300 years
in Lake Malawi, East Africa**

by
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AUTHOR'S DECLARATION FOR ELECTRONIC SUBMISSION OF A THESIS

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ABSTRACT

Lake Malawi is the second largest lake in Africa, supporting diverse populations of endemic cichlids and supplying essential water resources to Malawi, Mozambique and Tanzania. However, population growth, rapid deforestation and intensive agriculture, especially in the southern catchments, have accelerated soil erosion during the last half century. These anthropogenically-disturbed catchments have caused rivers to transport greater sediment loads into Lake Malawi than rivers within forested catchments. Lake Malawi's immense size and oligotrophic nature may retard detection of inputs of external contaminants. Reversing the effects of increased nutrient loading to Lake Malawi once observed would likely take generations, as the residence time of water is over 140 years. Therefore, sensitive metrics are required to assess the effects of land use change and climate variability in Lake Malawi in advance of deleterious effects. In this study, paleolimnological analyses of four sediment cores collected in 1997 and 1998 along a longitudinal transect of Lake Malawi, dated with ^{210}Pb analyses and analyzed for biogenic silica and sedimentary diatom assemblages, were used to create a long-term water quality dataset. These four sites span gradients of land use and latitude in order to reconstruct limnological conditions over the whole lake during the last 300 years. Paleoecological results indicate that patterns of diatom assemblage change are not uniform lake wide. Southern cores contain evidence of nutrient enrichment starting as early as ca. 1940, indicated by increased silica, carbon and nitrogen burial. By ca. 1970, increased rates of sedimentation, diatom influx and changes in diatom community composition, characterized by increased percent abundance of eutrophic diatom taxa, are attributable to accelerated enrichment by terrestrial soil erosion. The succession of diatoms in southern Lake Malawi begins with high percent abundance of *Aulacoseira nyassensis* and *Fragilaria africana*, which thrive in nutrient-rich waters, followed by a shift towards diatom taxa with reduced silica requirements by ca. 1980 (e.g. *Stephanodiscus nyassae*, *S. minutulus*, *S. muelleri*, *Cyclostephanos* and small *Nitzschia* species.), a pattern comparable to the eutrophication-induced decline in silica to phosphorus ratios in Lake Victoria. In Lake Malawi, evidence of eutrophication extends to the mid lake as indicated by similar diatom assemblage changes in the sediment core from

the central region. Diatom stratigraphies from the north end of the lake indicate no observable impacts of land use change on the northern basin of Lake Malawi during the past 350 years. However, a nine-meter rise in water level ca. 1860 AD appears to have resulted in elevated diatom influxes at that time comparable to the recent eutrophication-induced diatom influxes of the southern cores. The effects of this rise in water level was recorded in all three measured sites, southern, central and northern Lake Malawi, indicating lake-wide increased productivity, yet changes to the diatom community composition were imperceptible. This study shows evidence of recent cultural eutrophication altering limnological conditions with impacts to the biogeochemical cycling of silica, the available silica to phosphorus ratios and the biotic communities of a large portion of Lake Malawi. Thus, providing an early warning that proper stewardship of Lake Malawi requires effective management of land-use practices within the catchment to reduce soil erosion and avoid widespread water quality deterioration of this great lake.

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INTRODUCTION

Lake Malawi is the southernmost lake of the African Rift Valley extending from 9°30 S to 14°30 S (Figure 1) and is the second largest lake in Africa by volume (Bootsma and Hecky, 2003). Lake Malawi is bordered by the countries Tanzania, Mozambique and Malawi, which benefit from this large freshwater resource. The lake is used for drinking, irrigation, transportation, fishing, hydroelectricity, tourism and scientific research (Bootsma and Hecky, 1993). Lake Malawi has more fish species than any other lake in the world, consisting primarily of endemic cichlids (Snoeks, 1998). This faunal diversity, along with Lake Malawi's immense size, slow flushing rate and great age, are just a few distinguished limnological features that place the lake at risk due to human land use changes and climate warming (Bootsma and Hecky, 1993; Tweddle, 1992; Verburg et al., 2003; Vollmer et al., in press).

During the last 30 to 40 years, demands of rapidly growing human populations in the riparian zone of Lake Malawi have led to increased deforestation for cultivation, especially in the southern portion of the catchment (Cohen et al., 1996; Hudak and Wessman, 2000). Substantial deforestation from 1967 to 1990 in Malawi reduced the catchment from 64% to 51% forest coverage (Calder et al., 1995) and deforestation continues at an estimated rate of 1.8 % per year on average (Hudak and Wessman, 2000). This loss of natural vegetation results in an exchange of a deep root system for a fine root system of grasses and seasonally barren soils from row crops (Hudak and Wessman, 2000). At the same time, Calder (1995) estimated that a decline of 13% forest cover in the catchment, beginning in 1967, caused a one-meter rise in lake level due to increased runoff and reduced evapotranspiration and forest interception. In addition to the increased runoff, current agricultural practices in East Africa often neglect traditional soil conservation techniques used on steep slopes, such as soil terracing and crop rotation, resulting in the loss of nutrients and soil fertility (Cohen et al., 1996). Destabilization and exposure of soils (Hudak and Wessman, 2000), burning of fuel wood and crops (Tamatamah et al., in press), and eolian erosion of topsoil have increased riverine

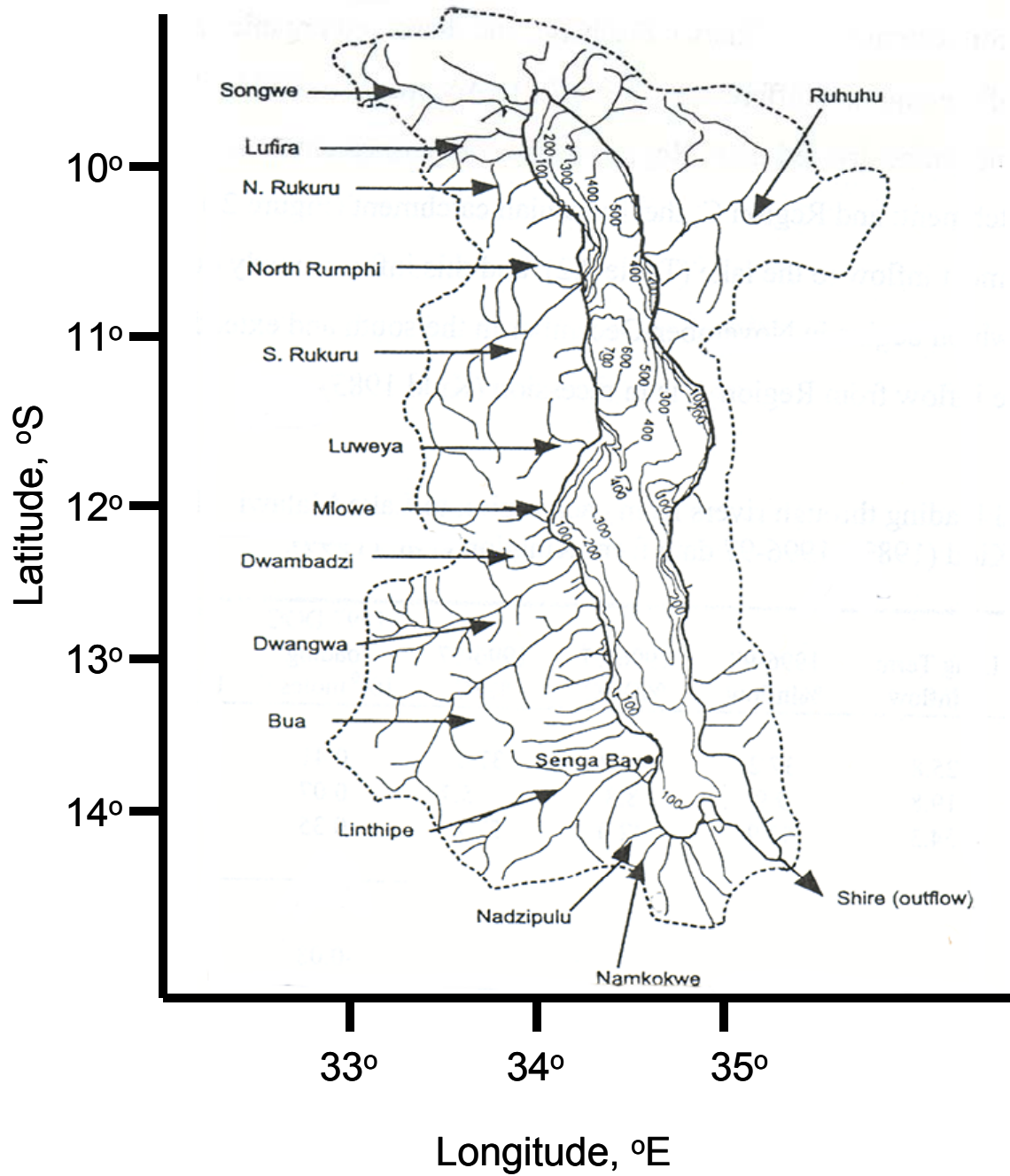


Figure 2. Map of Lake Malawi and the surrounding catchment with 14 of the major tributaries and the Shire River outflow labeled. Adapted from Hecky, et al. (2003).

(Hecky et al., 2003) and atmospheric (Bootsma et al., 1996a) loading of nutrients in several Malawi catchments. Increased atmospheric and riverine loadings of phosphorus are a particular concern for Lake Malawi, as they are the external sources of phosphorus inputs to the lake and response times to changes in external inputs of phosphorus are believed to be rapid (Bootsma and Hecky, 1999).

Land-use practices are most intensive in the southern catchments around the shallower end of Lake Malawi where the catchment relief is less steep than in the north and conducive to human habitation and extensive agriculture (Hecky et al., 2003). Therefore, lake water quality may be most affected by land use change at the south end of the lake. Human activities can impact the aquatic ecosystem by way of rivers that feed the lake and in southern Lake Malawi the Linthipe River is the largest, most impacted river to the southern portion of the lake (Figure 1). The Linthipe River has high flow variability and is responsible for transport of the greatest suspended nutrient loads into Lake Malawi, relative to a dozen of the most prominent inflow rivers along the Malawi coast (Hecky et al., 2003). Shallow, well-oxygenated waters in the south may be more sensitive to the onset of eutrophication in Lake Malawi than the north since nutrient inputs are effectively re-circulated during seasonal mixing and available to the photic zone rather than lost to the deep, anoxic monimolimnion in the north (Bootsma and Hecky, 2003). Consequently, increased runoff and sediment flux to the south end of the lake threaten the aquatic ecosystem in many ways such as modified nutrient ratios, altered phytoplankton communities (with reduced nutritional value), diminished light penetration and reduced fish habitat (Cohen et al., 1996).

Lake Malawi is currently classified as an ultra-oligotrophic system (Guildford et al., 2000; Kling et al., 2001) and its large volume of water has the potential to dilute pollutants from the air and watershed. In the past, however, human perturbations that increase nutrient loads have had catastrophic effects in Lake Victoria, another African Great Lake, which serves as a cautionary example of the potential for land-use induced eutrophication in tropical African Great Lakes. In the span of 30 years (1960-1990), Lake Victoria's trophic status shifted from oligo-mesotrophic to eutrophic (Kling et al., 2001) and anthropogenic eutrophication resulted in massive changes to the

phytoplankton community towards thinly silicified diatoms and persistence of cyanophytes (Kling et al., 2001; Mugidde et al., 2003; Verschuren et al., 2001). In Lake Malawi, during the 1960s, phytoplankton net samples from all stations in the lake were dominated by the large, heavily silicified diatom *Aulacoseira nyassensis* (Talling, 1969). But, by 1980, lightly silicified *Stephanodiscus* species and *Nitzschia* species had increased in abundance (Hecky and Kling, 1987). As well, monitoring of the phytoplankton community in the past decade in Lake Malawi revealed an increased abundance of cyanophytes *Planktolyngbya tallingii* and *Anabaena* in the southern portion of the basin (Hecky et al., 1999). These cyanophytes are commonly present in African Great Lakes that tend to be nitrogen deficient where these species will be favoured for their ability to fix nitrogen (Mugidde et al., 2003; Talling, 1966; Talling and Talling, 1965). In Lake Malawi, nitrogen in the mixolimnion consists predominantly of biologically fixed nitrogen (Hecky et al., 1996). Fixed nitrogen is lost from the mixed layer by sedimentation and denitrification at the oxic-anoxic boundary with the permanently anoxic monimolimnion. Thus, nitrogen is less effectively recycled in the lake than phosphorus. As a result, nutrient enrichment is expected to reduce the nitrogen to phosphorus ratio (N:P) and favour nitrogen-fixing cyanophytes (Bootsma and Hecky, 1999; Guildford et al., 1999). Thus far data are too sparse because of infrequent sampling spatially and temporally to accurately assess whether perturbations in the catchment have altered the phytoplankton community composition in Lake Malawi beyond the range of natural variability. To do so a longer temporal perspective of the lake's environmental history is necessary.

Paleolimnology is an interdisciplinary field of science using physical, chemical and biological information preserved in lacustrine sediments to provide a long-term record of past limnological conditions and to identify the causes of change (Frey, 1988). In a paleolimnological study by Hecky et al. (1999), a sediment core taken from the southern basin of Lake Malawi (Dwangwa Delta) in 1993 exhibited signs of nutrient enrichment, with increased relative abundance of *Aulacoseira* taxa as well as higher sedimentary content of phosphorus and silica after ca. 1950. Similarly, Ramlal (2002) conducted carbon stable isotope analyses of sediment cores from the central

and southern portions of Lake Malawi, finding an increased deposition of carbon carrying an isotopic signature of phytoplankton in the southern basin. These results are potentially due to an increase in primary production through elevated allochthonous nutrient loading at the south end of the lake (Ramlal, 2002), but, thus far evidence for deleterious effects of changing land use is limited as to the impacts on carbon cycling, and the effects of land use change on water quality and the response by the phytoplankton community remains unidentified.

Cultural eutrophication at the north end of Lake Malawi may be less significant as population densities are substantially lower than in the south, hence nutrient loads are much lower (Hecky et al., 2003). However, another factor potentially controlling Lake Malawi's nutrient availability and phytoplankton community composition is climatic variability. Lake Malawi's large surface area dictates the water budget, predominantly composed of direct precipitation to and evaporation from the lake surface area, making lake-level fluctuations particularly sensitive to changes in precipitation relative to evaporation (Spigel and Coulter, 1996). The relief at north end of the lake reaches over 2000m above sea level (Hamblin et al., 2002) and typically receives greater precipitation (Nicholson and Yin, 2002) and wind speeds (Patterson and Kachinjika, 1995) than the south end of the lake. Overall, limnological conditions in the north end of Lake Malawi are more likely impacted by climatic variability. Thus, paleolimnological analyses will compare patterns of limnological change at both the northern and southern ends of the basin following the gradient of land use change.

The objective of this research is to assess the long-term impacts of land use change and climatic variability on limnological conditions in Lake Malawi. In order to achieve these goals, paleolimnological analyses of biogenic silica and diatoms in four sediment cores collected along the length of Lake Malawi will be used to provide both a temporal (~300 years) and spatial representation of the whole lake. This study will provide an understanding of Lake Malawi's recent limnological history, which is pertinent in guiding effective ecosystem stewardship and land-use management practices to preserve the lake's water quality and unique ecology.

LAKE MALAWI DIATOM ECOLOGY

Class Bacillariophyceae, known commonly as diatoms, have been studied in Lake Malawi since the late 1800s by such algal taxonomists as Dickie, Schmidle and Muller. Diatoms are commonly used as paleoecological indicators as they preserve well in most lacustrine sediments (Battarbee et al., 2001). These algae are mostly unicellular with short life spans and are sensitive to changing environmental conditions. The siliceous cell walls, known as valves, are durable and taxonomically diagnostic, allowing diatomists to readily identify fossil specimens (Battarbee et al., 1999).

Aulacoseira are diatom genera prevalent in the African Great Lakes fossil records, including Lake Malawi, being heavily silicified and preserving well in lacustrine sediments (Kilham, 1990a). Most *Aulacoseira* species are adapted to nutrient-rich, deep-mixing events common to such meromictic lakes as Lake Tanganyika and Lake Malawi (Kilham, 1990a). In general, *Aulacoseira* are often outcompeted by euplanktonic diatom species under more stratified conditions when nutrient concentrations decline (Kilham, 1990a). On the other hand, *A. nyassensis* is a strong competitor for phosphorus given that required turbulent mixing conditions are met (Kilham et al., 1986).

Taxa in the genus *Stephanodiscus* are common in Lake Malawi readily outcompeting *Aulacoseira* spp., *Synedra* and similar *Nitzschia* spp. under conditions of reduced silica availability (Kilham, 1984). For example, *Stephanodiscus astraea* and *S. minutulus* (part of the *S. astraea* complex) are known to dominate in Lake Michigan during periods of low soluble reactive silica to soluble reactive phosphorus (atomic ratios < 20) (Kilham, 1990b). Within the African Great Lakes literature, *Stephanodiscus* and *Cyclostephanos* species are often lumped ecologically and are assumed to share similar autecology.

Phytoplankton tows in Lake Malawi are commonly abundant in *Nitzschia* species, which are typically long, narrow morphotypes that can persist within the photic zone during conditions of reduced wind energy due to their reduced sinking rates (Hecky and Kling, 1987; Kilham et al., 1986). However, short, more densely silicified *Nitzschia* species (e.g. *N. fonticola*) live in association with buoyant algal colonies (e.g. *Microcystis aeruginosa*). *Microcystis* species are non-nitrogen-fixing

cyanophytes that can leak organic nitrogen compounds under nutrient-stressed conditions and are adapted to warm, stratified waters (Kilham et al., 1986).

A number of littoral and riverine species have also been identified in Lake Malawi. *Achnanthes*, *Cocconeis*, *Cymbella*, *Fragilaria*, *Gomphonema*, *Navicula*, *Rhopalodia* and *Surirella* species are known components of the littoral community in both northern and southern ends of Lake Malawi (Cocquyt and Vyverman, 1994; Haberyan and Mhone, 1991; Higgins et al., 2001). Their occurrence within deep-water sediment cores is useful in signaling littoral disturbances and changing water levels that bring these periphytic species from source areas closer to deep-water coring sites (Haberyan and Mhone, 1991).

SEASONAL CYCLES

Climate in tropical East Africa is dominated by three limnological seasons, controlled largely by the passing of the Intertropical Convergence Zone (ITCZ) over the equator. The first of which is the cool, mixing period when the ITCZ is farthest north during May to September when surface water temperatures decline to 23°C and strong south-south easterly trade winds known as *mweras* persist over Lake Malawi. Deeper mixing of the epilimnion entrains nutrients from the metalimnion and establishes deep-water waves (known as internal seiches) and upwelling in the extreme southern end of the lake (Bootsma, 1993b; Eccles, 1962, 1974). An estimated 75% of the total silica inputs into the mixed layer of Lake Malawi are supplied by upwelling of metalimnetic waters (Bootsma and Hecky, 1999; Bootsma et al., 2003; Hamblin et al., 2003). The wind energy also creates turbulent mixing ideal for the suspension and proliferation of planktonic diatoms *Stephanodiscus*, *Cyclostephanos*, *Nitzschia* and *Aulacoseira* (Bootsma, 1993b; Hecky and Kling, 1987; Patterson and Kachinjika, 1995), and this season is correlated with high sedimentation rates of diatoms in northern Lake Malawi (Pilskaln, 2004).

In September, lake temperatures begin to rise with the onset of the dry, stratified period. By October, solar radiation reaches a maximum, warming the epilimnion to 27°C and establishing a

shallower thermocline depth (Eccles, 1974; Patterson and Kachinjika, 1995). Reduced vertical mixing in October leads to a decline in diatom abundance (Bootsma and Hecky, 1999; Hecky and Kling, 1987; Patterson and Kachinjika, 1995). In November, the wet stratified period begins with the ITCZ moving southwards bringing heavy rains (particularly in the north end of Lake Malawi) and northerly winds known as *mpotos* (Beauchamp, 1953). Often nitrogen deficiency increases from November to March, along with increased abundances of blue-green algae, including heterocystous *Anabaena* or non-nitrogen fixing *Lyngbya* and *Microcystis* species (Guildford et al., 2003; Patterson and Kachinjika, 1995). In the rainy season, the whole lake is believed to be relatively phosphorus sufficient with the increased wet deposition and riverine inputs, and cyanophytes and occasionally chlorophytes dominate the algal biomass (Bootsma, 1993a; Guildford et al., 2003). By the end of the wet stratified period, in April, nitrogen can once again become limiting for phytoplankton growth lake-wide (Bootsma, 1993a).

METEOROLOGICAL INFLUENCES ON NUTRIENT REGIMES

In order to understand fully the effects of nutrient enrichment, one must understand the relative availability of growth-limiting macronutrients in Lake Malawi. Nitrogen is often deficient over the whole lake, and can be severely deficient during stratified periods (Guildford et al., 2000; Guildford et al., 2003). This is due in part to the fact that over 70 % of Lake Malawi's nitrogen is supplied from the atmosphere in the form of $N_{2(g)}$ for biological fixation (Bootsma, 1993a; Bootsma and Hecky, 1999). However, less than four percent of Lake Malawi's epilimnetic nitrogen balance is due to $N_{2(g)}$ fixation within the sandy littoral zone (Gondwe, 2004) and nitrogen is readily lost through denitrification at the oxic-anoxic boundary layer of the permanently anoxic hypolimnion (Hecky et al., 1996).

Diatom community composition in the African Great Lakes is largely driven by competition for available silica, phosphorus and light (Kilham et al., 1986). In Lake Malawi, the monimolimnion (250-700 m depth) is potentially an important source of nutrient-rich waters, however, chemical and

thermal stratification restrict nutrient regeneration. Every year roughly 25% of the epilimnion (0-100 m depth) mixes with the metalimnion (100-250 m depth) and 20% of the metalimnion mixes with the hypolimnion (250-700 m depth) (Gonfiantini et al., 1979; Vollmer et al., 2002). This vertical exchange contributes 70 % of the silica and 50 % of the phosphorus supplied to the epilimnion (Bootsma, 1993a; Bootsma and Hecky, 1999; Bootsma et al., 2003). Recently, this exchange has declined due to decreased cool water convection and increased thermal warming (Vollmer et al., in press; Vollmer et al., 2002). From 1939 to 1999, only two wet periods (1961-1963 and 1977-1979) were found to have a cooling effect on the deep waters (Vollmer et al., in press). The increased discharge of colder river water and direct rainfall, and decreased summer insolation due to cloud cover, produce a net decline in epilimnetic heat inputs (Vollmer et al., in press). The cool riverine water sinks below the mixolimnion (0-250 m depth) and cools hypolimnetic water temperatures and nutrient depleted epilimnetic waters dilute nutrient concentrations in the monimolimnion, while the mixed layer is enriched by metalimnetic water (Vollmer et al., in press).

At the start of the rainy season, peak flow rates in the tributaries are associated with peak concentrations of suspended nitrogen, phosphorus and silica (Bootsma et al., 2003; Hecky et al., 2003). Interannual variability in precipitation is associated with these early peak rains because high early rains often produce high rainfall years (Nicholson, 1996). Following increases in precipitation, nutrient inputs increase for several reasons: the direct deposition of nutrients on the lake surface, the riverine export of particulate nutrients, and the increased runoff causing increased exchange with nutrient-rich deeper waters. Early in the river flow period, over 80% of Lake Malawi's annual silica inputs are supplied, of which roughly 60% is biogenic silica, often in the form of phytoliths (Bootsma et al., 2003). Meanwhile, soluble reactive silica concentrations in the river do not respond to changes in flow rate, remaining between 200-400 $\mu\text{mol/L}$ (Bootsma et al., 2003). Thus, increased runoff through Lake Malawi's tributaries will result in an overall increase in nutrients, but likely a decline in bioavailable Si:P inputs to the lake at the onset of the rainy season.

HISTORICAL LAKE LEVEL FLUCTUATIONS FOR LAKE MALAWI

Past change in Lake Malawi's level (Figure 2) has been reconstructed based on measured data by Vollmer (pers. comm.) since 1898 AD and levels from 1650-1898 AD were compiled from paleolimnological, archaeological and oral histories by Owen et al. (1990) and Nicholson (1998). The paleolimnological reconstruction by Owen et al. (1990) utilized multiple proxies, such as geopulse recordings and diatom stratigraphies, finding strong evidence that lake levels rose substantially (~ nine meters) ca. 1850AD, before which lake level was at a prolonged low stand until around 1700AD when a probable recovery of the lake level occurred (Nicholson, 1998).

Long-term changes of lake level have been recorded since 1895AD in association with the construction of a hydroelectric dam on the Shire River outflow. The Kapachira dam sits below the outlet control of the lake, thus no impacts to lake level were incurred as a result of its construction. However, a lowstand occurred from ~1898-1937AD in which the lake level fell below the level of the outlet (471 m. above sea level), halting hydroelectric production between 1915-1937 (Drayton, 1984). In 1965, a barrage was built to ensure flow of water from the lake to the dam and other irrigation projects downstream (Drayton, 1984). However, the Shire River contributes only ~ 8% of the outflow volume within the water balance (Owen et al., 1990), hence the strong correlation between lake level and evaporation: precipitation ratios.

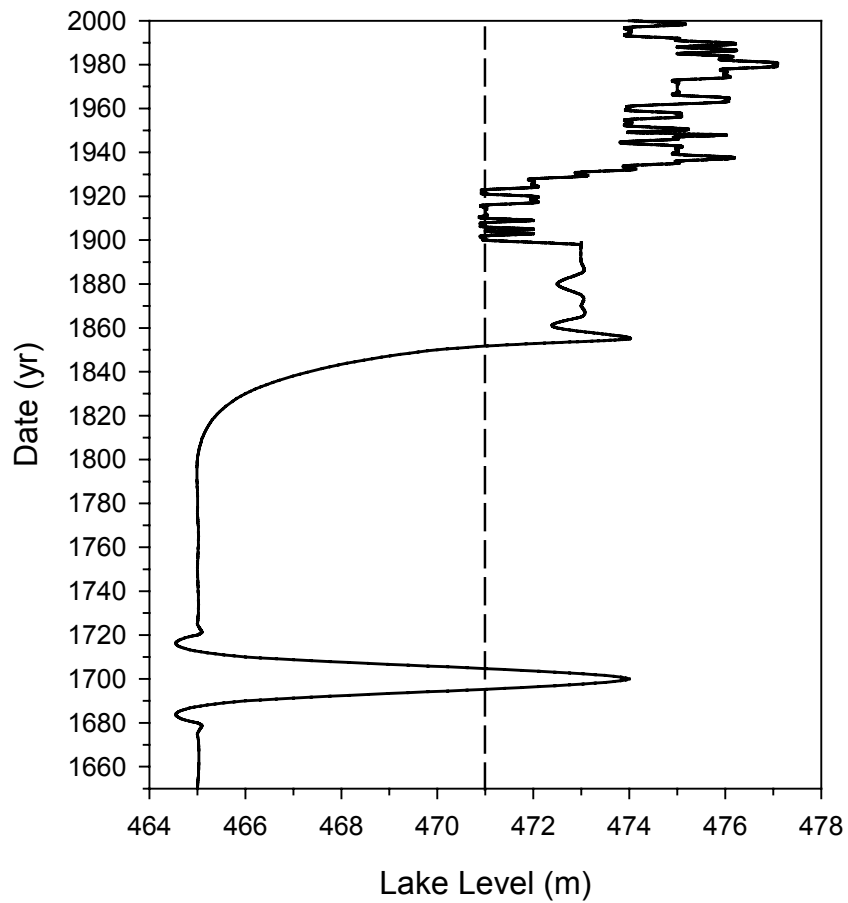


Figure 3. Lake level fluctuations for Lake Malawi since 1650 AD. Data from 1898-2000 AD supplied by M.K. Vollmer (pers. comm.) and data from 1650-1898 AD modified from Nicholson (1998) and Owen et al. (1990). Vertical dotted line denotes the outlet level (471 m.a.s.l.). Lake levels below the outlet level produce a closed basin system and lake levels above the outlet level produce an open basin system.

MATERIALS & METHODS

CORING SITE & SEDIMENT DESCRIPTION

Four sediment cores were used in this study, taken along a longitudinal transect of Lake Malawi and incorporating a range of water depths, surface sediments, neighbouring catchment elevations and land-use practices. These cores have been identified as: northern core M98-11MC, central core MAL 4, and southern cores MAL 10 and MAL 14 (Figure 3).

Northern Core - M98-11MC (10°00.2'S and 34°17.3'E)

The catchment of northern Lake Malawi is mountainous and relatively sparsely populated. Tectonic faulting and subsequent uplift that formed the rift basin during the Miocene (approximately 8.6 million years ago) are responsible for the catchment terrain and the formation of the Livingstone mountain range and associated Rungwe volcanics located north of Lake Malawi (Ebinger et al., 1984; Tiercelin and Lezzar, 2002). The largest tributary in close proximity to the coring site is the Ruhuhu River, which runs through a basin dominated by forest cover and is likely characterized by low flow variability, typical of a northern basin river (Hecky et al., 2003).

Core M98-11MC was collected using a multicorer from 404 m depth on March 7th, 1998 at the north end of Lake Malawi (Johnson et al., 2001) (Figure 3). Core M98-11MC measured 52 cm in length and was sectioned into one-centimeter intervals for most analyses (Table 1). The coring depth lies below the oxycline and within a region of laminated sediments (Figure 3). These laminae are considered annual couplets known as varves consisting of lightly pigmented, diatomaceous deposits overlain with dark, terrigenous deposits (Pilskaln, 2004; Pilskaln and Johnson, 1991). Three turbidite layers interrupt the laminae at 9.5-10.5cm, 23.0-24.5cm and 40.8-42.0cm intervals and a volcanic tephra lies at 48.5 depth. A turbidite is a depositional layer of remobilized sediment formed as a result of sediment laden gravity currents often occurring during a change in water level, severe flooding event or a seismic event (Cohen, 2003; Lezzar et al., 1996).

Central Core - MAL 4 (11°54.088'S, 34°16.717'E)

The drainage basin nearest core MAL 4 is steep, well-forested terrain drained by the Mlowe River. The small Mlowe River has low sediment loads and is considered among the least disturbed basins within Lake Malawi's catchment (Hecky et al., 2003; Ramlal, 2002). However, the largest river near the coring site is the Dwangwa River, a river with moderate impacts of agricultural clearance on the upland plateau (Hecky et al., 2003) while the lower reaches of the Dwangwa River lie within protected areas.

On November 3rd, 1997, core MAL 4 was collected at 285 m water depth in central Lake Malawi. Core MAL 4 was 48 cm in length and divided into one-centimeter intervals from 0-20 cm sediment depth, while slices 20 - 48 cm were sectioned in two-centimeter intervals (Table 1). Core MAL 4 was retrieved below the oxycline, yet sediments were not varved. Rather, they were homogeneous diatomite and clastic muds representative of the region (Figure 3), likely indicating a less seasonal and more continuous sedimentation rate (Pilska, 2004).

Southern Cores - MAL 10 (13°52.008'S, 34°45.112'E) & MAL 14 (13°58.997'S, 34°38.856'E)

The Linthipe River is the largest and most impacted river entering southern Lake Malawi. It drains land under intensive cultivation (Hecky et al., 2003) and receives discharges from the city of Lilongwe (2004 est. pop. 632,900 – C.I.A. (2004)), the largest city as well as the capital city of Malawi. Agricultural practices in this region commence before the onset of the rainy season such that fields are burned and sugar cane and maize are planted leaving soils and loose ash debris exposed to erosion with the onset of the rains. These practices are known to have accounted for much of the total suspended sediment and dissolved organic carbon transported into Lake Malawi (Hecky et al., 2003; Ramlal et al., 2003).

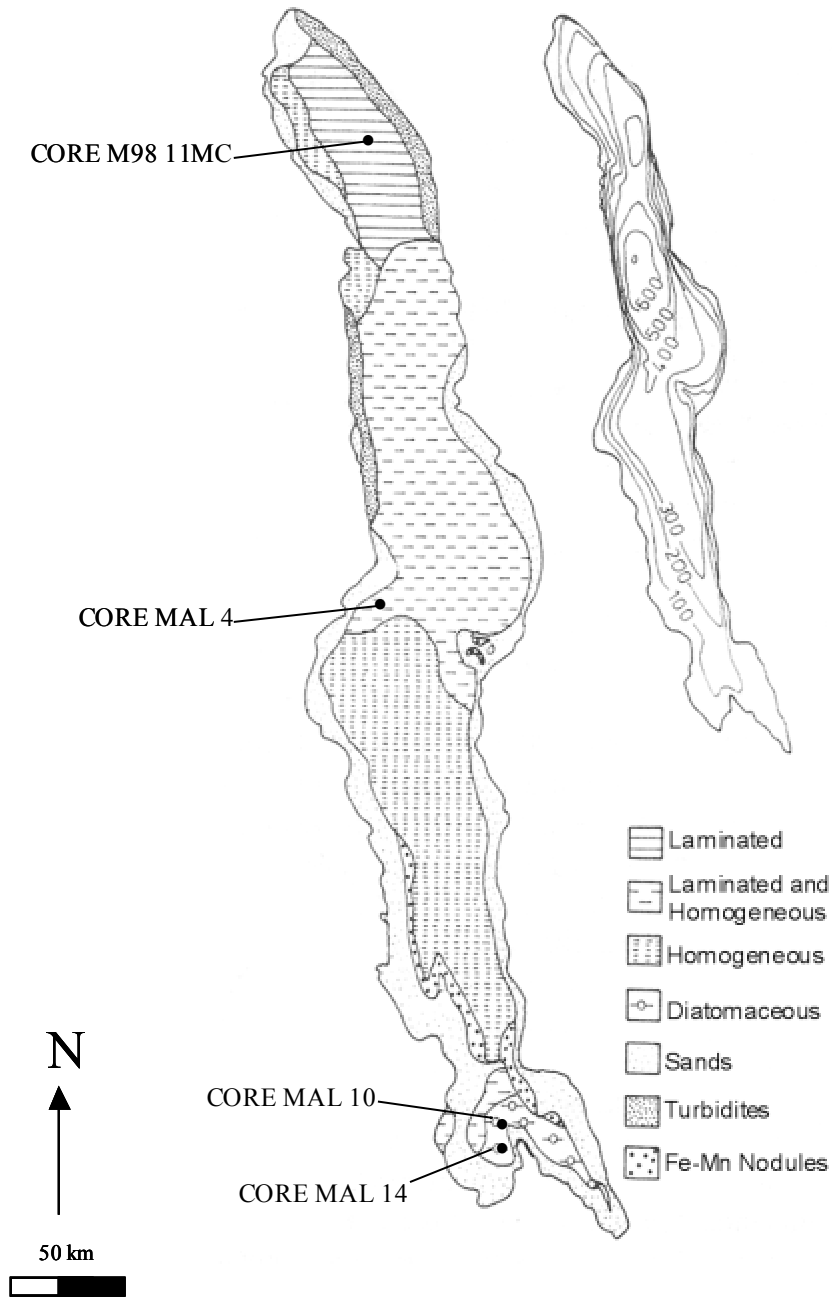


Figure 4. Map of coring sites with respect to surface sediments in Lake Malawi, East Africa for cores M98-11MC, MAL 4, MAL 10 and MAL 14, denoted by (●). Bathymetric map of Lake Malawi with 100m contour lines inserted. Adapted from Owen and Crossley, 1992.

Table 1. Summary of information on the coring site and sectioning intervals for sediment cores M98-11MC, MAL 4, MAL 10, and MAL 14 Lake Malawi, East Africa

CORE	M98-11MC	MAL 4	MAL 10	MAL 14
Date (d/m/y)	07/03/1998	03/11/1997	04/11/1997	05/11/1997
Latitude (S)	10°00.2	11°54.088	13°52.088	13°58.997
Longitudinal (E)	34°17.3	34°16.717	34°45.112	34°38.856
Water Depth (m)	404	285	124	81
Core Length (cm)	52	48	45	44
No. Slices Dated	52	34	32	32
No. Slices Analyzed for Diatom, BSi	51	17	32	16

At the south end of Lake Malawi, core MAL 10 was collected on November 4th, 1997 at a depth of 124 m and core MAL 14 was retrieved November 5th, 1997 at a depth of 81 m (Table 1). Southern cores were sectioned at one-centimeter intervals for the upper 20 cm while deeper sediments were sectioned in two-centimeter intervals (Table 1). The cold, south-south easterly *mweras* blow from June to August, leading to periods of destratification, oxygenation (to 200 m depth) and some benthic faunal activity in this region. As a result, the southern sediments are not laminated, consisting of homogeneous diatomites, clastics and sands, characteristic of productive waters and river discharge to the region (Figure 3).

SEDIMENTARY ANALYSES

CHRONOLOGY

Sediment cores were dated using techniques based on analyses of total ^{210}Pb and ^{137}Cs activity by P. Wilkinson at the Radioisotope Dating Laboratory of the Freshwater Institute in Winnipeg, Manitoba. ^{210}Pb is part of the radium-226 decay series, which is deposited from the atmosphere, known as *unsupported* ^{210}Pb and incorporated into the lake sediments. Unsupported ^{210}Pb decays to ^{210}Bi with time (^{210}Pb has a half-life of 22.26 yrs), causing a decline in total ^{210}Pb activity with sediment depth. Sediments also evolve a *supported* concentration of ^{210}Pb by decay from in situ ^{226}Ra , which must be subtracted from the total ^{210}Pb to derive the unsupported ^{210}Pb activity (Appleby and Oldfield, 1978).

Two models were used to estimate the chronology of these cores: the linear model and the constant rate of supply (CRS) model. The linear model assumes that the sediment accumulation rate does not vary over time, while CRS allows the dry mass accumulation to vary over time while the burial rate of unsupported ^{210}Pb is considered constant in time (Appleby and Oldfield, 1978). The Constant Rate of Supply (CRS) model was used to date core MAL 4, MAL 10 and MAL 14. For core intervals beyond the supported ^{210}Pb , chronology for this study assumes a constant sedimentation rate based on an average of the last five CRS modeled sedimentation rates.

^{137}Cs was used in an attempt to corroborate dates over the last 50 years. The half-life of ^{137}Cs is 33 years and a peak of ^{137}Cs is associated with a peak in nuclear testing (1963) which can be tracked in most sediment around the world (Appleby and Oldfield, 1978). Redistribution and deposition of the initial bomb fallout is believed to have taken one year approximately, therefore 1964 is commonly assumed to date the peak concentration of ^{137}Cs in sediments (Blais et al., 1995).

Chronology for core M98-11MC is based on varve counts, since core laminations extend to 51 cm and date to 1655 AD. Chronology and percent biogenic silica data for core M98-11MC is available at the NOAA website (<http://www.ngdc.noaa.gov/paleo/paleolim/paleolim.html>).

SEDIMENTARY BIOGENIC SILICA CONTENT & INFLUX

Biogenic silica (BSi) is the amorphous silica component within sediments and diatoms account for much of the sedimentary BSi found in most freshwater systems (Berglund, 1986). Biogenic silica in sediments provides an estimate of diatom productivity, with increased sedimentary BSi often signaling an increased sedimentation of diatoms (Schelske, 1999; Schelske et al., 1983). In Lake Malawi, lacustrine sediments are known to be composed predominantly of diatom valves, however riverine inputs of biogenic silica are often laden with siliceous phytoliths from terrestrial plant matter (Bootsma et al., 2003).

Biogenic silica analyses were performed by L. Powers and Y. Chan at the Department of Geological Sciences, University of Minnesota, Duluth, MN following DeMasters (1979) time series digestion technique. Sediment BSi is represented as both weight percent biogenic silica (%BSi) with a precision of $\pm 1\%$ SiO_2 and biogenic silica influx (BSi influx) following standard calculations (Berglund, 1986).

SEDIMENTARY CARBON & NITROGEN CONTENT

Organic carbon content in offshore sediments can provide a qualitative record of lacustrine productivity when the terrestrial inputs of organic matter are minimal and when mixing regimes and

degradation remain unaltered over time (Cohen, 2003). Nitrogen is essential in all organisms in the formation of amino acids and nucleic acids, and in most sediments, nitrogen is bound to organic matter (Berglund, 1986; Cohen, 2003). Carbon:nitrogen ratios in lacustrine sediments are often used to distinguish the origin of organic sediments and provide an index of aquatic productivity (Berglund, 1986). The carbon to nitrogen ratio (C:N) can provide a good indication of whether organic matter is mainly from terrestrial or aquatic origin, since terrestrial plant matter is composed of a relatively large quantity of carbon in the form of cellulose, which phytoplankton lack (Cohen, 2003). Carbon:nitrogen molar ratios greater than 20 typically indicate terrestrial debris while, C:N less than 10 are due to deposition of aquatic plant matter (Cohen, 2003). Analyses of particulate organic carbon and particulate nitrogen were performed at the Freshwater Institute in Winnipeg and reported in Ramlal (2002) and the POC and PN influxes were calculated using the CRS modeled sedimentation rates to account for the recent increased sedimentation rates.

FOSSIL DIATOMS

Samples from cores MAL 4, MAL 10 and MAL 14 were provided as freeze-dried, ground sediment, having been used in previous analyses of carbon and nitrogen content, as well as stable isotopes analyses of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) (Ramlal, 2002). Core M98-11MC was provided as wet sediment (Johnson et al., 2001). Subsamples of dried sediment (0.1g) and wet sediment (0.5g) were weighed out and prepared following standard methods (Hall and Smol, 1992). A small volume of synthetic microspheres at a known concentration was added to diatom slurries in order to estimate the concentration of diatoms per dry sediment mass, following methods of Battarbee and Kneen (1982). Slides and remaining diatom slurries were labeled and stored at the University of Waterloo Environmental Change Research Laboratory.

Diatoms were identified to highest possible taxonomic resolution (typically to species or subspecies) and at least 400 diatom valves were counted per sample. A number of valves were broken in shallow water cores MAL 10 and MAL 14, so, to avoid underestimating the actual diatom

concentration or misrepresenting taxa, fragments larger than 1/3 were summed together. Taxonomic identifications listed in Appendix A were based largely on Cocquyt (1998) and Gasse (1986), but other publications were used to aid taxonomic identifications (Cocquyt and Vyverman, 1994; Gasse, 1986; Klee and Casper, 1992, 1995; Krammer and Lange-Bertalot, 1986, 1988, 1991a, b; Müller, 1895, 1903, 1904, 1905, 1911; Schmidle, 1899). Digital photos of key taxa are presented in Appendix B. Appendix C tabulates diatom concentrations and diatom influx alongside chronology, sedimentation rates, %BSi, BSi influx, POC, PN and POC:PN. Appendix D presents diatom percent abundance data.

RESULTS

CHRONOLOGY

Chronology of northern core M98-11MC was previously developed by Johnson et al. (2001) and core chronology of central and southern cores MAL 4, MAL 10 and MAL 14 were by Ramlal (2002).

^{210}Pb activity declined approximately monotonically down core in accordance with the natural radioactive decay of ^{210}Pb (Appleby and Oldfield, 1978) for both the northern core M98-11MC and central core MAL 4 (Figure 4). In contrast, ^{210}Pb activities for the southern cores, MAL 10 and MAL 14, were low and relatively constant throughout the upper 15 cm, followed by a decline towards bottom sediments. Core MAL 14 also exhibited variable ^{210}Pb activity between 11 cm and 16 cm depth. Breaks in the expected monotonic decline may indicate episodic additions of ‘older’ sediments or increased sedimentation rates, which can be accounted for by the CRS model.

A peak of ^{137}Cs activity is commonly used as a stratigraphic marker corresponding with peak deposition in 1964, due to nuclear bomb testing (Appleby and Oldfield, 1978). In this study, ^{137}Cs activity was not useful in validating chronologies based on ^{210}Pb methods. ^{137}Cs peaks were detected in the near surface sediments of cores MAL 4, MAL 10 and MAL 14, and do not correspond with ^{210}Pb activity assigned date of 1964 AD. Rather, they aligned with ca. 1990-1995 based on ^{210}Pb dates (Figure 4). Since all three cores analyzed show the presence of ^{137}Cs in the surface sediments, the thirty-year discrepancy between ^{137}Cs and ^{210}Pb techniques were consistent with upward displacement of the ^{137}Cs peak (Blais et al., 1995). Appleby and Oldfield (1983) state that the ^{137}Cs peak can be mobile in undisturbed anoxic sediments. As well, Blais et al. (1995) found a strong correlation between low conductivity lakes with organic-rich sediments and ^{137}Cs mobility. No lakes as large as Lake Malawi were included in these studies, but Lake Malawi does have low conductivity and sediments are organic-rich and anoxic, which may explain the discrepancy. Since ^{137}Cs activity profiles maintained a sharp increase to the surface sediment without any indication of disturbance of the ^{137}Cs peak, it was assumed that mixing was unlikely to have strongly affected these sediment

cores and that near constant ^{210}Pb activities in the upper stratigraphy of core MAL 10 and MAL 14 are consistent with rapid sedimentation rates.

Chronology for core M98-11MC used varve counts (Figure 5) and dates to 1655 AD at 51 cm depth. At turbidite layers, in core M98-11MC, dating was based upon a correlation between other varved cores taken at the same time in the same region of Lake Malawi with similarly aligned laminae to complete the chronology (Johnson et al., 2001). For comparative purposes, dating based on ^{210}Pb activity corresponded closely with the upper 23 cm of the varve count profile or ca. 1878 AD with CRS dating and 1866 AD with varve counts for core M98-11MC.

Sediment chronologies for cores MAL 4, MAL 10 and MAL 14 (Figure 5) were estimated using both linear and CRS models. In order to allow for known recent increased sediment contributions from southern rivers (Hecky et al., 2003; Hecky et al., 1999; Ramlal et al., 2003), the CRS model was selected as the most appropriate technique to estimate chronology for cores MAL 4, MAL 10 and MAL 14. The CRS model is appropriate when analyzing different cores within the same lake and when a lake is exposed to human perturbations, such as deforestation and forest fires, which alter sedimentation rates in response to erosion or eutrophication (Appleby and Oldfield, 1978).

SEDIMENTATION RATES

In southern cores MAL 10 and MAL 14, CRS calculated sedimentation rates tripled after ca. 1970 (Figure 6), whereas sedimentation rates before ca. 1970 were relatively constant and comparable to the central and northern cores. After ca. 1980, sediment accumulation rates in cores M98-11MC and MAL 4 increased as well, but to a lesser extent than in the southern sites. The range in sedimentation rates for core MAL 14 was the greatest of all four Lake Malawi cores, with the 1990's being the greatest period of continual increase in sedimentation rate, at 133 g/m²/yr average increase over the course of the decade. In core M98-11MC, the profile exhibited the greatest sedimentation rates in ca. 1870 AD, after which sedimentation rates decline to the 20th century, unlike the other three coring

sites. Changes in sedimentation rate for core MAL 4 are subtle as compared to the other Lake Malawi cores in this study, remaining at on average 190 g/m²/yr.

SEDIMENTARY BIOGENIC SILICA CONCENTRATION & INFLUX

The southern cores MAL 10 and MAL 14 were relatively low and constant in sedimentary % BSi and influx prior to ~1940 (Figure 7), but, after ~1940 % BSi doubled and influx increased five to tenfold in both cores, comparable to the pattern of increase in sedimentation rates (Figure 6). In contrast, cores M98-11MC and MAL 4 showed no strong trend in recent decades in % BSi and influx. In core M98-11MC, the greatest biogenic silica influx rate occurred in ca. 1870 AD (Figure 7).

DIATOM CONCENTRATION & INFLUX

Diatom concentrations and influxes (Figure 8) exhibit a sharp increase in southern cores MAL 10 and MAL 14 since ~1960 and 1970 respectively, similar to the trends in % BSi and silica influx profiles (Figure 7) and sedimentation rates (Figure 6). The more offshore core, MAL 10, has both a greater concentration and influx of diatoms than the more nearshore core, MAL 14. Diatom concentrations post ~ 1970 in both cores MAL 10 and MAL 14 increased fivefold as compared to values before ~1970. However, diatom influxes in core MAL 10 increased twentyfold in near surface sediments as opposed to the sixfold increase in core MAL 14. In addition to these pronounced changes, cores M98-11MC, MAL 4 and MAL 10 exhibited a substantial increase in diatom concentration and influx to the sediments during ca. 1880 to 1910 AD, but not core MAL 14 as the data are missing due to the poor preservation of diatoms and high amounts of clastics on the slide. Northern core M98-11MC also displays more distinct variability with periods of high diatom concentrations alternating with intervals of low diatom concentrations.

SEDIMENTARY CARBON & NITROGEN INFLUX AND POC:PN RATIOS

Influx of POC and PN for both southern cores MAL 10 and 14 nearly doubled and tripled

respectively after ~1940 (Figure 9) (Ramlal, 2002), while a recent increased influx in core MAL 4 is more subdued. POC and PN influx for core M98-11MC were not readily available. In cores MAL 10, MAL 14, and to a lesser extent MAL 4, POC:PN declined upcore after ~1940 (Ramlal, 2002).

PERCENT ABUNDANCE & INFLUX OF DIATOM TAXA

Comparison of diatom percent abundance profiles amongst the four cores in this study identifies a pronounced change in the diatom assemblages in the central and southern cores beginning after ~1980 that is not present in the northern core.

Southern Cores MAL 10 & MAL 14

Integrity of diatom valves was generally poor in cores MAL 10 and MAL 14, with many damaged and fragmented frustules, yet both cores shared the same trend in diatom community composition change at 1980. From ca. 1700 to 1980 AD the diatom community composition in cores MAL 10 and MAL 14 were relatively constant (Figure 10). Contrary to core M98-11MC and MAL 4, these southern cores were dominated by *Aulacoseira nyassensis* and *Fragilaria africana*, while *Stephanodiscus spp.* and *Cyclostephanos malawiensis* had low relative abundance during this early time period. Influx of diatoms also remained low (Figure 8 & 11). However, in the more offshore core, MAL 10, there is one diatom influx spike between 1880-1900 AD (Figure 8 & 11), dominated by *Aulacoseira* and *Fragilaria* species.

After ca. 1980, the community composition of southern Lake Malawi changed directionally, with a decline in relative abundance of *Aulacoseira* and *Fragilaria* species and a pronounced rise in relative abundance of *Stephanodiscus*, *Cyclostephanos malawiensis*, *Cymbellonitzschia minima* and *Nitzschia* species, as well as a rise in sedimentation rate, POC, PN, % BSi, BSi influx, diatom concentrations and influxes (Figure 12 & 13). A few discrepancies between these two cores were noted; the more nearshore core MAL 14 contains a variety of small forms of *Fragilaria* (*F. leptostaurons var. dubia* and *F. pinnata*), which declined upcore in relative abundance, whereas in the

more offshore core, MAL 10, these species remained abundant in upper sediments (Figure 10). As well, *Aulacoseira nyassensis* and *Fragilaria africana* influxes declined in core MAL 14 after ca. 1985 (Figure 11) along with a decline in *S. muelleri* abundance in ca. 1995, which was not observed in the more offshore core, MAL 10.

Sediment profiles show a sharp change in diatom relative abundance between consecutive samples, as opposed to homogenized diatom assemblages, which occur with sediment mixing. These sediment profiles have not only presented a clear change in the paleoecological records, but cores MAL 10 and MAL 14 replicate the same pattern of changing sediment parameters at similar dates. Thus, concerns regarding sediment disturbances artificially producing high sedimentation rates can be eliminated.

Central Core MAL 4

Core MAL 4 fossil diatoms were less fragmented but as abundant as cores MAL 4 and MAL 14 (Figure 8). Overall the diatom assemblage was dominated by planktonic centric species *Cyclostephanos malawiensis*, *Stephanodiscus minutulus*, *S. muelleri*, *S. nyassae*, *Aulacoseira nyassensis* and pennate *Nitzschia* taxa (Figure 10 & 11). However, littoral species such as *Amphora pediculus*, *Cocconeis neothumensis*, *Fragilaria africana* and *Navicula scutelloides* were highly abundant in core MAL 4 as compared to the other three Lake Malawi cores (Figure 10).

Diatom assemblages from ca. 1700 to 1920 AD remained relatively unaltered, with the pelagic species *Cyclostephanos malawiensis* dominating (Figure 10). Interestingly, diatom influxes for all common diatom taxa increased during ~1890-1910 AD (Figure 8 & 11).

By ~1980, *Cyclostephanos malawiensis* and *Stephanodiscus nyassae* declined to their lowest relative abundances, while *A. nyassensis* reached a maximum relative abundance (Figure 10). As well, sedimentation rates declined in ca. 1980. After ca. 1980, *A. nyassensis* declined in relative abundance while *S. nyassae*, and to a lesser extent *Cyclostephanos malawiensis*, rose in percent abundance (Figure 10), in association with a rise in POC, PN, % BSi, BSi influx, diatom

concentration and influx (Figure 14). Combined with the increased diatom influxes (Figure 11) ca. 1980, these changes resemble the pattern of diatom community composition change found in the sediment profiles of cores MAL 10 and MAL 14.

Northern Core M98-11MC

Core M98-11MC fossil diatom assemblages were most abundant and well preserved with little fragmentation. The diatom assemblage is composed of the same centric species as in core MAL 4 and characteristic of open-water, well-mixed conditions (Figure 10 & 11). Overall, the diatom community composition in core M98-11MC showed little evidence of directional change, but had high decadal scale variability, the greatest being the substantial influx in diatoms in ca. 1880 AD (Figure 8 & 11).

Basal sedimentary diatom assemblages consist of relatively high abundance of *Aulacoseira nyassensis*, (38 % average) in ca. 1655 AD (Figure 10), corresponding with a volcanic tephra layer at 48.5cm depth near the base of the core.

During ca. 1670 to 1710 AD, the diatom community composition shifted towards increased relative abundance of periphytic *Nitzschia* species (*Nitzschia epiphytica*, *N. fonticola*, *N. frustulum* and *N. paleacea*) and *Stephanodiscus nyassae* (Figure 10). At the same time, %BSi and diatom concentrations increased and POC:PN values decreased substantially (Figure 15).

From 1840 to 1865 AD, a turbidite layer disrupts the chronology in association with a maximum sedimentation rate and increased POC:PN ratios (Figure 15). In subsequent samples upcore, ca. 1875, POC:PN ratios declined and diatom influx doubled, with the greatest contribution by *S. nyassae* (Figure 11). This influx of diatoms was unprecedented within the last 150 year (the period for which sedimentation rates can be estimated) in Lake Malawi, and the timing of this maximum diatom influx compares closely with peak influxes in cores MAL 4 and MAL 10.

SPATIAL DISTRIBUTION OF DIATOM COMMUNITY COMPOSITION

Spatial distributions of the average abundance of common diatom taxa (Figure 16) for cores M98-11MC, MAL 4, MAL 10 and MAL 14 were divided into three time periods in order to assess the main spatial patterns of diatom community composition relative to the diatom community change. A decadal average from 1880-1890 AD (representing baseline community composition), 1980-1990 AD and 1990-1997/98 AD were compared to highlight the rapid community composition change between the 1980s and the 1990s as compared to a century's change in diatom community composition between the 1880s and the 1980s. Diatom taxa are divided into the following categories: *Aulacoseira nyassensis* & varieties, other *Aulacoseira*, *Stephanodiscus* & *Cyclostephanos* sp., *Nitzschia* sp., and other diatoms, consistent with microfossil classifications of Owen and Crossley (1992). The southern cores MAL 10 and MAL 14 exhibit the greatest amount of change between 1980 and 1990 AD, characterized by an increased abundance of *Nitzschia* spp. and *Stephanodiscus* & *Cyclostephanos*, and a decline of *Aulacoseira nyassensis* & varieties and other *Aulacoseira*. Central core MAL 4 exhibits the greatest increase during 1880-1980 in *Aulacoseira nyassensis* relative abundance. Meanwhile, community composition in northern core M98-11MC remained relatively unaltered during 1880-1990 AD.

Overall, the relative proportion of each the diatom taxa categories within each site varied among the study sites of Lake Malawi. An abundance of *Stephanodiscus* & *Cyclostephanos* dominates the northern core, with decreasing representation southwards in all three periods. The categories *Aulacoseira nyassensis* & varieties, other *Aulacoseira* and other diatoms (composed primarily of *Fragilaria* spp. in this study) are most abundant in the southern cores, with decreasing abundance northward. Lastly, *Nitzschia* percent abundances are greatest in the northern core with recent increased abundance of *Nitzschia* in the southern cores ~1990AD.

The category *Nitzschia* species is commonly composed of long thinly silicified taxa such as *Nitzschia acicularis*, *N. gracilis* and *N. nyassensis* (Hecky and Kling, 1987; Patterson and Kachinjika, 1995). Diatom slides did show a presence of long, thinly silicified *Nitzschia* species, yet, high

fragmentation of these delicate morphotypes made them unquantifiable and resulted in the enumeration of only short, more heavily silicified morphotypes, predominately *Nitzschia amphibia*, *N. epiphytica*, *N. fonticola*, *N. frustulum*, *N. inconspicua* and *N. paleacea*. Haberyan (1990) had found that lightly silicified *Nitzschia* and *Synedra* species declined in relative abundance during deposition (Haberyan, 1990; Haberyan and Mhone, 1991) due to several potential factors such as differential silica dissolution (Reynolds, 1986) or preferential grazing by zooplankton (Irvine and Waya, 1999; Owen and Crossley, 1992). All of these preservation factors are assumed to remain unchanged for the duration of the sediment core profiles (Hecky et al., 1999). Therefore, interpretations of *Nitzschia spp.* in this study refer only to smaller, more densely silicified morphotypes.

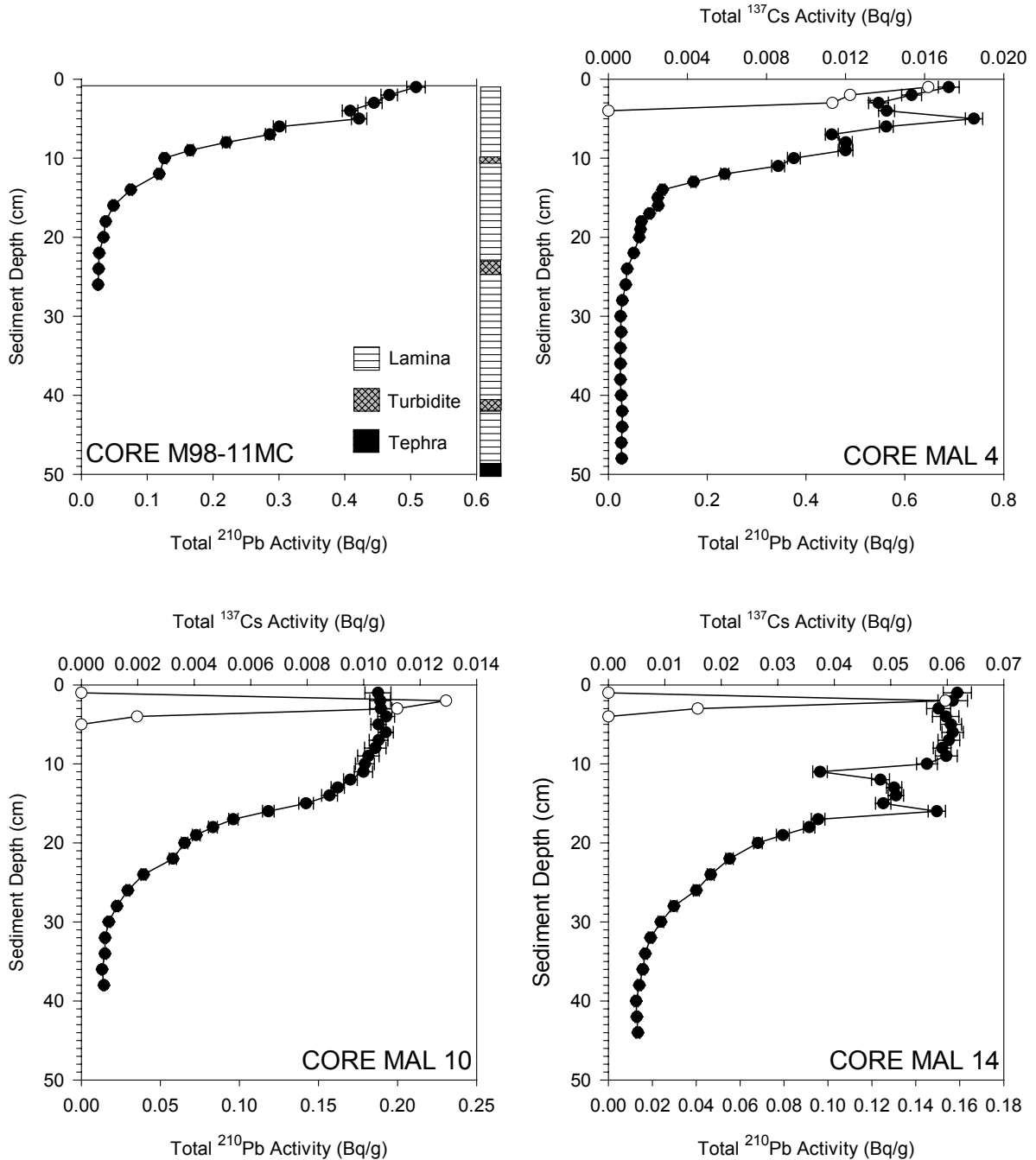


Figure 5. Total ²¹⁰Pb (●) activity profiles of sediment cores M98-11MC, MAL 4, MAL 10 and MAL 14, and ¹³⁷Cs (○) activity profiles of sediment cores MAL 4, MAL 10 and MAL 14 from Lake Malawi, East Africa. Sediment stratigraphy including legend for Core M98-11MC inserted. Error bars represent ± one standard deviation. Data for M98-11MC from T.C. Johnson et al. (2001) & for MAL 4, MAL 10 and MAL 14 from P. Ramlal (2002)

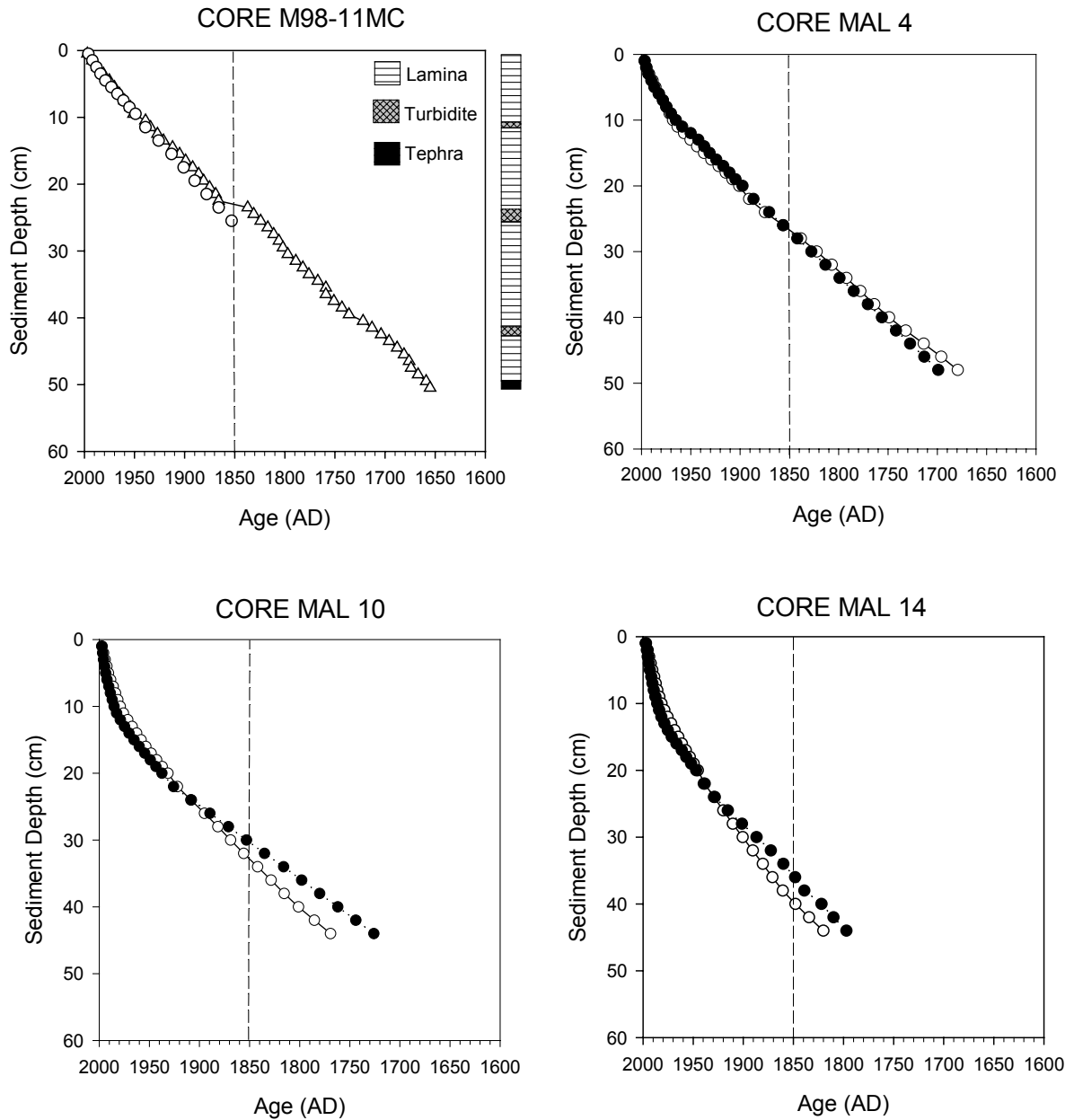


Figure 6. Results of varve counts (Δ), linear (o) and constant rate of supply (\bullet) dating models for sediment cores M98-11MC, MAL 4, MAL 10 and MAL 14 from Lake Malawi. The vertical dashed lines denote the year 1850 AD, before which total ^{210}Pb activities equate to supported ^{210}Pb concentrations and after which a constant sedimentation rate was used to extrapolate older dates. Data for M98-11MC modified from Johnson et al. (2001) and data for MAL 4, MAL 10 and MAL 14 modified from Ramlal (2002).

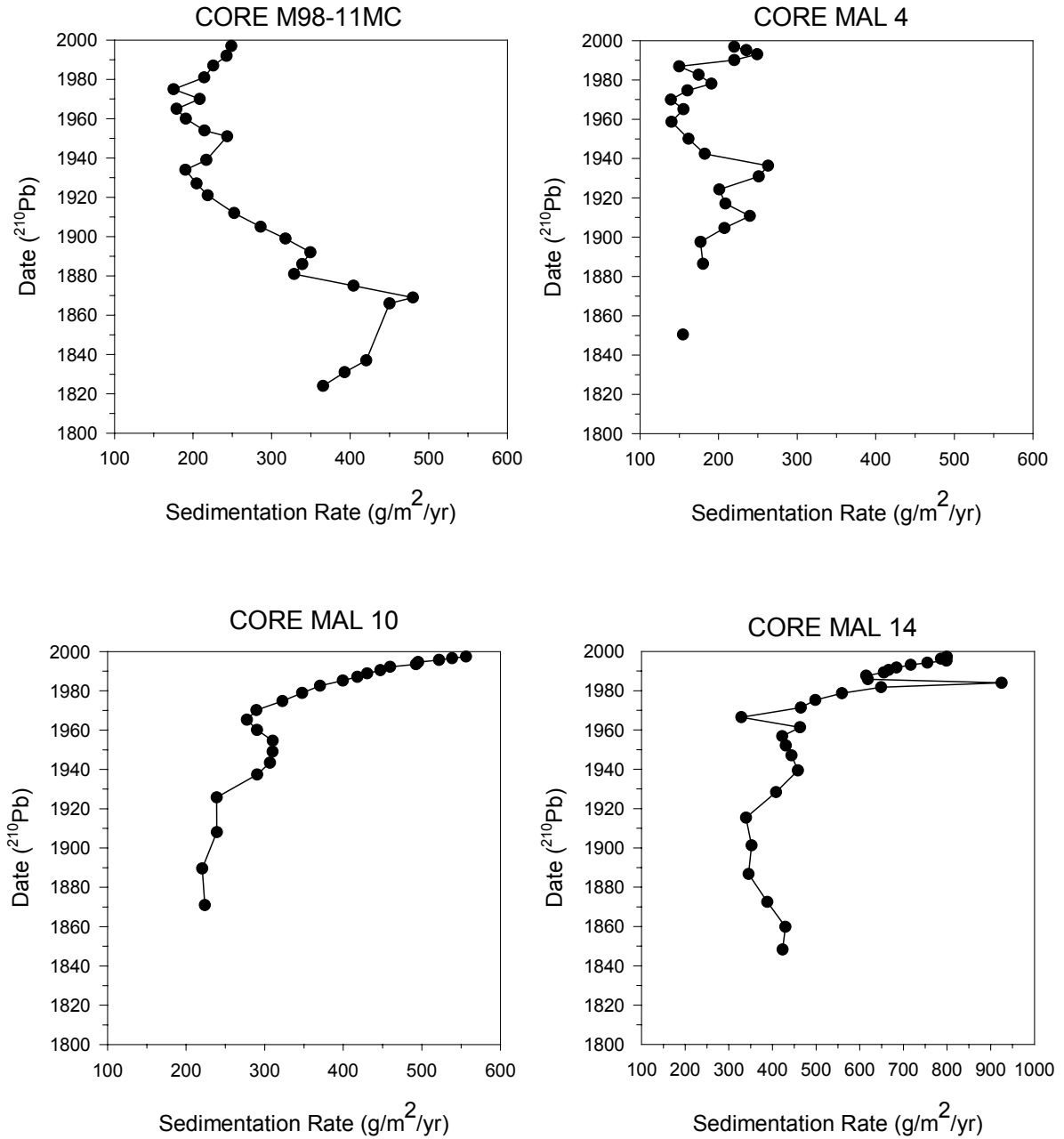


Figure 7. Estimated sedimentation rates for sediment cores M98-11MC, MAL 4, MAL 10 and MAL 14 from Lake Malawi, based on constant rate of supply model applied to ²¹⁰Pb activity data. Note the x-axis scale of core MAL 14 is greater than the three other plots. Data for M98-11MC from T.C. Johnson (pers. comm.) & data for MAL 4, MAL 10 and MAL 14 from P. Ramlal (2002).

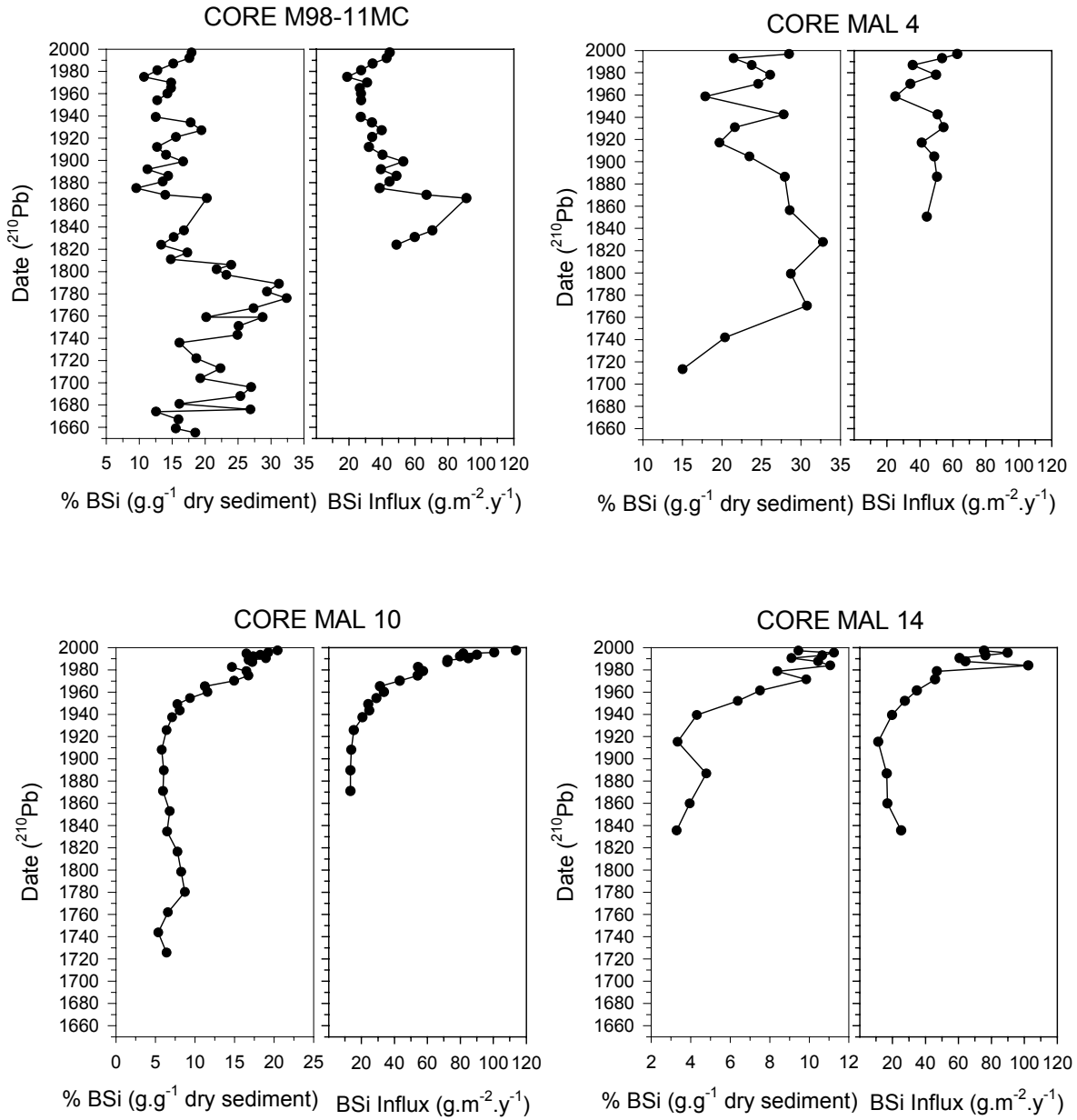


Figure 8. Percent biogenic silica (%BSi) and biogenic silica influx (BSi influx) profiles for sediment cores M98-11MC, MAL 4, MAL 10 and MAL 14 from Lake Malawi, East Africa. %BSi is measured with a precision of + 1% SiO₂. Note the x-axis scale varies among plots. Data for core M98-11MC profile modified from Johnson et al. (2001).

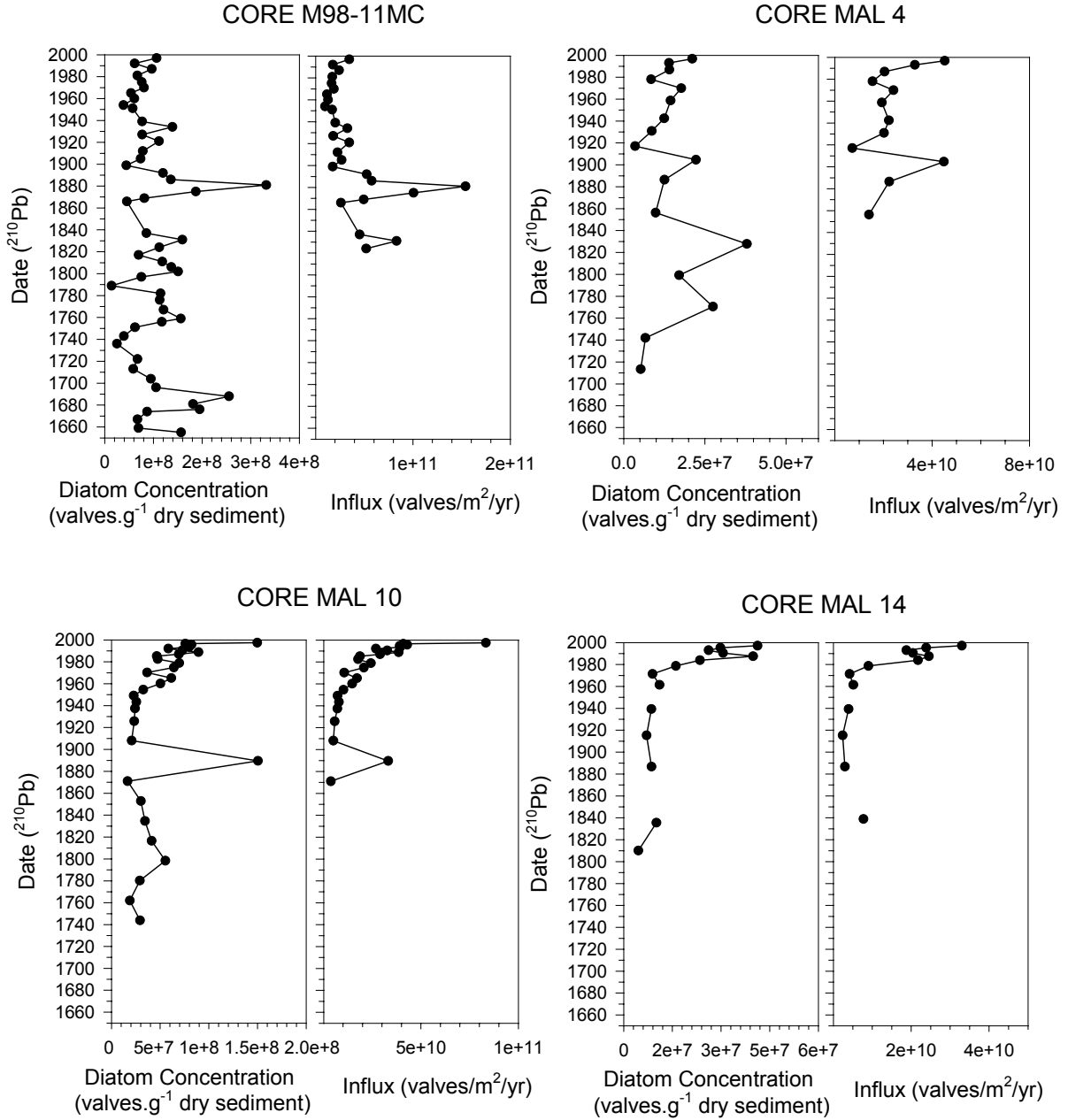


Figure 9. Diatom concentrations and diatom influx profiles for sediment cores M98-11MC, MAL 4, MAL 10 and MAL 14 Lake Malawi, East Africa. Note the x-axis scale varies among plots.

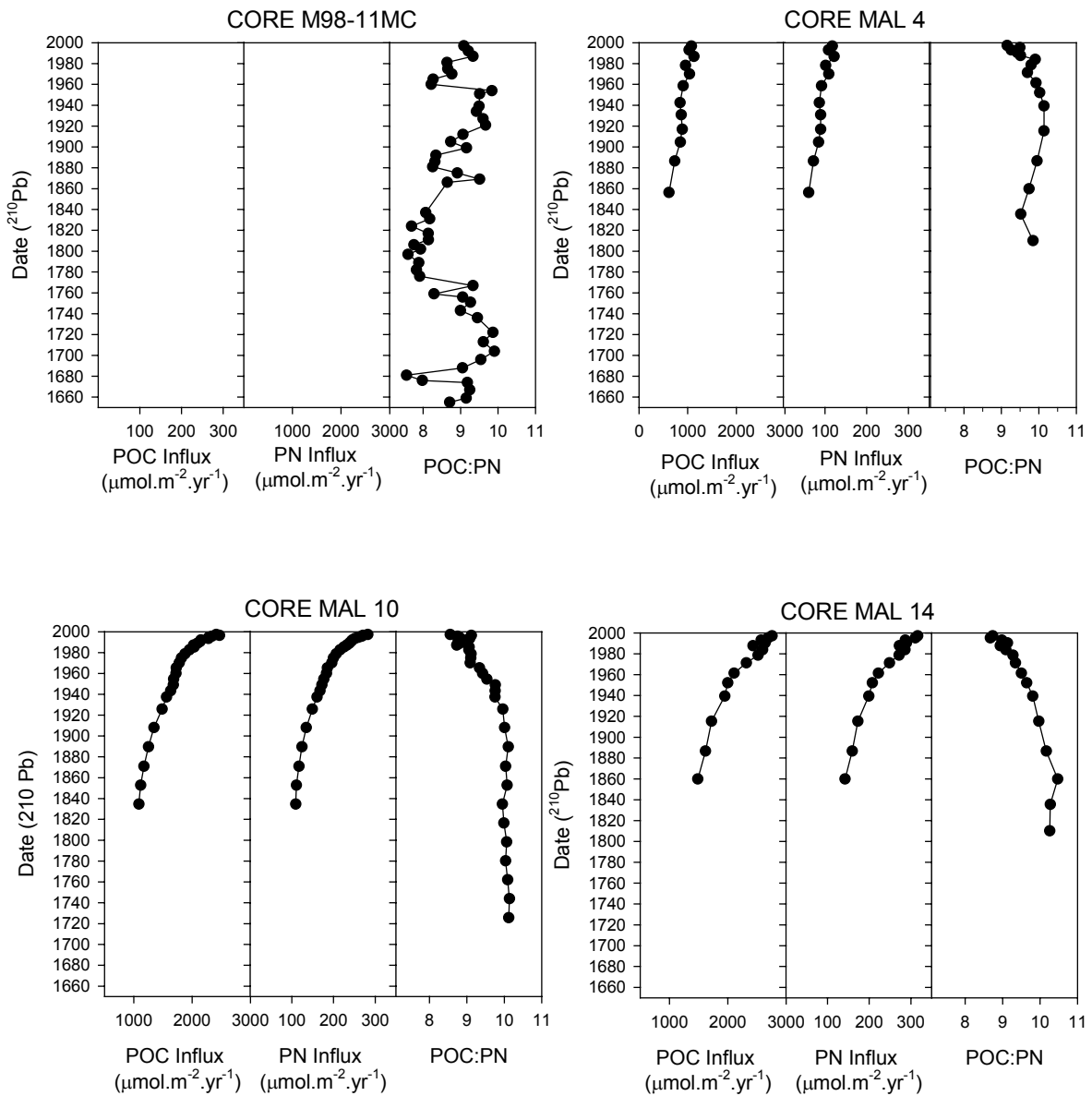


Figure 10. Influx of particulate organic carbon and particulate nitrogen and the particulate organic carbon:particulate nitrogen ratio of sediment cores M98-11MC, MAL 4, MAL 10 and MAL 14 of Lake Malawi, East Africa. Data for core M98-11MC from Isla Castaneda (pers. comm.) and for cores MAL 4, MAL 10 and MAL 14 from P. Ramlal (2002).

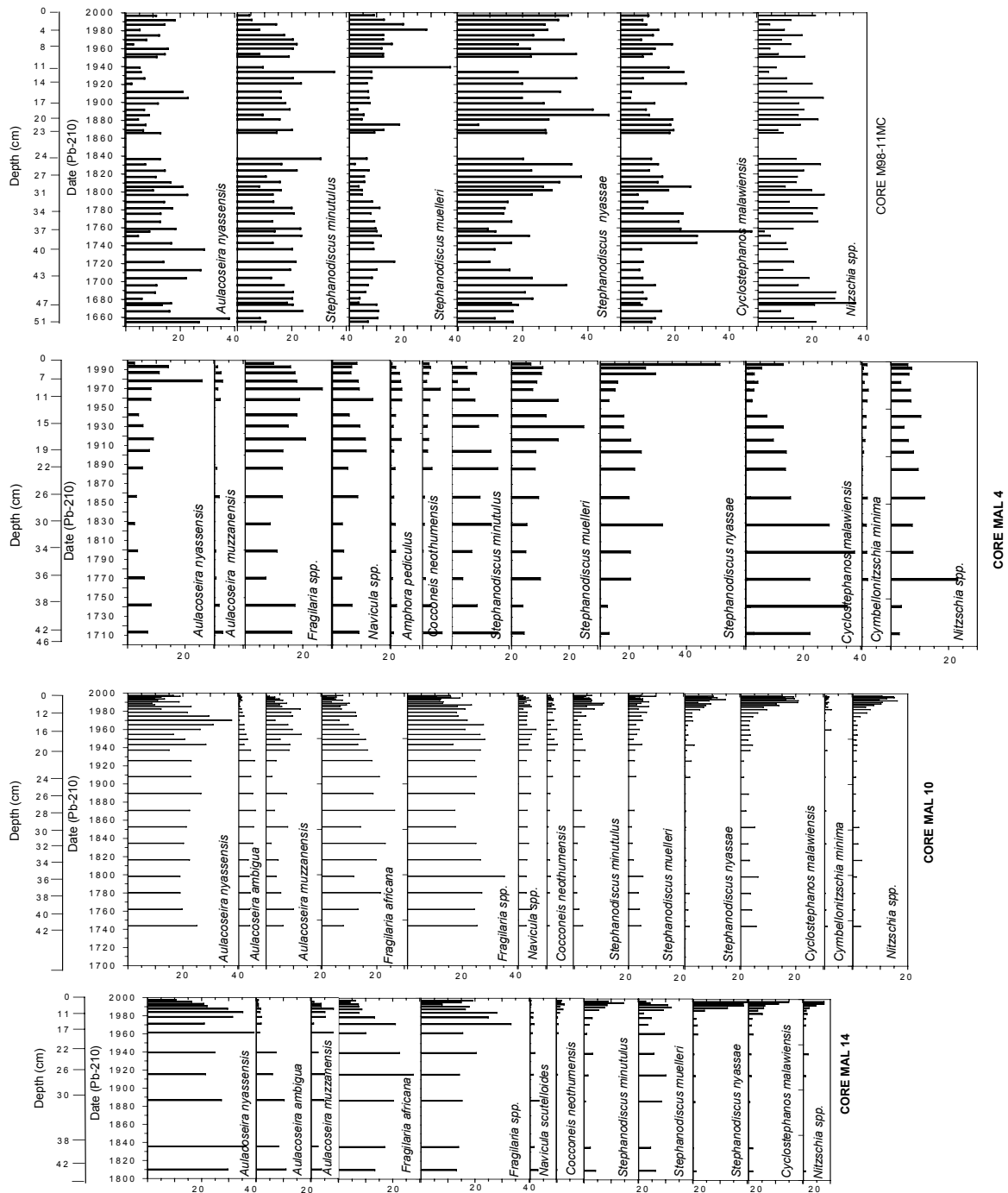


Figure 11. Summary profiles of relative diatom abundances for major diatom taxa from cores M98-11MC, MAL 4, MAL 10 and MAL 14, Lake Malawi, East Africa. Note that date scales differ with respect to the length of each coring record and diatom abundances are represented as percent. Terms '*Navicula spp.*' and '*Nitzschia spp.*' refer to the sum of all enumerated taxa from these genera. '*Fragilaria spp.*' includes all *Fragilaria* species except *F. africana*.

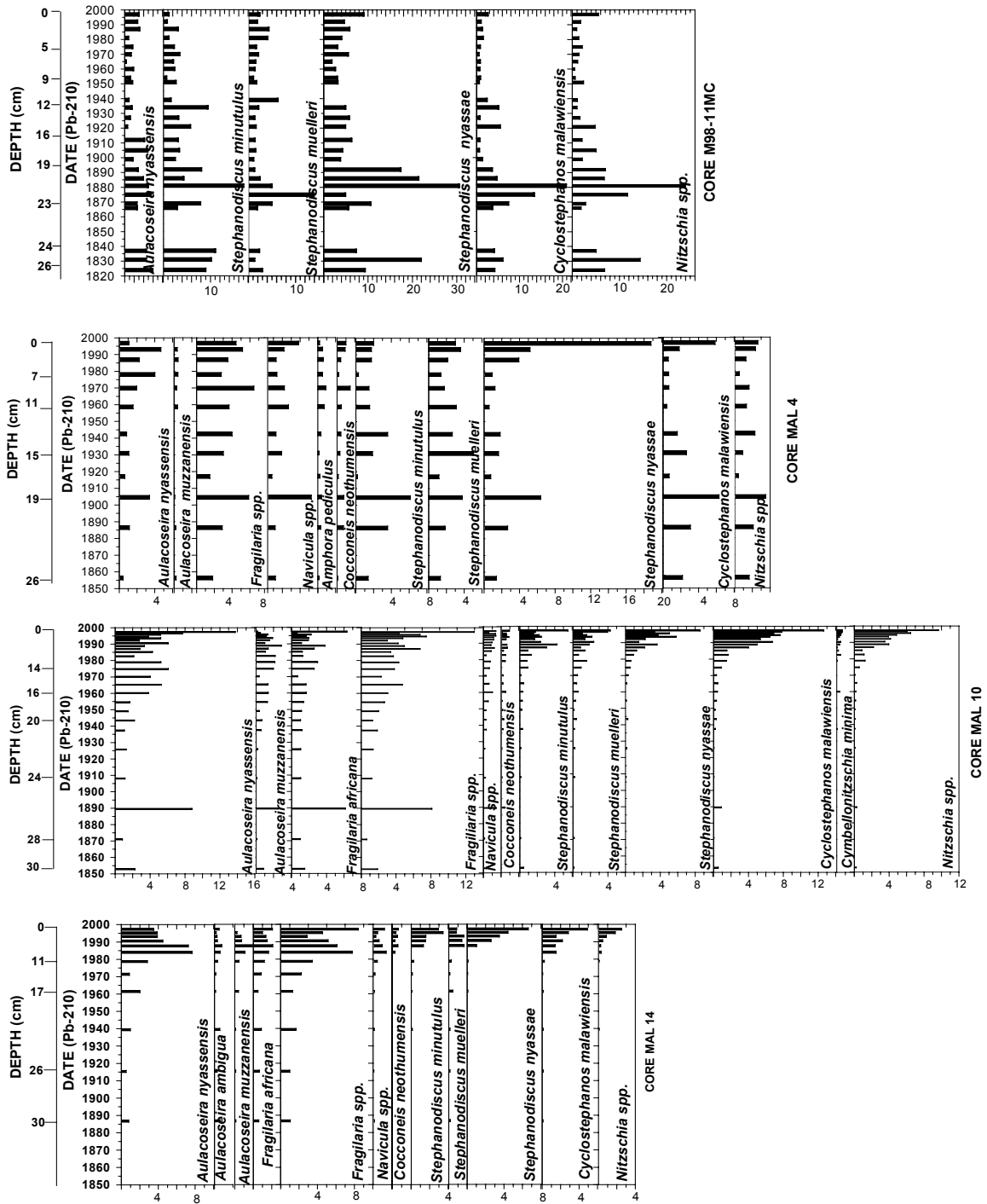


Figure 12. Summary profiles of diatom influx rates (values $\times 10^9/m^2/yr$) for major diatom taxa from cores M98- 11MC, MAL 4, MAL 10 and MAL 14, Lake Malawi, East Africa. Terms '*Navicula spp.*' and '*Nitzschia spp.*' refer to the sum of all enumerated taxa from these genera. '*Fragilaria spp.*' includes all *Fragilaria* species except *F. africana*.

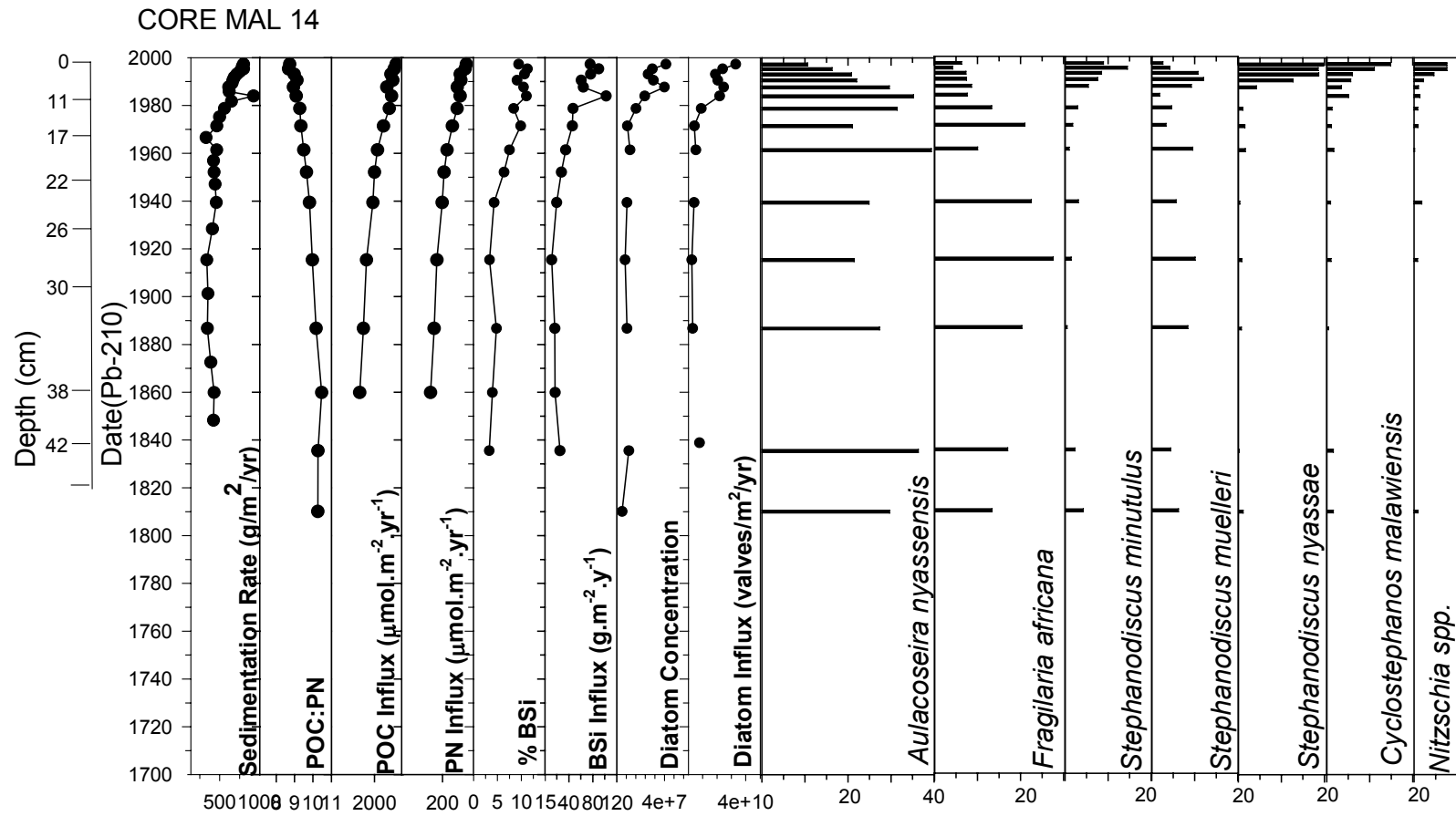


Figure 13. Summary stratigraphy of sedimentary analyses with diatom relative abundances represented as percent for southern core MAL 14, Lake Malawi, East Africa

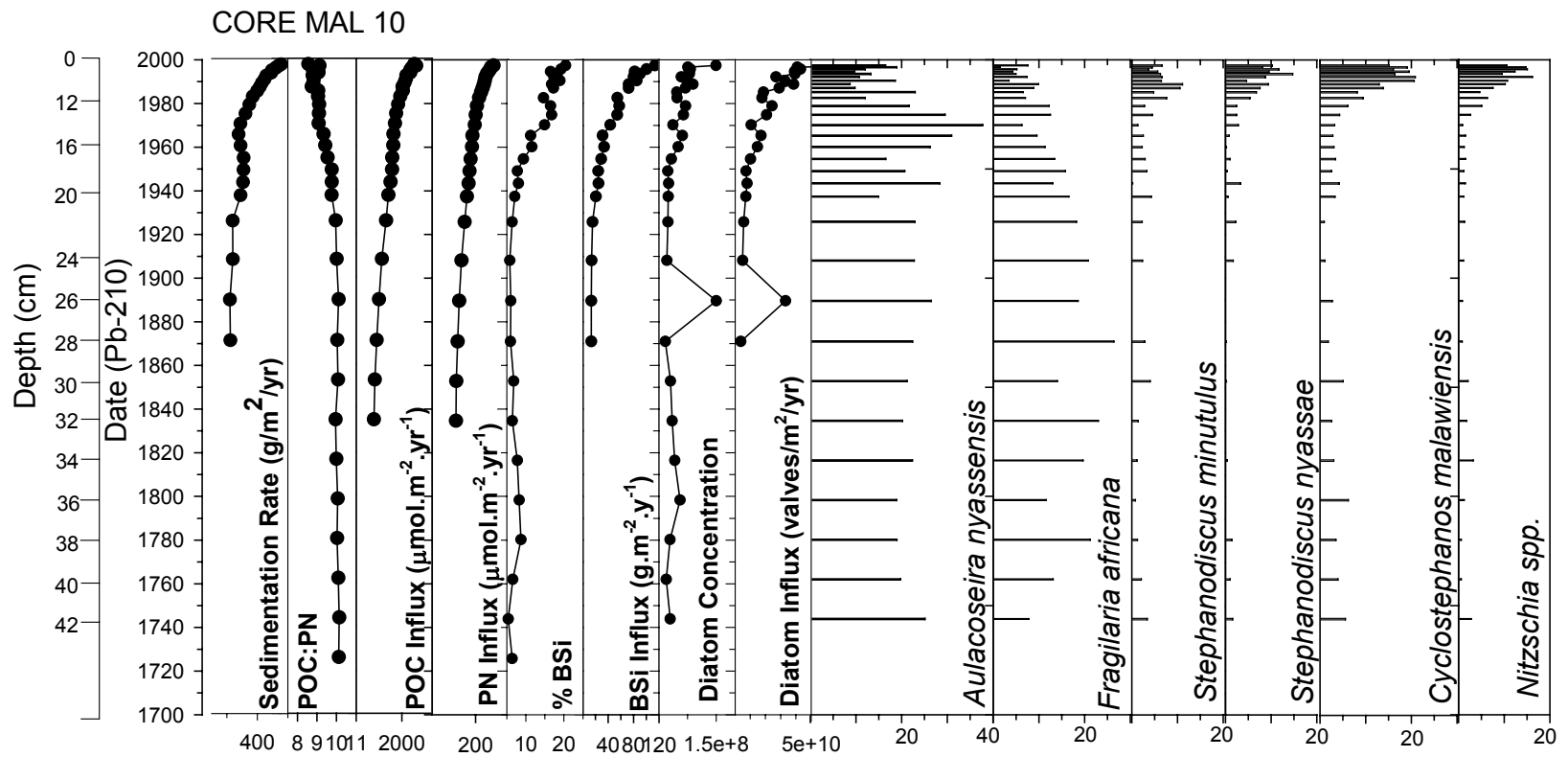


Figure 14. Summary stratigraphy of sedimentary analyses with diatom relative abundances represented as percent for southern core MAL 10, Lake Malawi, East Africa

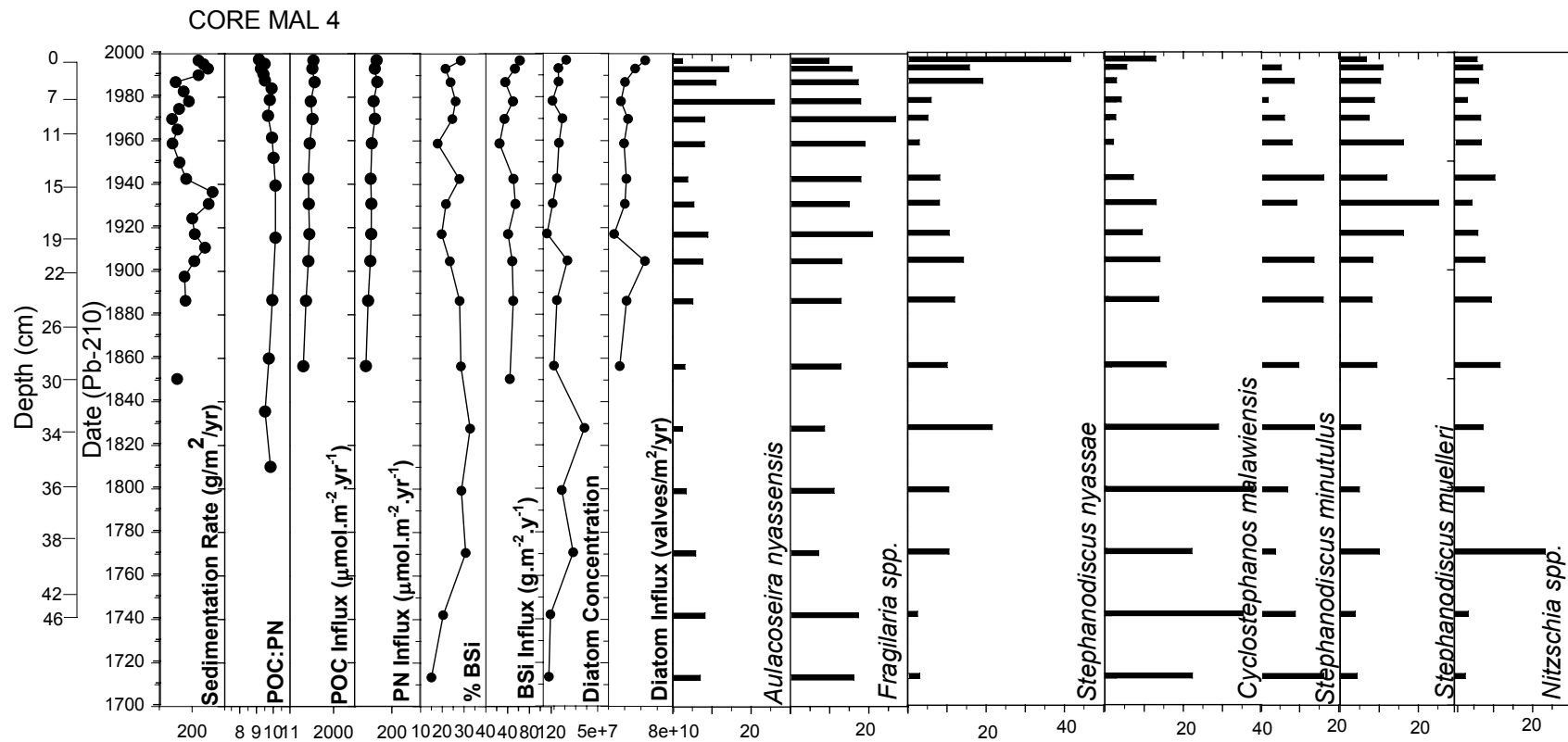


Figure 15. Summary stratigraphy of sedimentary analyses with diatom relative abundances represented as percent for central core MAL 4, Lake Malawi, East Africa

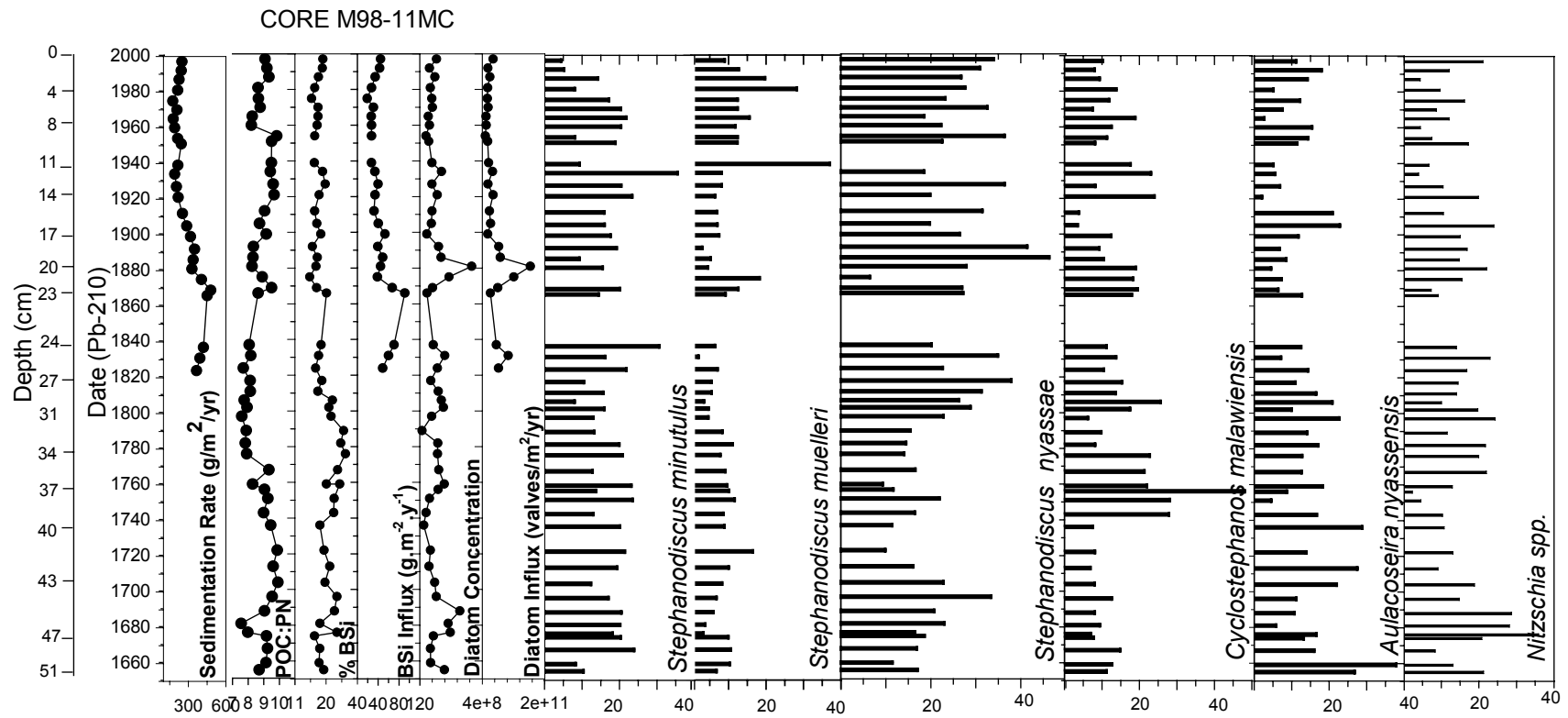


Figure 16. Summary stratigraphy of sedimentary analyses with diatom relative abundances represented as percent for northern core M98-11MC, Lake Malawi, East Africa

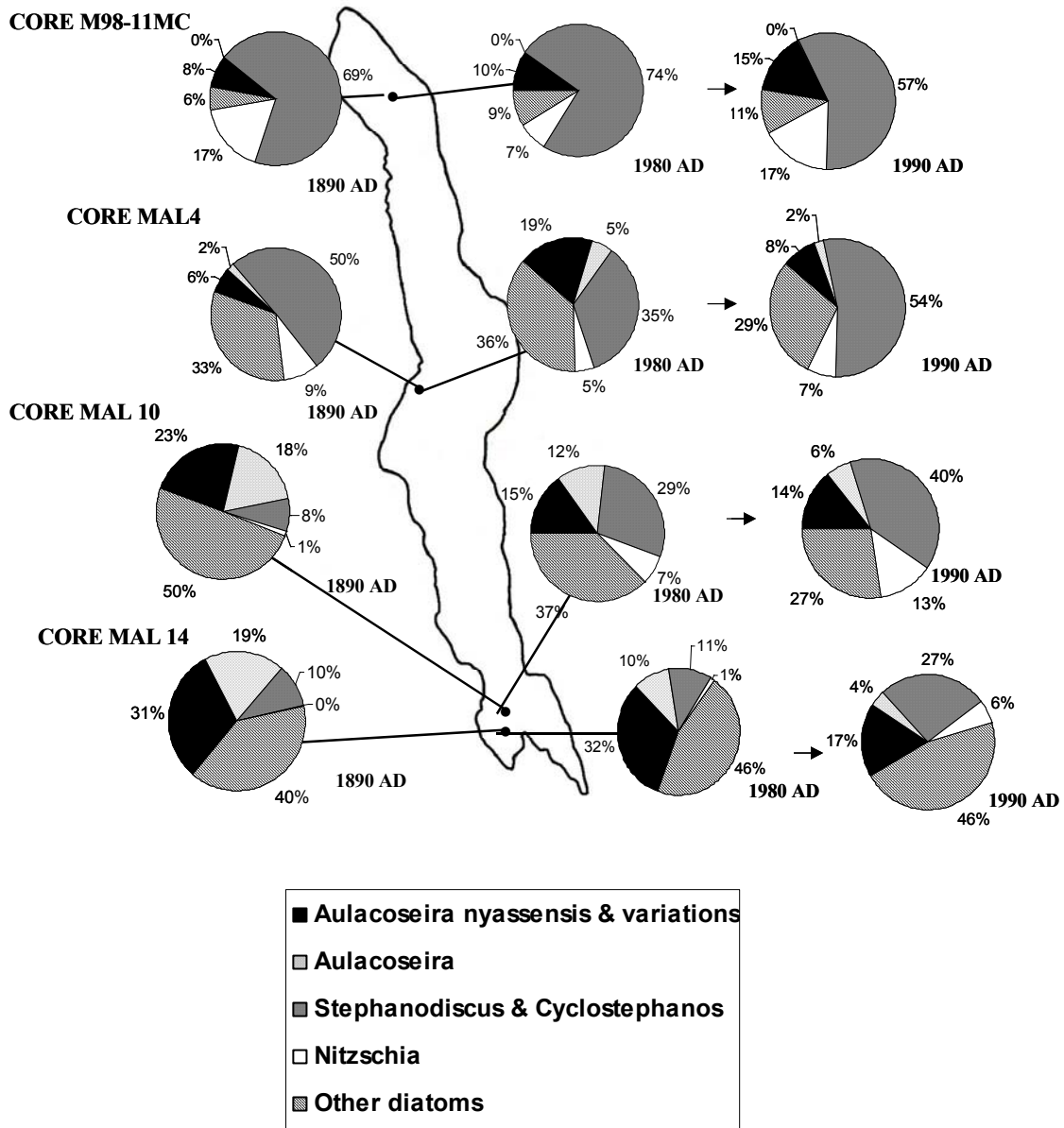


Figure 17. Spatial variation of diatom community abundance averaged over three time periods. Bottom sediments date from 1880-1910 AD (labeled 1890 AD) and near surface sediments date from both 1980-1989 AD (labeled 1980 AD) and 1990-1997/98 (labeled 1990 AD) of cores M98-11MC, MAL 4, MAL 10 and MAL 14 from Lake Malawi, East Africa. Legend categories follow Owen and Crossley (1992).

DISCUSSION

EVIDENCE OF RECENT CULTURAL EUTROPHICATION

The most conspicuous trend within the sediment cores profiles, which has not previously been documented, is the unprecedented sequence of limnological changes in cores MAL 4, MAL 10 and MAL 14, indicative of eutrophication in Lake Malawi commencing after ~1940 (Figure 12-14). The southern cores indicated a relatively stable community composition and lower sedimentation rates from ca. 1700-1940 AD, with an abundance of *Aulacoseira nyassensis* and *Fragilaria africana*. These diatom assemblages are indicative of well-mixed waters relatively high silica availability, which is consistent with known nutrient dynamics of the region (Bootsma, 1993b; Hecky and Kling, 1981; Talling, 1969). Sedimentation rates, biogenic silica content, particulate organic carbon and particulate nitrogen influx increased beginning as early as ~1940, while particulate organic carbon to particulate nitrogen (POC:PN) ratios decreased in southern cores MAL 10 and MAL 14 (Figure 12 & 13). This pattern of change could be interpreted to represent increased deposition of autochthonous organic matter and biogenic forms of silica. P. Ramlal (2002) found that autochthonous inputs are the primary source of organic carbon in Lake Malawi. This increased organic matter sedimentation may be linked to the historic rise in water level that led to the reconnection of the Shire River outflow in ca. 1937 (Calder et al., 1995; Drayton, 1984), yet, impacts are expected to be muted as the steep sides of the basin restrict the expansion of nearshore habitats in Lake Malawi. Another, more likely scenario that could account for the rise in productivity in ca. 1940 in Lake Malawi is increased anthropogenic perturbations in the southern catchments. In Lake Victoria, for example, human impacts arose as early as the 1940s corresponding with European colonization and increased agricultural activity, which caused increased nutrient inputs and elevated primary production of the lake (Hecky, 1993; Verschuren et al., 2001). The decline in POC:PN ratios up core in MAL 4, MAL 10 and MAL 14 could be due to the effects of incomplete diagenesis, as more labile nitrogen-bearing compounds are preserved in the uppermost sediments (Cohen, 2003). Yet, C:N ratios correspond with

increasing % BSi, POC and PN influx trends, which is counter to the effects of diagenesis alone and in support of increased lake productivity starting ca. 1940.

Diatom production in southern Lake Malawi began to accelerate into the 1970's, as indicated by increased rates of sedimentation, increased diatom influx to the sediments and increased *A. nyassensis* (in core MAL 10 & MAL 14) and *F. africana* (core MAL 14) relative abundances. The central core, MAL 4, shows a similar rise in *A. nyassensis* abundance, with a six-fold increase from ca. 1940 to 1980. At this time, rising *A. nyassensis* abundance (and *F. africana* abundance in the southern cores) likely required relatively high concentration of silica to support the increased production of these heavily silicified diatoms (Kilham et al., 1986).

The increased nutrients required to sustain elevated diatom influxes by ca. 1980 could be due to either increased river discharge to the south, or increased wind speeds, which disrupt the layers of stratification and reintroduce nutrient-rich metalimnetic waters (Bootsma et al., 1996a; Bootsma and Hecky, 1999). For Lake Malawi, meteorological data are sparse and the nearest approximation is by way of extrapolating values from regional historic data. Lake level fluctuations and wind speeds from 1948 to 2003 (Figure 17) show that from 1972 wind speeds declined as water levels rose. The period from 1978 to 1982 exhibited the lowest wind speeds and highest water level recorded over Lake Malawi. Therefore, increased wind speeds do not appear to drive the increased nutrients required to increase diatom influxes by ca. 1980. 1977-1979 was one of the wettest periods over Lake Malawi during the past 60 years, resulting in high water levels in 1980 and an abyssal cooling event (Vollmer et al., in press). During the rainy season in Lake Malawi, high inflow of cold river water and reduced summer insolation due to increased cloudiness enhanced convective cooling and promoted vertical mixing (Vollmer et al., in press). Precipitation over Lake Malawi is greatest in the north end (Nicholson, 1996) and limnological impacts of heavy rainfall years would be anticipated in northern core M98-11MC. The diatom assemblage in M98-11MC shows no response consistent with increased precipitation ca. 1980 (Figure 5). However, runoff may be greater for the same amount of rainfall during 1977-1979 because of the loss of natural vegetation due to intensive deforestation

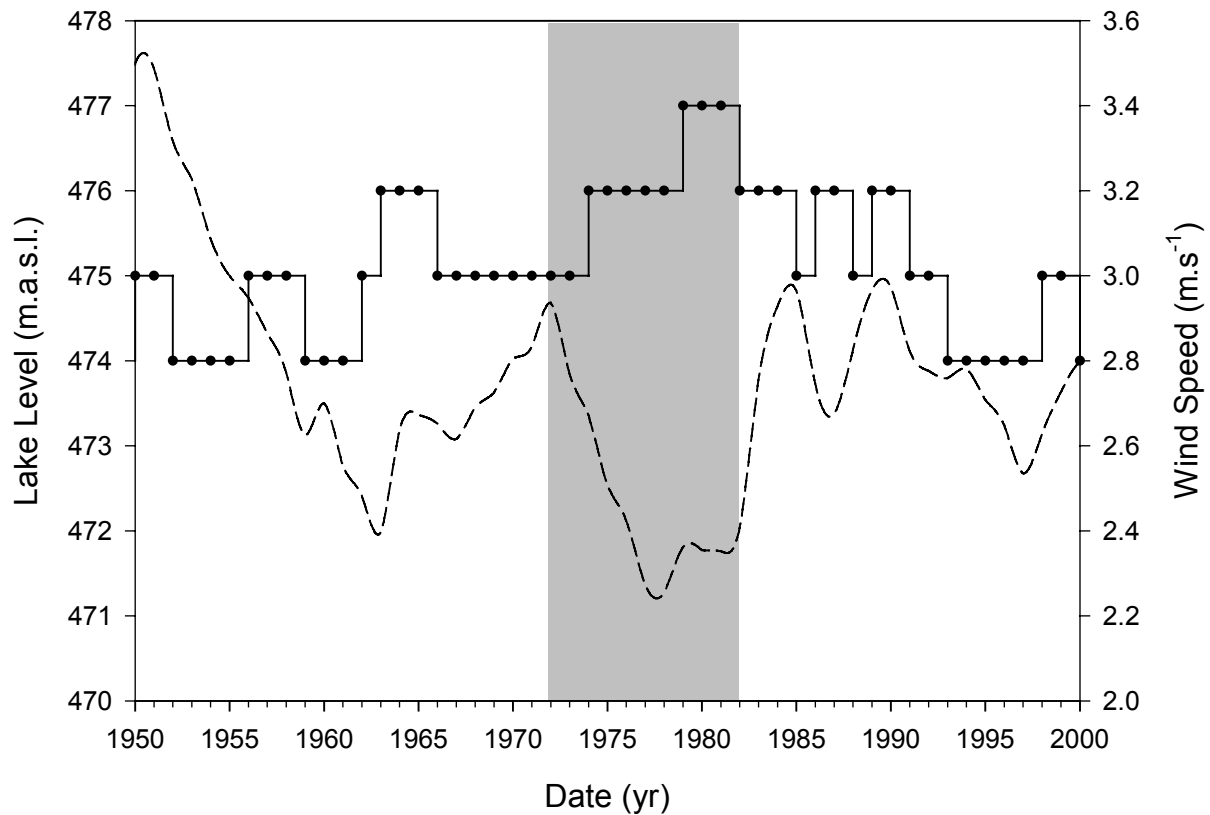


Figure 18. Lake level fluctuations (solid line) and annual wind speeds represented as a three-year running mean (dashed line) for Lake Malawi. Grey zone denotes 1972-1982 when lake levels rose and wind speeds declined. Lake level data provided by M.K. Vollmer (pers. comm.) wind speed data provided by G. Silsbe (pers. comm.).

Wind speed data compiled from the meteorological dataset from the National Centers for Environmental Prediction-National Center for Atmospheric Research project. NCEP-NCAR uses state-of-the-art analysis/forecast system to perform data assimilation using global datasets (Kistler 2001). Monthly wind speed and direction data from 10 m height for 1948 to 2003, downloaded from the Climate Diagnostic Center (<http://www.cdc.noaa.gov/cdc/data.ncep.reanalysis.derived.html>) from an area delineated by 30°E, 40°E, 15°S and 5°S, with a spatial grid of 2.5 x 2.5°. Wind speeds, direction for each grid point, and temporal observations were geospatially interpolated on a 10 x 10 km grid from which mean monthly wind speeds were spatially extracted over Lake Malawi. To facilitate comparison with historic data, wind speeds were converted from 10 m to 2 m using the formula $U_{10} = U_2 [\ln(10/z_0)] / [\ln(2/z_0)] - 1$ (Brutseart 1982) where U_Z = wind speed measurement at height z and z_0 = roughness height (0.1 mm, Chow et al. 1988).

and agriculture in Lake Malawi's Linthipe River catchment (Calder et al., 1995; Lam et al., 2002). The release of nitrogen and phosphorus from the terrestrial environment increases with increasing runoff (Likens and Bormann, 1974; Likens et al., 1970). The Linthipe River is located along the southwestern shore of Lake Malawi and is considered the most anthropogenically disturbed river within the catchment, producing the highest yields of suspended sediments (498.5 tons/km²/y) and nutrients (49.7 megamoles/y TP) (Hecky et al., 2003). The trend in accelerated nutrient inputs is due most likely to land use changes in the southern catchments of Lake Malawi that began as early as ca. 1940 and continued into the present. As well, high runoff years may amplify the effects of increased runoff and nutrient inputs (Hecky et al., 2003).

Both southern cores, MAL 10 and MAL 14, record a decline in silica availability after ~1980 as inferred by the decline in relative abundance of heavily silicified *A. nyassensis* and *F. africana* and the rise in relative abundance of more lightly silicified *Stephanodiscus*, *Cyclostephanos*, *Cymbellonitzschia* and *Nitzschia* taxa (Figure 12 & 13). Thus, limnological conditions appear to favour diatom assemblages with reduced silica requirements after 1980. In Lake Victoria, East Africa, cultural eutrophication led to a doubling in primary production and a tenfold reduction of silica concentrations in the water column to < 1.0 µmol, resulting in conditions largely responsible for the loss of *Aulacoseira* from phytoplankton communities by 1990 AD (Kling et al., 2001). The sequence of events in Lake Malawi are not unlike the pattern of diatom community composition change of Lake Victoria, which pass from an abundance of *Aulacoseira* to *Stephanodiscus* to a succession of long, lightly-silicified *Nitzschia acicularis* and *Cyclostephanos* species (Hecky, 1993; Kling et al., 2001). The relative abundance of these growth-limiting nutrients (Si:P) has been demonstrated to dictate the competitive outcome of phytoplankton community compositions in the African Great Lakes (Kilham et al., 1986) and a silica deficiency in the mixolimnion may be controlling this shift in diatom community composition since ca. 1980. The most revealing trend is the absolute decline in *Aulacoseira* influx in core MAL 14, which is also similar to that noted by Hecky (1993) in Lake Victoria.

An increased loading of phosphorus and nitrogen may have reduced soluble reactive silica relative availability in the southern end of Lake Malawi by way of increased sedimentation of siliceous diatoms (Figure 7). Diatoms sequester soluble reactive silica during the formation of their siliceous frustules (Reynolds, 1986). The % BSi profiles displayed by Lake Malawi's southern cores follow a pattern comparable to those found in the Laurentian Great Lakes, Lake Michigan and Lake Huron in North America (Schelske, 1999; Schelske et al., 1986) and Lake Victoria in Africa (Hecky et al., 2003; Verschuren et al., 1998). These deep-water Laurentian Great Lakes sedimentary biogenic silica content increased in response to increased phosphorus inputs from agriculture, sewage and grey water discharge (Schelske, 1999). These same trends in the African Great Lakes are dependent on phosphorus loading in the form of soil bound phosphorus (Hecky et al., 2003; Verschuren et al., 1998). Increased riverine inputs of terrestrial biogenic silica from phytoliths may also amplify this increase in southern Lake Malawi (Bootsma et al., 2003), however no trend in phytoliths content amongst cores was seen.

Catchment disturbances in Lake Malawi increase phosphorus relative to dissolved silica inputs (Hecky et al., 2003) and response times to these critical nutrients are rapid (Bootsma and Hecky, 1999). Relatively low levels of phosphorus enrichment can lead to increased diatom productivity (Guildford et al., 1999) and increased silica sedimentation rates (Hecky, 2000; Schelske et al., 1986) that result in a decline in water column Si:P ratios. Suspended nitrogen and phosphorus loads are greater in the southernmost rivers impacted by human perturbation than other less impacted rivers that drain into Lake Malawi. The Linthipe River alone delivers nearly 50% of the riverine annual load of total phosphorus and over 40% of the total nitrogen relative to in a dozen of the major Malawian rivers measured in 1997 (Hecky et al., 2003). As well, riverine inputs constitute the second largest component of the phosphorus budget after metalimnetic inputs (Hecky et al., 1996). In 1993, sediment cores taken from Lake Malawi found that phosphorus sedimentation had increased since 1950 in the south end of the lake (Hecky et al., 1999) most likely due to mobilization of terrestrial nutrients by current land-use practices. Silica to phosphorus ratios may have continued to decline as

nutrient loading to Lake Malawi progressed. *Aulacoseira* influxes to the nearshore core MAL 14 declined by ca. 1990 relative to the peak levels in ca. 1985 (Figure 11) indicating that conditions are becoming much less favourable for these poor silica competitors. This decline in *Aulacoseira* abundance ca. 1990 also correlates with recent increased occurrences of bluegreen algae *Anabaena* and *Planktolyngbya nyassensis* in phytoplankton samples (Hecky et al., 1999). Should nitrogen and silica become more limiting to primary producers as anthropogenic nutrient inputs continue, cyanobacteria will likely become a dominant component in the phytoplankton community resulting in increased abundances of noxious algal species and a decline in water quality, as in Lake Victoria in 1994-95, where nearly 70% of the mean phytoplankton biomass consisted of cyanophytes, predominately *Anabaena*, *Cylindrospermopsis* and *Planktolyngbya* species.

The effects of eutrophication-induced silica limitation in Lake Malawi appear to have extended into the central core MAL 4, with peak abundances of *Stephanodiscus nyassae* and *Cyclostephanos malawiensis* in ca. 1996 (Figure 14), but land-use effects do not extend as far as the northern core M98-11MC (Figure 15). The change in diatom community composition in central core MAL 4 is linked to relative increases in sedimentation rate and elevated influxes of silica and diatoms to the sediment (Figure 14), suggesting that effects of anthropogenic eutrophication coincide with the gradient of land use intensity, with the earliest and greatest effects at the south end of the lake; later, modest effects in the mid-lake region; and currently, no discernable effects at the north end of the lake.

EVIDENCE OF LAKE LEVEL RISE CA. 1860 AD

Northern core M98-11MC, mid core MAL 4 and southern core MAL 10 profiles provide evidence of a lake-wide event late during the 19th century that are consistent with a lake-level rise. These cores exhibit a large influx of diatoms to the sediment from ca. 1860-1905 AD (Figure 8), due most likely to a climatic event, since no human perturbations are known to extend throughout the entire basin. Core MAL 14 of this study does not exhibit a similar trend in diatom influx since the sample within

this time period was poorly preserved with high clastics, which prevented enumeration and identification of the diatoms.

The most probable cause for this lake-wide event is a climate-induced substantial (nine-meter) rise in water level (Figure 2) estimated at ca. 1860 AD in Lake Malawi (Owen et al., 1990). These lake level reconstructions are based on measured data (1898-1997 AD) by Vollmer (pers. comm.) and historical information (1650-1898 AD) compiled from paleolimnological, archaeological, and oral histories by Owen et al. (1990) and Nicholson (1998). In Lake Malawi, rising lake level is controlled largely by increased precipitation (Nicholson, 1996) and decreased evaporation (Hamblin et al., 2002) as would occur with prolonged cool rainy periods. Evidence of lake level rise at this time period is the presence of a turbidite layer (23-24.5 cm depth) ca. 1866 AD in core M98-11MC. A turbidite layer is the displacement of lacustrine sediments from upslope of the coring site, often due to deepwater currents or cold, well-oxygenated, riverine waters plunging deep below the oxycline (McCullough, 1999; Pilskalns, 2004; Vollmer et al., in press). Precipitation to Lake Malawi is greater at the north end than in the south, and the steep relief in combination with the increased river inflow likely carried a greater amount of terrestrial and inorganic particulates to the northern coring site and entrained older sediments from upslope (Lezzar et al., 1996). Increased allochthonous inputs are likely responsible for the rise in both sedimentation rates and POC:PN ratios (Figure 6 & 9). The subsequent increased nutrient availability and mixing of the water column may have resulted in the increased diatom influx and reduced POC:PN ratios in northern sediments, as represented by core M98-11MC. However, increased diatom productivity ~ 1880 is not associated with a change in nutrient ratios or community composition change within any of the cores analyzed. Thus, the inferred cultural eutrophication signal in ~1980 AD has had substantial impacts on the limnology (in particular the Si:P) of present day Lake Malawi as compared to large-scale climatic events like a nine-meter rise in water level, which had no obvious effect on diatom community composition.

CONTRIBUTIONS TO PALAEOCLIMATOLOGY

Northern core M98-11MC is evidently unaffected by cultural eutrophication and observed stratigraphic variability may more strongly reflect climatically driven hydrological and limnological changes. The northern core M98-11MC from Lake Malawi spans a period of over 350 years and displays considerable decadal- and centennial-scale variability in the diatom community composition profile.

The period of time encompassed by core M98-11MC (Figure 15) overlaps with a climatic period, known as the Little Ice Age ~1350-1850AD, in which global temperatures declined (Johnson et al., 2001). Johnson and his colleagues found that core M98-11MC, in combination with several other cores from Lake Malawi, revealed prolonged elevated biogenic silica content composed primarily of *A. nyassensis* from ca. 1550 to 1820 (Johnson et al., 2001). During ca. 1655-1665 AD, Lake Malawi's northern waters were likely exposed to increased wind intensity and cooler air temperatures as indicated by the abundance of *Aulacoseira nyassensis* in the diatom community composition in core M98-11MC (Figure 15). Dominance by *A. nyassensis* in the north requires increased wind energy to entrain the negatively buoyant, chain-forming populations from deeper in the water column or from sediment surfaces, and is possibly related to increased intensity of northwesterly trade winds during this time (Johnson et al, 2001). These high winds enhance circulation of metalimnetic waters that are rich in phosphorus and silica. At the same time, a tephra layer produced by volcanic ash deposition that most likely originated from the northern Rungwe volcanoes may have increased surface water silica concentrations and contributed to the abundance of *A. nyassensis* (Haberyan and Hecky, 1987). Johnson et al. (2001) found increased % BSi associated with *Aulacoseira* abundance existed until ca. 1820, however closer examination of core M98-11MC diatom community composition reveals that periods of high % BSi are not linked solely to high abundances of *Aulacoseira*, but may be related to elevated abundances of *Nitzschia*, *Cyclostephanos* and *Stephanodiscus* as well (Figure 10). Diatom productivity in northern core M98-11MC over the course of the Little Ice Age is more variable than %BSi profiles interpreted by Johnson et al. (2001),

as indicated by the changing community composition, the sedimentary diatom concentrations and the POC:PN ratios (Figure 15), suggesting that this global decline in temperatures is not the sole determinant in Lake Malawi's paleoecology. Thus, sedimentary biogenic silica content may be useful in determining large scale climatic events, yet historic impacts on the biological community within the lake appear to be more dynamic, taking place on smaller time scales.

In reconstructions of Lake Malawi's water level, archaeological findings suggest a rapid high stand occurred around 1700 AD (Figure 2) and core M98-11MC's profiles corroborate such an event (Figure 15). Varve counts suggest a rapid sedimentation rate around this time period, as sediment slices 46-47 cm and 47-48 cm date to ca. 1674 to 1676 AD (Figure 5). With elevated lake levels and high river inflow, nutrient loading from atmospheric deposition and riverine and metalimnetic waters is enhanced (Vollmer et al., in press). These, in turn, stimulate diatom production and increased autochthonous production in the lake ca. 1680-1700, resulting in elevated sedimentary diatom concentrations (Figure 8), increased sedimentary biogenic silica content (Figure 7) and decreased POC:PN ratios (Figure 9). The impacts of greater rains and increased cloud cover may have led to both reduced wind speeds and the decline of *A. nyassensis* in favour of *S. nyassae* and *Nitzschia* abundance. A reduction of the Si:P ratio may have been the result of increased wet and dry deposition of phosphorus and phosphorus loading from river runoff (which is rainfall dependent), which are the major phosphorus inputs. Atmospheric inputs of silica however, amount to only 5% of the total estimated silica budget (Bootsma et al., 2003). As a result limnological conditions favoured *S. nyassae* and *Nitzschia*, which are better competitors of silica and are less negatively buoyant than *Aulacoseira*, with lower sinking rates due to their shell morphology. The *Nitzschia* percent abundance profiles are composed primarily of *N. frustulum*, *N. fonticola* and *N. epiphytica*. The obligate heterotroph *N. fonticola* proliferates with host colonies of *Microcystis* (Kilham et al., 1986) requiring a reduction of wind speeds commonly occurring during wetter periods (Nicholson, 1996) as seen in Figure 17. Thus, a diatom community composition dominated by *Nitzschia* and *Stephanodiscus*

nyassae is likely the result of increased precipitation and reduced wind speeds (Figure 17), leading to a lake level rise.

CONCLUSION

Paleolimnological investigations have shown both lake-wide similarities and contrasting stratigraphies from north to south in Lake Malawi. Previous studies by Ramlal (2002) found that autochthonous inputs had increased in the southern end of the basin ca. 1920, likely due to changes in land-use practices. This study provides paleolimnological evidence of effects of cultural eutrophication on biogeochemical cycling and biotic communities in the south and central region of Lake Malawi since ca. 1940 AD which surpass the range of natural variability (including a 9 m rise in water level) observed during the past 300 years, whereas sedimentary analyses in the north end of Lake Malawi do not exhibit any anthropogenically-induced change. Central and southern cores reveal increased diatom production after ca. 1970 due to increased nutrient availability, which far exceeds the nutrient inputs observed during the previous 300 years. By ca. 1980, a shift in diatom community composition from *Aulacoseira nyassensis* and *Fragilaria africana* to *Stephanodiscus*, *Cyclostephanos* and *Nitzschia* species, and increased silica burial indicate that eutrophication has not only led to an alteration of the biological community structure due to species competition for available silica, but, that eutrophication has also led to altered biogeochemical cycling of silica due to greater permanent burial of available silica. This study has detected the impacts of recent land use change in the southern catchment, providing an early warning that proper stewardship of the lake is required and appropriate management of both the lake and the catchment must be implemented to avoid widespread water quality deterioration.

FUTURE IMPLICATIONS

Unlike Lake Malawi, the eutrophication of Lake Victoria was not detected in advance of deleterious effects and Lake Victoria is now dominated by cyanobacteria year round (Kling et al., 2001). The abundance of bluegreen algae, in particular the nuisance species *Cylindrospermopsis*, *Anabaena*, *Aphanizomenon* and *Microcystis*, are now responsible for fish kills, either directly through phycotoxin production or indirectly by increased seston, respiration and deoxygenation of Lake Victoria's

hypolimnion (Kling et al., 2001). Lake Victoria has also experienced a dramatic loss of species diversity, especially in endemic cichlids, due mostly to the combined effects of cultural eutrophication and the introduction of Nile perch (Bootsma and Hecky, 1993; Cohen et al., 1996). Lake Malawi shares the same cichlid diversity in the shallow-water margins and many of these haplochromine fish have high trophic specializations (Bootsma et al., 1996b) and require transparent water to maintain behavioral barriers to hybridization (Seehausen et al., 1997). The effects of eutrophication threaten the entire food web, with increased suspended solids transported into the lake reducing oxygenation and water clarity and causing silica depletion.

Effects of human perturbations to the terrestrial environment have had implications for Lake Malawi's aquatic ecosystem. Elevated inputs of suspended nutrients are the result of a very complicated set of dynamics unique to a developing country such as Malawi. Approximately 90 % of Lake Malawi's riparian population resides in rural agricultural settings, where cultivation of crops is the dominant form of employment (Central Intelligence Agency, 2002). Subsistence farming predominates, such as slash and burn practices, and are not sustainable for long periods of time (World Food Programme, 2001). Amendments to the soil through agricultural inputs, such as livestock waste or chemical fertilizers, are unavailable or unaffordable to most farmers in Malawi (Cooper et al., 1996). Reduced soil fertility is compensated by increased cultivation of arable land, increasing the expanse of land exposed to weathering and erosion (Mkanda, 2002). Employment is based largely on agricultural production and the populations are expanding at a rate of approximately 2.2 % per year, (while developed countries such as Canada and the United States of America average 0.93 % annually,) (Central Intelligence Agency, 2002). Decreasing soil fertility and increasing infection by the human immunodeficiency virus (HIV and AIDS) combine to exacerbate the demand for maximum agricultural yields (World Food Programme, 2001). Climatic events such as the severe drought of 1991/92 also increased the demand for higher agricultural yields and food imports. This resulted in decreased food production, increased dependence on international financing and decreased

food security (World Food Programme, 2001). As a result, management strategies must consider both the ecological and socio-economic implications of any future recommendations.

Adjustments to the current deforestation and agricultural practices are necessary, yet must account for agricultural yields, income and employment, and result in decreased soil erosion and nutrient inputs. Mkanda (2002) found that the use of fertilizers was insufficient and that increased applications to maize and tobacco crops increased yields and decreased the need for expansion of the cultivated lands, thus decreasing soil erosion. A study of the Linthipe watershed found that a 50% reforestation would lead to an estimated reduction of one-third the amount of total phosphorus input during initial peak flows (Lam et al., 2002). However strategic reforestation as opposed to random reforestation of sensitive high slopes would be even more effective. Forest in the southern basin is an important asset to the dense populations for both domestic fuelwood used for cooking and commercial fuelwood for smoking fish (Abbot and Homewood, 1999). Researchers have begun to experiment with possible solutions to the demands for cheap fuel while mitigating soil degradation; one such solution may be the implementation of agroforestry in this region (Cooper et al., 1996).

Development in Lake Malawi's mountainous northern region is a particular concern, as it will yield substantial suspended sediment loads if steep slopes are brought into agricultural production. Maximum loading of nutrients into Lake Victoria was observed in pasturelands characterized by high discharges and steep topography (Lindenschmidt et al., 1998), suggesting that deforestation along Lake Malawi's escarpment would accelerate transport of particulate bound nutrients. Due to the relative abundance of low-nutrient indicator diatom taxa and the sensitivity of the northern coring location to changing climatic conditions, development in the north would likely lead to rapid degradation of water quality. The growing human populations in the north have already begun development in the Songwe River watershed (Hecky et al., 2003) and management of this region must be ecologically sound to avoid unacceptable water-quality deterioration. Hecky, et al. (2003) concluded that maintaining protection of the forested escarpment slopes will be essential in controlling yields of sediment and nutrients to Lake Malawi.

Persistent long-term warming trends may also become a problem with Lake Malawi (Vollmer et al., in press), however paleolimnological evidence does not show evidence of a substantially altered thermal regime. Recent evidence shows that the monimolimnion has warmed by 0.7°C from 1940-2000 in Lake Malawi due to decreasing cold-water convection (Vollmer et al., in press). Verburg et al. (2003) have found a similar trend in Lake Tanganyika's abyssal layer and several ecological consequences are anticipated. The thermal inertia of these large African Great Lakes has led to a gradual warming of the monimolimnion, resulting in increased density gradients and decreased vertical mixing (Verburg et al., 2003). Nutrient recycling and oxygenation of deep-waters in Lake Tanganyika has declined, as a result phytoplankton biomass and diatom abundance has declined (Verburg et al., 2003). Should the warming trend persist in this region it is likely that Lake Malawi's diatom community will come under stress, not only by the eutrophication-induced silica depletion in the mixolimnion in the south, but by the reduced vertical mixing. The loss of diatoms as an edible food source for grazers will undoubtedly affect Lake Malawi's food chain and the increased thermal stratification and elevated phosphorus inputs flushed in from the southern catchment will favour cyanobacteria species capable of regulating their buoyancy and fixing atmospheric nitrogen where nitrogen is most likely to limit algal growth (Guildford and Hecky, 2000; Guildford et al., 2003).

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APPENDICES

APPENDIX A.

Table 2. List of identified diatom taxa and authority encountered in sediment multicores M98-11MC, MAL 4, MAL 10, and MAL 14 from Lake Malawi.

Diatom taxon and Authority	Diatom taxon and Authority
<i>Achnanthes buccula</i> Cholnoky	<i>A. subarctica</i> (O. Müller) Haworth
<i>A. clevei</i> var. <i>bottnica</i> (Grunow) Clevei	<i>A. valida</i> (Grunow) Krammer
<i>A. delicatula</i> ssp. <i>englebrectii</i> (Cholnoky) Lange-Bertalot	<i>Caloneis bacillum</i> (Grunow) Cleve
<i>A. exilis</i> Kützing	<i>Capartogramma crucicula</i> (Grunow ex Cleve) Ross
<i>A. grischuna</i> Wuthrich	<i>Capartogramma karstenii</i> (Zanon) Ross
<i>A. holsatica</i> Hustedt	<i>Cocconeis neodiminuta</i> Krammer
<i>A. lanceolata</i> ssp. <i>rostrata</i> (Østrup) Lange-Bertalot	<i>C. neothumensis</i> Krammer
<i>A. marginulata</i> Grunow	<i>C. placentula</i> var. <i>egypta</i> (Ehrenberg) Cleve
<i>A. minutissima</i> Kützing	<i>C. placentula</i> var. <i>lineate</i> (Ehrenberg) Van Heurck
<i>A. subhudsonis</i> Hustedt	<i>Cyclostephanos damasii</i> (Hustedt) Stoermer & Håkansson
<i>A. suchlandtii</i> Hustedt	<i>C. malawiensis</i> Klee & Casper
<i>Amphora copulata</i> Kützing	<i>C. novaezeelandiae</i> (Cleve) Round
<i>A. inariensis</i> Krammer	<i>Cyclotella bodanica</i> var. <i>lemanica</i> (O. Müller) Bachmann
<i>A. pediculus</i> (Kützing) Grunow	<i>C. krammeri</i> Håkansson
<i>A. tanganyikae</i> Caljon	<i>C. meneghiniana</i> Kützing
<i>Aulacoseira ambigua</i> (Grunow) Simonsen	<i>C. ocellata</i> Pantocsek
<i>A. crassipunctata</i> Krammer	<i>C. radiosa</i> (Grunow) Lemmermann
<i>A. crenulata</i> (Ehrenberg) Thwaites	<i>C. stelligera</i> Cleve & Grunow
<i>A. granulata</i> (Ehrenberg) Simonsen	<i>C. tripartate</i> Håkansson
<i>A. granulata</i> var. <i>angustissima</i> (O. Müller) Simonsen	<i>Cymatopleura solea</i> (Brébisson) W. Smith
<i>A. italica</i> (Ehrenberg) Simonsen	<i>Cymbella budayana</i> Pantocsek
<i>A. laevissima</i> (Grunow) Krammer	<i>C. minuta</i> Hilse
<i>A. lirata</i> (Ehrenberg) Ross	<i>C. muellerii</i> Hustedt
<i>A. muzzanensis</i> (Meister) Krammer	<i>C. subaequalis</i> Grunow
<i>A. nyassensis</i> O. Müller	<i>C. caespitosa</i> (Kützing) Brun

Table 2. Continued...

Diatom Taxa & Authority	Diatom Taxa & Authority
<i>Cymbellonitzschia minima</i> Hustedt	<i>M. undulata</i> (Ehrenberg) Kützing
<i>Diploneis ovalis</i> (Hilse) Cleve	<i>Navicula absoluta</i> Hustedt
<i>D. parma</i> Cleve	<i>N. atomus</i> (Kützing) Grunow
<i>D. pseudovalis</i> Hustedt	<i>N. arvensis</i> Hustedt
<i>Epithemia adnata</i> (Kützing) Brébisson	<i>N. bacilloides</i> Hustedt
<i>Eunotia incisa</i> Gregory	<i>N. barbarica</i> Hustedt
<i>E. intermedia</i> (Krasske) Nörpel & Lange-Bertalot	<i>N. capitata</i> Ehrenberg var. <i>hungarica</i> (Grunow) Ross
<i>E. subarcuatooides</i> Alles	<i>N. capitoradiata</i> Germain
<i>Fragilaria africana</i> Hustedt	<i>N. cincta</i> (Ehrenberg) Ralfs
<i>F. brevistriata</i> Grunow	<i>N. confervacea</i> (Kützing) Grunow
<i>F. capucina</i> var. <i>rumpens</i> (Kützing) Lange-Bertalot	<i>N. contenta</i> Grunow
<i>F. construens</i> (Ehrenberg) Grunow	<i>N. costulata</i> Grunow
<i>F. construens</i> f. <i>venter</i> (Ehrenberg) Hustedt	<i>N. cryptotenella</i> Lange-Bertalot
<i>F. heidenii</i> Østrup	<i>N. damasii</i> Hustedt
<i>F. leptostauron</i> (Ehrenberg) Hustedt	<i>N. decussis</i> Østrup
<i>F. leptostauron</i> var. <i>dubia</i> (Grunow) Hustedt	<i>N. elkab</i> O. Müller
<i>F. pinnata</i> Ehrenberg	<i>N. exiguiiformis</i> Hustedt
<i>F. pinnata</i> var. <i>intercedens</i> (Grunow) Hustedt	<i>N. gastrum</i> (Ehrenberg) Kützing
<i>F. sp. 2</i> PIRLA Camburn	<i>N. gastrum</i> var. <i>signata</i> Hustedt
<i>F. ulna</i> (Nitzsch) Lange-Bertalot	<i>N. halophila</i> (Grunow) Cleve
<i>Gomphonema affine</i> Kützing	<i>N. ignota</i> var. <i>accepta</i> (Hustedt) Lund
<i>G. clevei</i> Fricke	<i>N. Insociabilis</i> Krasske
<i>G. gracile</i> Ehrenberg	<i>N. kuelbsii</i> Lange-Bertalot
<i>G. parvulum</i> (Kützing) Kützing	<i>N. minima</i> Grunow
<i>Gyrosigma attenuatum</i> (Kützing)	<i>N. modica</i> Hustedt
<i>Gyrosigma nodiferum</i> (Grunow) Reimer	<i>N. mutica</i> Kützing
<i>Hantzschia amphioxys</i> (Ehrenberg) Grunow	<i>N. muticoides</i> Hustedt
<i>Mastogloia elliptica</i> var. <i>dansei</i> (Thwaites) Cleve	<i>N. nyassensis</i> O. Müller
<i>Melosira arentii</i> (Kolbe) Nagumo & Kobayasi	<i>N. peliculosa</i> (Brébisson) Hilse

Table 2. Continued...

Diatom Taxa & Authority	Diatom Taxa & Authority
<i>N. perlatoides</i> Hustedt	<i>N. gracilis</i> Hantzsch
<i>N. placentula</i> (Ehrenberg) Grunow	<i>N. inconspicua</i> Grunow
<i>N. platycephala</i> O. Müller	<i>N. lacuum</i> Lange-Bertalot
<i>N. pupula</i> Kützing	<i>N. lancettula</i> O Müller
<i>N. pupula</i> Kützing var. <i>pupula</i> Hustedt	<i>N. leibetruthii</i> Rabenhorst
<i>N. rhynchocephala</i> Kützing	<i>N. nyassensis</i> O. Müller
<i>N. rotunda</i> Hustedt	<i>N. palea</i> (Kützing) W. Smith
<i>N. schoenfeldii</i> Hustedt	<i>N. paleacea</i> Grunow
<i>N. scutelloides</i> W. Smith	<i>N. pura</i> Hustedt
<i>N. seminuloides</i> Hustedt	<i>N. recta</i> Hantzsch
<i>N. subatomoides</i> Hustedt	<i>N. reversa</i> W. Smith
<i>N. sublucidula</i> Hustedt	<i>N. sigma</i> (Kützing) W. Smith
<i>N. submiscula</i> Manguin	<i>N. sigmoides</i> (Nitzsch) W. Smith
<i>N. submuralis</i> Hustedt	<i>N. subacicularis</i> Hustedt
<i>N. subrotundata</i> Hustedt	<i>N. valdecostata</i> Lange-Bertalot & Simonsen
<i>N. trivialis</i> Lange-Bertalot	<i>N. vermicularis</i> (Kützing) Hantzsch
<i>N. utermoehlee</i> Hustedt	<i>Orthoseira roeseana</i> (Rabenhorst) O'Meara
<i>N. vitabunda</i> Hustedt	<i>Pinnularia mesolepta</i> (Ehrenberg) W. Smith
<i>N. zanonii</i> Hustedt	<i>Rhoicosphenia abbreviata</i> (C. Agardh) Lange-Bertalot
<i>Neidium ampliatum</i> (Ehrenberg) Krammer	<i>Rhopalodia gibba</i> (Ehrenberg) O. Müller var. <i>gibba</i> Hustedt
<i>Nitzschia acicularis</i> (Kützing) W. Smith	<i>R. gracilis</i> O. Müller
<i>N. adnata</i> Hustedt	<i>Stephanodiscus hantzschii</i> Grunow
<i>N. amphibia</i> Grunow	<i>S. medius</i> Håkansson
<i>N. bacillum</i> Hustedt	<i>S. minutulus</i> (Kützing) Round
<i>N. communis</i> Rabenhorst	<i>S. mülleri</i> Klee & Casper
<i>N. compressa</i> (Bailey) Boyer vexans (Grunow) Lange-Bertalot	<i>S. niagara</i> Ehrenberg
<i>N. dissipata</i> (Kützing) Grunow	<i>S. nyassae</i> Klee & Casper
<i>N. epiphytica</i> O Müller	<i>Surirella nyassae</i> O. Müller
<i>N. fonticola</i> Grunow	<i>Synedra ulna</i> (Nitzsch) Ehrenberg
<i>N. frustulum</i> (Kützing) Grunow	<i>Tabellaria fenestrata</i> (Lyngbye) Kützing

APPENDIX B.

PLATE 1. Figures 1-11 (X 1000)

Fig. 1-2: *Aulacoseira nyassensis* O. Müller

Fig. 3: *Aulacoseira nyassensis* O. Müller (girdle view)

Fig. 4-6: *Cyclostephanos malawiensis* Klee & Casper

Fig. 7-8: *Stephanodiscus minutulus* (Kützing) Round

Fig. 9-10: *Stephanodiscus nyassae* O. Müller

Fig. 11: *Stephanodiscus muelleri* Klee & Casper

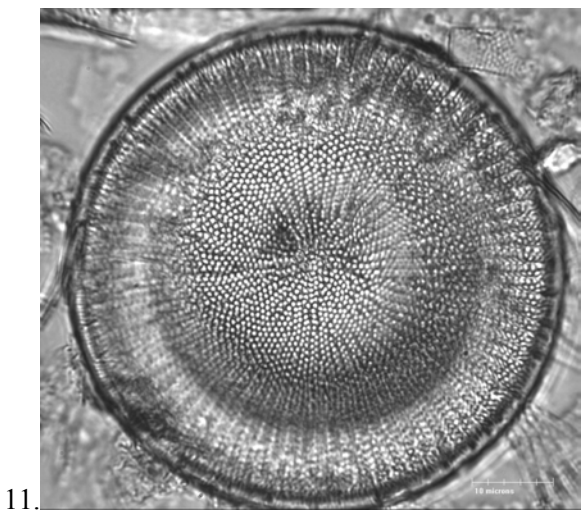
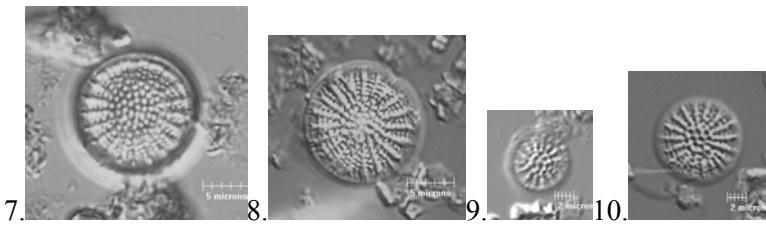
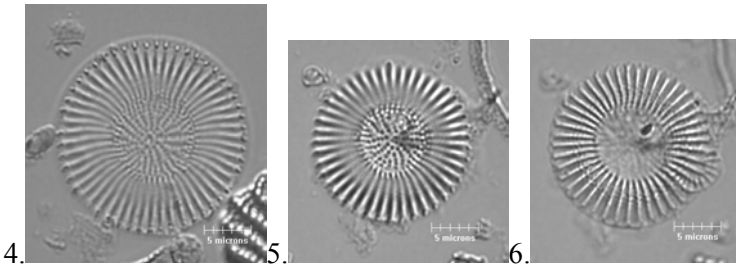
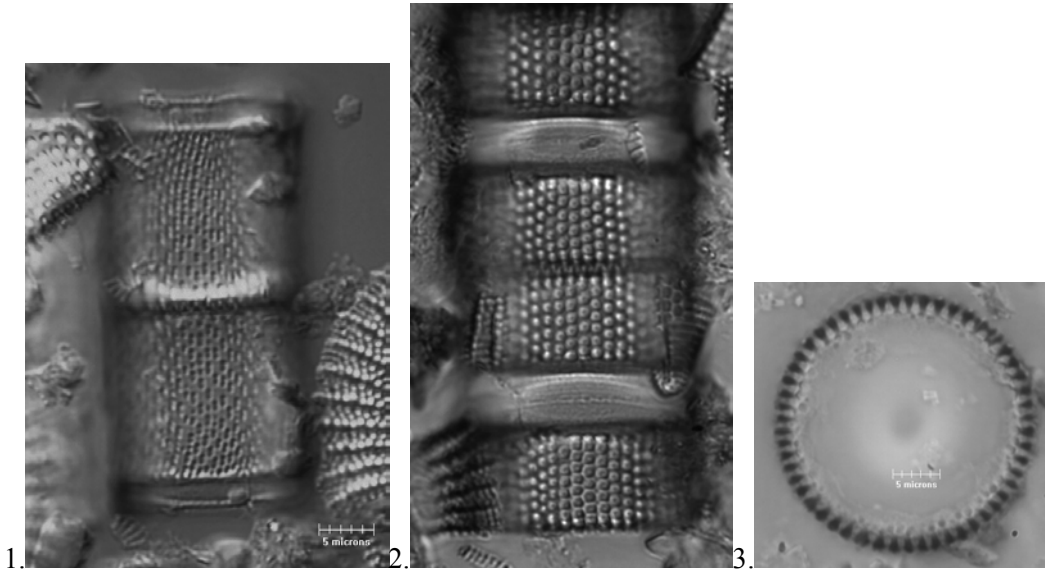


PLATE 2. Figures 1-24 (X 1000)

Fig. 1: *Amphora pediculus* (Kützing) Grunow

Fig. 2: *Cocconeis neothumensis* Krammer

Fig. 3: *Diploneis pseudovalis* Hustedt

Fig. 4: *Cymbellonitzschia minima* Hustedt

Fig. 5: *Cymbellonitzschia minima* Hustedt (girdle view)

Fig. 6: *Nitzschia amphibia* Grunow

Fig. 7: *Nitzschia leibetruthii* Rabenhorst

Fig. 8-9: *Nitzschia epiphytica* O Müller

Fig. 10: *Nitzschia fonticola* Grunow

Fig. 11-12: *Fragilaria africana* Hustedt

Fig. 13: *Fragilaria africana* Hustedt (girdle view)

Fig. 14: *Fragilaria brevistriata* Grunow

Fig. 15: *Fragilaria leptostauron* var. *dubia* (Grunow) Hustedt

Fig. 16: *Fragilaria leptostauron* var. *dubia* girdle view (Grunow) Hustedt

Fig. 17: *Fragilaria construens* f. *construens* (Ehrenberg) Grunow

Fig. 18: *Fragilaria construens* f. *venter* (Ehrenberg) Hustedt

Fig. 19: *Navicula seminuloides* Hustedt

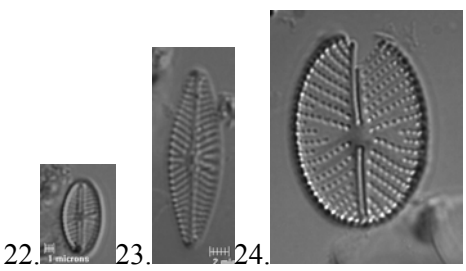
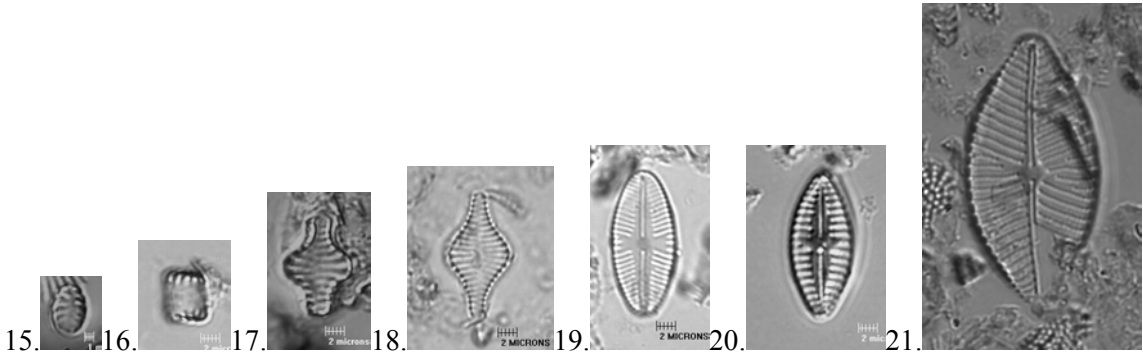
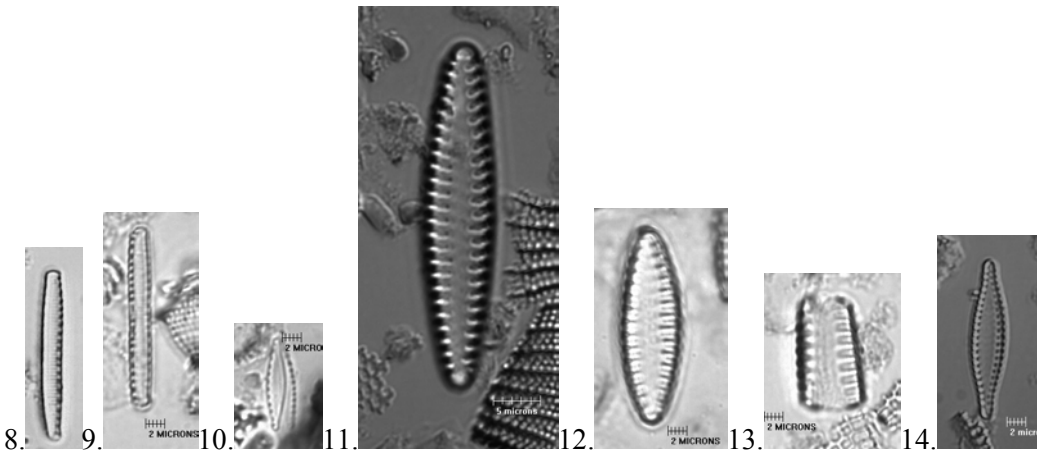
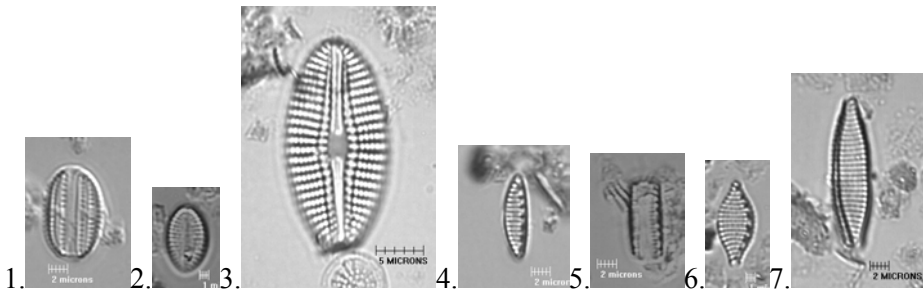
Fig. 20: *Navicula barbarica* Hustedt

Fig. 21: *Navicula gastrum* (Ehrenberg) Kützing

Fig. 22: *Navicula subrotunda* Hustedt

Fig. 23: *Navicula cryptotenella* Lange-Bertalot

Fig. 24: *Navicula scutelloides* W. Smith



APPENDIX C.

Table 2. Summary of parameters for northern core M98-11MC

Slice	Date	Sediment- ation Rate	Diatom Conc.	Diatom Influx	% BSi	BSI Influx	POC Influx	PN Influx	POC :PN
1	1997	248.73	1.06E+08	2.65E+10	17.95	44.65			9.09
2	1992	242.67	6.14E+07	1.49E+10	17.6	42.71			9.21
3	1987	225.74	9.67E+07	2.18E+10	15.17	34.25			9.33
4	1981	214.25	6.70E+07	1.43E+10	12.74	27.30			8.64
5	1975	175.31	7.61E+07	1.33E+10	10.73	18.81			8.66
6	1970	208.51	8.07E+07	1.68E+10	14.84	30.94			8.77
7	1965	178.93	5.41E+07	9.68E+09	14.83	26.54			8.27
8	1960	190.88	6.09E+07	1.16E+10	14.27	27.24			8.21
9	1954	214.59	3.86E+07	8.29E+09	12.73	27.32			9.84
10	1951	243.52	5.76E+07	1.40E+10	na	na			9.51
11	1939	216.89	7.69E+07	1.67E+10	12.5	23.78			9.49
12	1934	190.26	1.39E+08	2.65E+10	17.8	38.93			9.42
13	1927	204.48	7.69E+07	1.57E+10	19.44	55.60			9.60
14	1921	218.69	1.12E+08	2.44E+10	15.57	54.38			9.67
15	1912	252.36	7.84E+07	1.98E+10	12.7	41.74			9.06
16	1905	286.02	7.37E+07	2.11E+10	14.07	67.52			8.74
17	1899	317.64	4.45E+07	1.41E+10	16.66	70.04			9.16
18	1892	349.25	1.20E+08	4.18E+10	11.25	41.10			8.34
19	1886	338.94	1.36E+08	4.60E+10	14.38				8.31
20	1881	328.63	3.32E+08	1.09E+11	13.56				8.25
21	1875	404.25	1.87E+08	7.56E+10	9.55				8.91
22	1869	479.87	8.15E+07	3.91E+10	13.95				9.51
23	1866	450.13	4.55E+07	2.05E+10	20.25				8.65
24	1837	420.39	8.57E+07	3.60E+10	16.78				8.07
25	1831	392.87	1.60E+08	6.27E+10	15.23				8.17
26	1824	365.35	1.12E+08	4.10E+10	13.33				7.69
27	1817		6.97E+07		17.31				8.13
28	1811		1.18E+08		14.78				8.14
29	1806		1.37E+08		23.97				7.75
30	1802		1.51E+08		21.74				7.93
31	1797		7.53E+07		23.22				7.59
32	1789		1.40E+07		na				7.88
33	1782		1.15E+08		31.2				7.81
34	1776		1.13E+08		29.38				7.91
35	1767		1.21E+08		32.37				9.33
36	1759		1.56E+08		27.35				8.29
37	1759		1.17 ^E +08		20.17				9.06
38	1751		6.23E+07		28.73				9.27

Table 2 Continued. Summary of parameter for northern core M98-11MC.

Slice	Date	Sediment- ation Rates	Diatom Conc.	Diatom Influx	% BSi	BSi Influx	POC Influx	PN Influx	POC :PN
39	1743		3.93E+07		25.08				9.00
40	1736		2.52E+07		24.9				9.45
41	1722		6.72E+07		16.11				9.86
42	1713		5.84E+07		18.67				9.61
43	1704		9.47E+07		22.32				9.90
44	1696		1.05E+08		19.26				9.54
45	1688		2.55E+08		26.98				9.05
46	1681		1.81E+08		25.35				7.55
47	1676		1.95E+08		16.08				7.98
48	1674		8.70E+07		26.89				9.18
49	1667		6.73E+07		12.55				9.25
50	1659		6.95E+07		15.95				9.15
51	1655		1.57E+08		15.55				8.71
52			1.10E+08		18.51				8.51

Table 3. Summary of parameters for central core MAL 4

Slice	Date	Sediment- ation Rate	Diatom Conc.	Diatom Influx	% BSi	BSi Influx	POC Influx	PN Influx	POC :PN
1	1997	219.81	2.11E+07	4.51E+10	28.49	62.63	1079	117.8	9.16
3	1993	249.05	1.40E+07	3.29E+10	21.47	53.47	1029	108.4	9.50
5	1987	149.82	1.41E+07	2.05E+10	23.77	35.61	1128	121.8	9.26
7	1978	190.78	8.46E+06	1.55E+10	26.11	49.81	957	101.6	9.42
9	1970	139.15	1.77E+07	2.41E+10	24.59	34.21	1038	109.1	9.51
11	1959	140.06	1.45E+07	1.94E+10	17.88	25.05	909	91.8	9.90
13	1942	182.30	1.25E+07	2.22E+10	27.82	50.71	845	86.3	9.79
15	1931	251.17	8.67E+06	2.02E+10	21.64	54.36	870	89.7	9.70
17	1917	208.57	3.55E+06	7.18E+09	19.69	41.07	888	89.5	9.93
19	1905	207.40	2.23E+07	4.49E+10	23.48	48.69	849	84.7	10.02
21	1886	180.21	1.26E+07	2.24E+10	27.95	50.37	734	72.4	10.14
23	1850	154.69	9.85E+06	1.41E+10	28.57	44.20	617	60.8	10.14
25	1818		3.80E+07		32.77				9.95
27	1789		1.71E+07		28.73				9.74
29	1762		2.75E+07		30.75				9.52
31	1734		6.72E+06		20.39				9.85
33	1704		5.25E+06		15.02				10.04

Table 4. Summary of parameters for southern core MAL 10

Slice	Date	Sediment- ation Rate	Diatom Conc.	Diatom Influx	% BSi	BSi Influx	POC Influx	PN Influx	POC :PN
1	1997	556.28	1.50E+08	8.33E+10	20.45	113.76	2415	282.3	8.55
2	1997	538.37	7.59E+07	4.09E+10	na	na	2473	271.1	9.12
3	1996	521.79	8.22E+07	4.29E+10	19.27	100.55	2339	267.3	8.75
4	1995	495.29	7.88E+07	3.90E+10	16.51	81.77	2284	259.4	8.80
5	1994	492.48	7.98E+07	3.93E+10	18.27	89.98	2282	251.4	9.08
6	1992	459.52	5.85E+07	2.69E+10	17.38	79.86	2153	245.4	8.77
7	1990	447.14	7.29E+07	3.26E+10	18.98	84.87	2137	242.1	8.83
8	1989	430.36	8.94E+07	3.85E+10	16.79	72.26	2092	237.5	8.81
9	1987	417.82	6.93E+07	2.90E+10	17.25	72.07	2025	232.0	8.73
10	1985	399.38	4.66E+07	1.86E+10	na	na	2037	224.9	9.06
11	1983	370.29	4.76E+07	1.76E+10	14.67	54.32	1954	215.9	9.05
12	1979	347.61	6.96E+07	2.42E+10	16.51	57.39	1881	206.4	9.11
13	1975	322.57	6.40E+07	2.07E+10	16.76	54.06	1819	199.8	9.10
14	1970	289.37	3.66E+07	1.06E+10	14.95	43.26	1780	195.9	9.09
15	1965	277.36	6.15E+07	1.71E+10	11.26	31.23	1730	185.3	9.33
16	1960	290.16	5.03E+07	1.46E+10	11.58	33.60	1724	183.1	9.42
17	1955	310.20	3.27E+07	1.01E+10	9.38	29.10	1685	176.7	9.53
18	1949	309.96	2.29E+07	7.11E+09	7.78	24.12	1681	172.2	9.76
19	1943	306.59	2.55E+07	7.81E+09	8.07	24.74	1634	167.6	9.75
20	1937	290.39	2.42E+07	7.02E+09	7.1	20.62	1563	160.3	9.75
21	1926	238.97	2.34E+07	5.60E+09	6.4	15.29	1485	149.2	9.96
22	1908	239.14	2.07E+07	4.95E+09	5.79	13.85	1346	134.5	10.01
23	1890	220.53	1.50E+08	3.32E+10	6.05	13.34	1254	124.1	10.11
24	1871	223.91	1.66E+07	3.71E+09	5.96	13.35	1177	117.3	10.04
25	1856	354.96	3.02E+07	1.07E+10	6.81	24.17	1120	111.2	10.07
26	1849	931.30	3.45E+07	3.21E+10	6.47	60.26	1089	109.4	9.95
27	1844	882.38	4.13E+07	3.64E+10	7.79	68.74	2415	282.3	9.99
28	1832		5.53E+07		8.26				10.06
29	1820		2.91E+07		8.72				10.03
30	1808		1.89E+07		6.58				10.09
31	1794		2.94E+07		5.36				10.14

Table 5. Summary of parameters for southern core MAL 14

Slice	Date	Sediment- ation Rate	Diatom Conc.	Diatom Influx	% BSi	BMAR	POC Influx	PN Influx	POC :PN
1	1997	799.32	4.13E+07	3.30E+10	9.45	75.52	2759	315.9	8.73
3	1995	798.61	2.98E+07	2.38E+10	11.25	89.86	2691	310.4	8.67
5	1993	716.75	2.62E+07	1.88E+10	10.66	76.40	2571	286.3	8.98
7	1991	666.22	3.06E+07	2.04E+10	9.10	60.62	2641	289.3	9.13
9	1988	614.50	3.99E+07	2.45E+10	10.45	64.21	2432	272.2	8.94
11	1984	925.01	2.35E+07	2.17E+10	11.07	102.35	2596	285.7	9.09
13	1979	559.15	1.61E+07	9.00E+09	8.38	46.86	2519	271.5	9.28
15	1971	465.10	8.90E+06	4.14E+09	9.85	45.82	2320	248.3	9.34
17	1961	463.03	1.11E+07	5.13E+09	7.51	34.77	2110	222.0	9.50
19	1952	430.39	na	na	6.39	27.48	2001	207.5	9.64
21	1939	458.12	8.55E+06	3.92E+09	4.31	19.75	1950	198.8	9.81
23	1915	339.26	7.07E+06	2.40E+09	3.34	11.33	1722	172.8	9.97
25	1887	345.17	8.57E+06	2.96E+09	4.79	16.52	1618	159.2	10.17
27	1860	429.58	na	na	3.95	16.96	1487	142.0	10.47
29	1839	766.86	1.01E+07	7.73E+09	3.29	25.25	2759	315.9	10.27
31	1816		4.56E+06						10.26

Appendix D.

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14
Sediment Midpoint	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5
Diatom Taxa														
<i>Achnanthes buccula</i>	3.3	1.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>A. delicatula</i> spp. <i>englebrechtii</i>	0.6	1.0	0.0	0.0	0.2	0.9	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.2
<i>A. holsatica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.0	0.4	0.2	0.4	0.0	0.4	0.6	0.0	0.4	0.0	0.4	0.5	0.0	0.2
<i>A. minutissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. suchlandii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. subhudsonis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. sp</i>	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Amphora copulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.0
<i>A. pediculus</i>	0.6	0.4	0.7	0.2	0.2	0.7	0.4	1.3	0.4	1.2	0.0	1.2	0.7	0.2
<i>Aulacoseira ambigua</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>A. crassipunctata</i>	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. crenulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i> var. <i>angustissima</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. muzzanensis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0.2	0.2	0.0	0.0
<i>A. nyassensis</i>	11.2	18.0	14.3	5.2	12.3	7.5	2.7	15.5	14.3	11.4	5.1	5.5	6.9	2.1
<i>A. subarctica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Caloneis bacillum</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Capartogramma karstenii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cocconeis neodiminuta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.4	0.0
<i>C. neothumensis</i>	0.2	2.0	0.9	1.2	1.2	1.6	2.1	1.1	2.4	0.4	0.7	0.0	0.4	0.2
<i>C. placentula</i> var. <i>lineata</i>	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. placentula</i> var. <i>eglypta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cyclostephanos malawiensis</i>	10.3	8.1	9.4	13.8	11.9	7.5	18.9	12.6	11.3	8.2	17.6	23.1	8.2	24.0
<i>C. novaezeelandiae</i>	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	1.6	0.0	0.4	0.0
<i>Cyclotella bodanica</i> var. <i>lemanica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. stelligera</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
<i>C. ocellata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. tripartate</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cymatopleura solea</i>	0.2	0.0	0.0	0.8	0.5	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.2	0.4
<i>Cymbella caespitosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. minuta</i>	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
<i>C. muelleri</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14
Sediment Midpoint	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5
Diatom Taxa														
<i>Cymbellonitzschia minima</i>	2.4	0.2	1.1	0.4	0.0	1.1	1.9	1.5	1.1	1.4	0.9	0.7	0.4	0.0
<i>Diploneis pseudovalis</i>	0.0	0.2	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0
<i>Epithemia adnata</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Eunotia incisa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. intermedia</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. subarcuatooides</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Fragilaria africana</i>	0.0	0.6	0.4	0.0	0.0	0.0	0.0	1.5	0.0	0.4	0.0	0.2	0.7	0.0
<i>F. brevistriata</i>	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
<i>F. construens f. venter</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. heidenii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. leptostauron var. dubia</i>	0.7	0.0	1.5	0.4	0.0	0.9	0.0	0.8	1.9	0.0	0.0	0.0	0.0	0.0
<i>F. pinnata</i>	0.7	2.4	2.2	0.6	1.2	0.9	0.4	1.5	0.4	1.2	0.4	0.0	2.0	0.8
<i>F. PIRLA sp. 2</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gomphonema affine</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. clevei</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. gracile</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
<i>G. parvulum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gyrosigma nodiferum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Melosira arentii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>M. undulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Navicula aff. minima</i>	0.0	1.0	0.0	0.0	0.0	0.0	0.4	0.2	0.4	0.0	0.0	0.0	0.0	0.0
<i>N. bacilloides</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.8	0.0	0.0	0.2	0.2	0.0	0.0	0.0
<i>N. bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. barbarica</i>	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0
<i>N. capitata var. hungarica</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cincta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>N. contenta</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. costulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cryptotenella</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. decussis</i>	0.0	0.4	0.0	0.0	0.4	0.4	0.8	0.2	0.9	0.4	0.9	0.9	0.0	0.4
<i>N. gastrum</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0
<i>N. insociabilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. minima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. miniscaloides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14
Sediment Midpoint	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5
Diatom Taxa														
<i>N. mutica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. nyassensis</i>	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>N. perlatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pupula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. rotunda</i>	0.0	0.2	0.9	0.0	0.4	1.1	1.2	0.0	0.4	0.2	0.7	0.9	0.0	0.0
<i>N. scutelloides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. seminulooides</i>	0.2	0.4	0.7	0.4	0.9	1.1	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.2
<i>N. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
<i>N. submuralis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. subrotundata</i>	0.0	0.2	0.0	0.2	0.7	0.0	0.0	1.5	0.0	0.0	0.2	0.0	0.2	0.6
<i>N. vitabunda</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Neidium ampliutum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Nitzschia acicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. adnata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1
<i>N. amphibia</i>	0.0	1.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. communis</i>	0.7	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	2.2	0.0	0.0	0.4
<i>N. compressa v. vexans</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>N. dissipata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. epiphytica</i>	4.4	4.8	2.0	6.2	8.7	2.7	7.1	1.1	3.6	12.2	1.3	0.2	6.0	5.6
<i>N. epiphyticoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. fonticola</i>	9.4	1.6	1.8	0.6	1.1	0.4	0.0	0.4	1.5	0.8	0.0	0.0	1.3	3.3
<i>N. frustulum</i>	1.7	1.4	0.0	0.4	2.1	2.7	1.2	0.0	0.2	0.0	0.7	0.0	0.0	2.5
<i>N. gracilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>N. inconspicua</i>	1.3	1.8	0.2	1.0	1.6	0.2	2.7	2.1	1.3	0.8	1.1	1.8	2.2	0.6
<i>N. lacuum</i>	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. lancettula</i>	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.4	0.2	2.0	0.0	0.2	0.2	0.2
<i>N. leibetruthii</i>	0.4	0.6	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
<i>N. nyassensis</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.0	0.0	0.4
<i>N. palaea</i>	0.7	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.8
<i>N. paleacea</i>	1.1	0.2	0.0	1.0	2.1	0.9	0.6	0.0	0.0	1.2	0.4	0.5	0.0	0.4
<i>N. recta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigma</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4
<i>N. sigmoides</i>	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14
Sediment Midpoint	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5
Diatom Taxa														
<i>N. sp</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.2	0.0	0.0	0.2	0.2	2.9
<i>N. subacicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. roeseana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. mesolepta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhoicosphenia abbreviata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhopalodia gibba</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>R. gracilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Stephanodiscus minutulus</i>	4.4	5.3	14.3	8.7	17.2	20.4	21.8	20.6	8.4	21.2	25.4	35.6	21.1	23.4
<i>S. mulleri</i>	9.7	12.7	19.7	28.2	12.4	12.4	15.6	11.8	12.4	12.4	37.3	8.1	8.2	6.4
<i>S. niagara</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>S. nyassae</i>	33.9	30.9	26.8	27.6	23.3	32.6	18.5	22.3	36.4	22.6	0.0	18.5	36.4	19.9
<i>Surirella nyassae</i>	0.2	0.4	1.3	0.6	0.4	0.2	0.2	0.2	0.2	0.2	0.0	0.5	0.0	0.0
<i>Synedra ulna</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Tabellaria fenestra</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28
Sediment Midpoint	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5
Diatom Taxa														
<i>Achnanthes buccula</i>	0.0	0.0	0.4	0.0	0.0	0.2	0.4	0.0	0.0	0.2	0.0	0.2	0.0	0.0
<i>A. delicatula</i> spp. <i>englebrechtii</i>	0.4	0.2	0.0	0.2	0.0	0.0	0.2	0.0	0.2	0.2	0.0	0.0	0.0	0.2
<i>A. holsatica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.9	0.0	0.0	0.0	0.2	0.0	0.0
<i>A. minutissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. suchlandii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. subhudsonis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. sp</i>	0.2	0.0	0.0	0.0	0.0	0.0	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Amphora copulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4	0.0
<i>A. pediculus</i>	0.0	0.4	0.4	0.0	0.4	0.6	0.4	0.7	0.8	0.0	0.4	0.0	0.4	0.0
<i>Aulacoseira ambigua</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. crassipunctata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. crenulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i> var. <i>angustissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. muzzanensis</i>	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>A. nyassensis</i>	20.9	22.9	11.8	6.7	8.5	4.5	7.3	6.4	12.8	12.5	7.2	14.4	11.0	16.5
<i>A. subarctica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Caloneis bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Capartogramma karstenii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cocconeis neodiminuta</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>C. neothumensis</i>	0.8	0.4	2.2	1.4	0.4	0.8	0.2	1.3	1.0	1.1	0.2	0.8	0.5	0.2
<i>C. placentula</i> var. <i>lineata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. placentula</i> var. <i>eglypta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.2
<i>Cyclostephanos malawiensis</i>	3.8	3.5	12.5	9.3	10.5	19.1	18.3	19.5	18.0	11.3	13.8	10.5	15.3	13.7
<i>C. novaezeelandiae</i>	0.4	0.0	0.4	0.4	0.4	0.0	0.0	0.0	1.5	0.4	0.2	0.0	0.2	0.0
<i>Cyclotella bodanica</i> var. <i>lemanica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. stelligera</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. ocellata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. tripartate</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cymatopleura solea</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0
<i>Cymbella caespitosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. minuta</i>	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. muelleri</i>	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28
Sediment Midpoint	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5
Diatom Taxa														
<i>Cymbellonitzschia minima</i>	2.9	0.4	0.9	0.8	0.4	1.0	0.0	0.9	0.0	0.8	0.8	0.4	2.3	0.0
<i>Diploneis pseudovalis</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>Epithemia adnata</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
<i>Eunotia incisa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. intermedia</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. subarcuatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Fragilaria africana</i>	0.0	0.4	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.4	0.0	0.0	0.0	0.7
<i>F. brevistriata</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. construens f. venter</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. heidenii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. leptostauron var. dubia</i>	1.9	1.3	1.3	0.0	0.4	0.0	0.9	0.4	1.7	0.0	0.0	1.0	0.0	0.0
<i>F. pinnata</i>	1.2	0.2	0.4	0.2	0.4	0.4	0.0	0.0	1.5	0.8	0.0	1.6	0.5	0.9
<i>F. PIRLA sp. 2</i>	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gomphonema affine</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. clevei</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. gracile</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>G. parvulum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gyrosigma nodiferum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Melosira arentii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>M. undulata</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
<i>Navicula aff. minima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.2	0.0
<i>N. bacilloides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>N. bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. barbarica</i>	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>N. capitata var. hungarica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. cincta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
<i>N. contenta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. costulata</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cryptotenella</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. decussis</i>	0.0	0.4	0.9	0.2	0.0	0.0	0.0	0.2	0.2	0.0	0.8	0.4	0.0	0.0
<i>N. gastrum</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0
<i>N. insociabilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. minima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. minisculoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28
Sediment Midpoint	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5
Diatom Taxa														
<i>N. mutica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. nyassensis</i>	0.2	0.7	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>N. perlatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pupula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. rotunda</i>	0.2	0.7	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.4
<i>N. scutellooides</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.4	0.0	0.0
<i>N. seminulooides</i>	0.0	0.4	0.4	0.0	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>N. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. submuralis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. subrotundata</i>	0.4	0.0	0.0	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. vitabunda</i>	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Neidium ampliatum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Nitzschia acicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. adnata</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.2	0.4	0.0	0.0	0.0	1.2	0.0	0.2
<i>N. amphibia</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>N. bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. communis</i>	0.0	0.0	0.0	0.0	0.8	0.0	0.2	0.0	0.2	0.4	0.4	0.0	0.4	0.0
<i>N. compressa v. vexans</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. dissipata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. epiphytica</i>	4.8	15.2	11.2	10.3	4.9	4.3	4.5	3.3	5.0	5.7	10.8	6.9	7.4	4.2
<i>N. epiphyticoides</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. fonticola</i>	0.8	1.8	0.0	2.6	5.5	6.7	2.4	1.1	0.6	3.4	3.6	4.0	2.5	6.2
<i>N. frustulum</i>	1.3	4.0	0.6	1.4	2.4	3.0	3.2	0.4	0.4	2.3	0.6	2.4	1.8	2.2
<i>N. gracilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
<i>N. inconspicua</i>	0.8	0.9	1.7	1.6	1.0	0.0	0.9	0.2	0.8	0.4	0.8	1.2	0.0	0.0
<i>N. lacuum</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. lancettula</i>	0.4	0.0	0.4	0.0	0.0	0.8	0.0	0.2	0.2	0.2	0.0	0.0	0.2	0.0
<i>N. leibetruthii</i>	0.6	0.0	0.6	0.2	0.0	0.0	0.0	0.7	0.6	0.2	0.2	0.2	0.4	0.0
<i>N. nyassensis</i>	0.2	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.2	0.2	0.6	0.0	0.0	0.0
<i>N. palaea</i>	0.0	2.2	0.0	0.8	0.0	0.4	0.4	0.0	0.0	0.6	0.0	0.0	0.0	0.0
<i>N. paleacea</i>	0.8	0.0	0.0	0.0	0.0	3.1	3.2	0.9	0.4	0.4	5.2	0.8	0.7	1.3
<i>N. recta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigma</i>	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigmoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28
Sediment Midpoint	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5
Diatom Taxa														
<i>N. sp</i>	0.4	0.0	0.0	0.0	0.2	1.2	0.4	0.0	0.4	0.0	0.8	0.0	0.0	0.0
<i>N. subacicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. roeseana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. mesolepta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhoicosphenia abbreviata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhopalodia gibba</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>R. gracilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Stephanodiscus minutulus</i>	15.9	16.0	17.6	19.2	9.3	15.6	0.0	20.1	14.4	30.6	16.2	21.9	10.5	15.6
<i>S. mulleri</i>	6.9	7.0	7.5	3.0	5.3	4.5	18.3	12.6	9.2	6.4	2.0	7.1	5.4	5.5
<i>S. niagara</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>S. nyassae</i>	31.5	19.8	26.5	41.5	46.4	28.0	6.5	27.0	27.2	20.2	34.9	22.7	37.9	31.3
<i>Surirella nyassae</i>	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
<i>Synedra ulna</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Tabellaria fenestra</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	28-29	29-30	30-31	31-32	32-33	33-34	34-35	35-36	36-37	37-38	38-39	39-40	40-41	41-42
Sediment Midpoint	28.5	29.5	30.5	31.5	32.5	33.5	34.5	35.5	36.5	37.5	38.5	39.5	40.5	41.5
Diatom Taxa														
<i>Achnanthes buccula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. delicatula</i> spp. <i>englebrechtii</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. holsatica</i>	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.0	0.0	0.6	0.2	0.0	0.2	0.0	0.0	0.5	0.7	0.4	0.2	0.4	0.5
<i>A. minutissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. suchlandii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. subhudsonis</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>A. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Amphora copulata</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.2	0.0	0.2
<i>A. pediculus</i>	0.0	0.0	0.6	0.0	0.7	0.0	0.4	0.0	0.5	0.0	0.4	0.5	0.9	0.0
<i>Aulacoseira ambigua</i>	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>A. crassipunctata</i>	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. crenulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i> var. <i>angustissima</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. muzzanensis</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.6	0.5
<i>A. nyassensis</i>	20.8	10.0	22.6	14.1	17.1	12.8	12.6	18.3	8.7	4.6	16.7	28.8	13.9	27.5
<i>A. subarctica</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.7	0.0	0.2	0.4	0.0	0.0	0.0
<i>Caloneis bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Capartogramma karstenii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
<i>Cocconeis neodiminuta</i>	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
<i>C. neothumensis</i>	1.0	0.2	0.2	0.9	1.5	0.4	0.0	0.0	0.7	0.0	0.2	1.4	2.7	1.2
<i>C. placentula</i> var. <i>lineata</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. placentula</i> var. <i>eglypta</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.9	0.0	1.1	0.0
<i>Cyclostephanos malawiensis</i>	25.7	17.5	6.3	9.9	8.2	22.8	21.4	22.0	48.1	28.1	27.9	7.6	8.2	6.9
<i>C. novaezeelandiae</i>	1.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cyclotella bodanica</i> var. <i>lemanica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>C. stelligera</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. ocellata</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. tripartate</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cymatopleura solea</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
<i>Cymbella caespitosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>C. minuta</i>	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0
<i>C. muelleri</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	28-29	29-30	30-31	31-32	32-33	33-34	34-35	35-36	36-37	37-38	38-39	39-40	40-41	41-42
Sediment Midpoint	28.5	29.5	30.5	31.5	32.5	33.5	34.5	35.5	36.5	37.5	38.5	39.5	40.5	41.5
Diatom Taxa														
<i>Cymbellonitzschia minima</i>	0.8	0.0	1.3	2.1	0.7	0.4	0.0	0.0	0.9	0.7	0.0	0.5	2.1	0.0
<i>Diploneis pseudovalis</i>	0.0	0.2	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>Epithemia adnata</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Eunotia incisa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. intermedia</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. subarcuatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Fragilaria africana</i>	0.0	0.4	0.2	3.9	0.0	0.0	0.0	0.7	0.2	1.1	0.0	1.1	0.0	1.0
<i>F. brevistriata</i>	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. construens f. venter</i>	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. heidenii</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. leptostauron var. dubia</i>	0.0	0.0	0.4	8.1	0.7	0.0	0.0	0.0	0.0	0.7	0.9	0.9	1.3	0.5
<i>F. pinnata</i>	1.2	0.7	0.4	3.2	0.4	0.0	0.9	0.0	0.0	0.0	1.3	1.1	2.1	1.0
<i>F. PIRLA sp. 2</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gomphonema affine</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>G. clevei</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. gracile</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. parvulum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gyrosigma nodiferum</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Melosira arentii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>M. undulata</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Navicula aff. minima</i>	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacilloides</i>	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. barbarica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
<i>N. capitata var. hungarica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cincta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. contenta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. costulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cryptotenella</i>	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. decussis</i>	0.8	0.2	0.4	0.0	0.4	0.2	0.0	0.0	0.2	0.7	0.0	1.6	1.1	0.7
<i>N. gastrum</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.0
<i>N. insociabilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.7	0.0	0.0	0.0	0.5
<i>N. minima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. miniscaloides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval Sediment Midpoint Diatom Taxa	28-29	29-30	30-31	31-32	32-33	33-34	34-35	35-36	36-37	37-38	38-39	39-40	40-41	41-42
	28.5	29.5	30.5	31.5	32.5	33.5	34.5	35.5	36.5	37.5	38.5	39.5	40.5	41.5
<i>N. mutica</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. nyassensis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
<i>N. perlatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pupula</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>N. rotunda</i>	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.7	0.0	0.0	0.0	0.0	1.0
<i>N. scutelloides</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0
<i>N. seminulooides</i>	0.0	0.0	0.0	0.4	0.4	0.0	1.7	0.0	0.2	0.5	0.0	1.8	1.5	1.7
<i>N. sp</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. submuralis</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. subrotundata</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.4	1.1	0.0	0.0	0.4	0.5	2.3	0.0
<i>N. vitabunda</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Neidium ampliatum</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>Nitzschia acicularis</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.0	0.2	0.7	0.0	0.0	0.0
<i>N. adnata</i>	0.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. amphibia</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacillum</i>	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. communis</i>	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. compressa v. vexans</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. dissipata</i>	0.0	0.0	0.0	0.0	0.4	0.9	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. epiphytica</i>	9.6	6.7	13.8	2.6	10.3	9.3	10.5	5.1	0.5	0.5	4.2	5.9	7.4	6.5
<i>N. epiphyticoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. fonticola</i>	0.0	2.7	2.7	1.9	6.9	4.3	7.2	1.3	0.5	0.5	0.9	0.0	0.8	1.0
<i>N. frustulum</i>	0.0	1.1	0.0	0.4	0.7	0.4	0.7	0.4	0.0	0.0	0.7	0.5	0.0	0.0
<i>N. gracilis</i>	0.0	0.0	0.0	0.9	0.4	0.0	0.0	0.4	0.0	0.2	0.2	0.2	0.6	0.7
<i>N. inconspicua</i>	0.0	0.7	1.9	0.4	0.4	0.9	1.3	1.3	1.1	1.1	0.7	1.4	1.7	1.0
<i>N. lacuum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. lancettula</i>	0.0	0.4	0.4	0.0	0.0	0.0	0.2	0.9	0.0	0.9	0.7	0.0	0.2	0.0
<i>N. leibetruthii</i>	0.0	0.2	0.0	0.0	1.1	0.9	0.2	0.0	0.0	0.2	0.7	1.4	2.1	0.0
<i>N. nyassensis</i>	0.0	1.3	0.4	1.7	0.0	0.2	0.0	0.2	0.0	0.2	0.7	0.5	0.0	0.0
<i>N. palaea</i>	0.0	0.7	0.4	0.6	0.0	3.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0
<i>N. paleacea</i>	0.0	4.7	3.6	1.7	1.1	0.0	0.9	2.2	0.2	0.5	0.0	0.9	0.4	0.0
<i>N. recta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigma</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigmoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	28-29	29-30	30-31	31-32	32-33	33-34	34-35	35-36	36-37	37-38	38-39	39-40	40-41	41-42
Sediment Midpoint	28.5	29.5	30.5	31.5	32.5	33.5	34.5	35.5	36.5	37.5	38.5	39.5	40.5	41.5
Diatom Taxa														
<i>N. sp</i>	0.4	0.4	0.2	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>N. subacicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>N. roeseana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. mesolepta</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>Rhoicosphenia abbreviata</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhopalodia gibba</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.2	0.0	0.2	0.0
<i>R. gracilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>Stephanodiscus minutulus</i>	8.0	16.4	13.0	13.3	20.0	20.8	12.9	23.2	13.7	23.5	13.0	20.1	21.4	19.4
<i>S. mulleri</i>	3.4	4.7	4.6	8.4	11.1	7.8	9.2	9.6	10.1	11.6	8.6	8.9	16.5	10.0
<i>S. niagara</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>S. nyassae</i>	26.3	28.8	22.9	15.4	14.5	14.1	16.6	9.4	11.7	21.9	16.5	11.4	9.9	16.0
<i>Surirella nyassae</i>	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Synedra ulna</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>Tabellaria fenestra</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	42-43	43-44	44-45	45-46	46-47	47-48	48-49	49-50	50-51
Sediment Midpoint	42.5	43.5	44.5	45.5	46.5	47.5	48.5	49.5	50.5
Diatom Taxa									
<i>Achnanthes buccula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. delicatula</i> spp. <i>englebrechtii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. holsatica</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.8	0.2	0.4	0.0	0.0	0.4	0.0	0.0	0.0
<i>A. minutissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. suchlandii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. subhudsonis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Amphora copulata</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>A. pediculus</i>	0.4	0.0	0.4	0.4	0.0	0.0	0.5	0.9	0.0
<i>Aulacoseira ambigua</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0
<i>A. crassipunctata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>A. crenulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>A. granulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i> var. <i>angustissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. muzzanensis</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.1	0.4
<i>A. nyassensis</i>	22.0	11.3	10.8	5.8	16.6	13.2	16.0	37.9	26.8
<i>A. subarctica</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
<i>Caloneis bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Capartogramma karstenii</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>Cocconeis neodiminuta</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
<i>C. neothumensis</i>	0.2	1.4	0.0	0.2	0.0	0.6	0.5	2.1	0.2
<i>C. placentula</i> var. <i>lineata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. placentula</i> var. <i>eglypta</i>	0.0	0.0	0.4	0.0	0.0	0.4	0.9	0.0	0.9
<i>Cyclostephanos malawiensis</i>	8.1	12.6	8.1	9.4	7.0	7.8	14.9	12.6	11.3
<i>C. novaezeelandiae</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cyclotella bodanica</i> var. <i>lemanica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. stelligera</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. ocellata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. tripartate</i>	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cymatopleura solea</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.2
<i>Cymbella caespitosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. minuta</i>	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4
<i>C. muelleri</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	42-43	43-44	44-45	45-46	46-47	47-48	48-49	49-50	50-51
Sediment Midpoint	42.5	43.5	44.5	45.5	46.5	47.5	48.5	49.5	50.5
Diatom Taxa									
<i>Cymbellonitzschia minima</i>	2.3	0.8	0.4	1.9	1.2	1.9	1.1	0.0	1.1
<i>Diploneis pseudovalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Epithemia adnata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Eunotia incisa</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>E. intermedia</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. subarcuatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Fragilaria africana</i>	0.4	0.0	0.0	5.8	0.0	0.6	0.2	0.0	0.0
<i>F. brevistriata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. construens f. venter</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. heidenii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. leptostauron var. dubia</i>	0.4	0.0	0.8	0.8	0.0	0.9	0.2	0.5	0.4
<i>F. pinnata</i>	0.6	0.6	0.0	0.0	0.4	1.3	0.9	0.5	0.4
<i>F. PIRLA sp. 2</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gomphonema affine</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. clevei</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
<i>G. gracile</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. parvulum</i>	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gyrosigma nodiferum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Melosira arentii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>M. undulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Navicula aff. minima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacilloides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>N. barbarica</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.5	0.0	0.0
<i>N. capitata var. hungarica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cincta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. contenta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>N. costulata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cryptotenella</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. decussis</i>	0.6	0.0	0.4	0.0	0.2	0.4	2.3	0.0	0.9
<i>N. gastrum</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. insociabilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>N. minima</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. minisculoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	42-43	43-44	44-45	45-46	46-47	47-48	48-49	49-50	50-51
Sediment Midpoint	42.5	43.5	44.5	45.5	46.5	47.5	48.5	49.5	50.5
Diatom Taxa									
<i>N. mutica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. nyassensis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
<i>N. perlatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pupula</i>	0.0	0.0	0.2	0.0	0.0	0.2	0.5	0.0	0.0
<i>N. rotunda</i>	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0
<i>N. scutellooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. seminulooides</i>	0.6	0.2	0.0	0.4	0.0	0.4	0.9	0.2	0.0
<i>N. sp</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>N. submuralis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. subrotundata</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. vitabunda</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Neidium ampliatum</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Nitzschia acicularis</i>	0.0	0.0	0.2	0.0	0.2	0.0	0.7	0.0	0.0
<i>N. adnata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. amphibia</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacillum</i>	0.6	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
<i>N. communis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. compressa v. vexans</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. dissipata</i>	0.0	0.2	0.4	0.0	0.5	0.0	0.0	0.0	0.9
<i>N. epiphytica</i>	9.8	6.0	9.1	11.3	14.7	10.6	3.4	8.3	10.6
<i>N. epiphyticoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. fonticola</i>	1.1	3.9	11.2	7.0	10.2	7.8	1.1	2.8	4.7
<i>N. frustulum</i>	2.6	0.0	0.4	0.4	0.5	0.0	0.0	0.5	0.9
<i>N. gracilis</i>	0.0	0.8	0.4	0.4	0.9	0.6	0.0	0.0	0.0
<i>N. inconspicua</i>	0.9	0.4	0.4	1.9	1.2	0.6	0.9	0.5	1.3
<i>N. lacuum</i>	0.0	0.8	0.0	0.4	0.0	0.0	0.0	0.0	0.0
<i>N. lancettula</i>	0.0	0.0	0.4	0.0	0.2	0.0	0.7	0.7	0.0
<i>N. leibetruthii</i>	1.9	0.2	1.4	0.0	2.5	0.2	0.5	0.0	1.1
<i>N. nyassensis</i>	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.2
<i>N. palaea</i>	1.5	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4
<i>N. paleacea</i>	0.4	2.5	4.5	4.3	2.6	0.4	0.9	0.5	1.3
<i>N. recta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigma</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigmoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percent abundances of diatom taxa from core M98-11MC northern Lake Malawi

Sediment Interval	42-43	43-44	44-45	45-46	46-47	47-48	48-49	49-50	50-51
Sediment Midpoint	42.5	43.5	44.5	45.5	46.5	47.5	48.5	49.5	50.5
Diatom Taxa									
<i>N. sp</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
<i>N. subacicularis</i>	0.0	0.0	0.0	1.1	1.9	0.4	0.2	0.0	0.0
<i>N. roeseana</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. mesolepta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhoicosphenia abbreviata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhopalodia gibba</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>R. gracilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Stephanodiscus minutulus</i>	12.4	17.1	20.5	20.2	18.2	20.3	23.9	8.3	10.4
<i>S. mulleri</i>	8.3	6.8	5.9	3.8	3.3	10.0	10.6	10.3	6.8
<i>S. niagara</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>S. nyassae</i>	22.8	33.4	20.7	23.0	16.5	18.6	16.9	11.5	17.0
<i>Surirella nyassae</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Synedra ulna</i>	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
<i>Tabellaria fenestra</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0

Table 7. Percent abundance of diatom taxa from core MAL 4 mid Lake Malawi

Sediment Interval	0-1	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-22	24-26	28-30	32-34	36-38	40-42	44-46
Sediment Midpoint	0.5	2.5	4.5	6.5	8.5	10.5	12.5	14.5	16.5	18.5	21.0	25.0	29.0	33.0	37.0	41.0	45.0
Diatom Taxa																	
<i>Achnanthes buccula</i>	0.0	0.7	0.0	0.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.7	0.0
<i>A. clevei</i> var. <i>bottanica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. delicatula</i> spp. <i>englebrechtii</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. exilis</i>	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. holsatica</i>	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.2	1.1	1.2	0.4	2.4	1.6	0.4	0.2	2.1	1.0	0.4	0.4	0.6	0.2	0.0	0.5	2.4
<i>A. marginulata</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. minutissima</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>A. subhudsonis</i>	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. suchlandii</i>	0.0	1.9	0.0	0.0	0.6	2.4	1.1	0.0	0.0	0.2	1.0	1.2	0.4	0.8	0.0	0.2	0.0
<i>Amphora copulata</i>	0.0	0.4	0.2	0.4	0.8	1.4	0.4	0.2	0.8	0.8	0.4	0.4	0.0	0.2	0.3	0.2	0.2
<i>A. pediculus</i>	0.4	1.7	2.9	3.4	3.8	3.7	1.6	0.8	3.5	1.0	1.4	1.0	1.5	1.6	0.5	2.0	0.9
<i>A. sp</i>	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. tanganyikae</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Aulacoseira ambigua</i>	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.4
<i>A. ambigua</i> var. <i>angustissima</i>	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.1
<i>A. crassipunctata</i>	0.0	0.6	0.0	1.6	1.0	0.4	0.0	0.0	0.0	0.2	0.4	0.2	0.0	0.2	0.0	0.0	0.2
<i>A. crenulata</i>	0.0	0.2	0.7	0.2	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0
<i>A. granulata</i>	1.6	0.0	0.7	0.2	0.0	0.0	0.0	0.0	2.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i> var. <i>angustissima</i>	0.4	0.7	0.0	0.0	0.8	0.8	3.6	0.2	0.4	0.0	0.0	0.8	0.2	0.0	0.0	0.7	0.0
<i>A. lirata</i>	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. muzzanensis</i>	0.0	1.1	2.2	2.8	1.2	2.0	0.2	0.0	0.0	0.2	0.8	1.6	0.2	0.4	0.5	1.6	2.8
<i>A. nyassensis</i>	2.5	14.3	11.1	25.9	8.1	8.1	3.8	5.4	8.9	7.6	5.1	3.1	2.5	3.5	5.8	8.2	7.0
<i>A. sp.</i>	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Caloneis bacillum</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>Capartogramma crucicula</i>	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>Cocconeis neodiminuta</i>	0.0	0.0	0.3	0.2	0.6	1.0	0.2	0.0	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.4	0.2
<i>C. neothumensis</i>	2.2	2.8	2.1	1.4	6.2	2.6	2.0	1.7	2.1	1.8	3.3	0.6	0.6	0.2	1.0	2.7	6.8
<i>C. placentula</i> var. <i>lineata</i>	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0
<i>Cyclostephanos malawiensis</i>	13.0	6.7	4.0	5.4	3.6	2.4	8.7	13.1	9.6	14.1	16.5	24.2	29.0	40.7	28.2	37.1	24.1
<i>C. damasii</i>	0.0	3.3	2.1	2.8	3.6	2.4	4.7	3.9	0.0	2.7	4.3	0.0	1.3	3.9	2.3	1.3	0.7
<i>Cyclotella krammeri</i>	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. meneghiniana</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4
<i>C. ocellata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>C. tripartate</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>Cymatopleura solea</i>	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>Cymbella budayana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. caespitosa</i>	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. minuta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.8	0.0	0.0	0.0	0.0
<i>C. muelleri</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>C. subaequalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
<i>Cymbellonitzschia minima</i>	1.8	0.6	1.9	0.8	2.2	1.8	1.5	1.5	1.0	0.6	0.2	1.8	1.5	1.6	2.0	0.0	0.0
<i>Diploneis ovalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>D. pseudovalis</i>	0.7	1.7	0.5	0.4	0.8	0.4	0.4	0.2	0.6	0.0	0.2	0.0	0.0	0.0	0.2	0.7	0.2
<i>Epithemia adnata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>E. subarcuatooides</i>	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.0
<i>Fragilaria africana</i>	2.9	1.7	4.3	1.6	2.2	3.0	2.0	1.0	0.4	3.3	1.9	1.2	1.1	1.4	0.3	2.5	5.9
<i>F. brevistriata</i>	3.1	3.3	0.9	6.4	4.4	1.4	5.8	0.6	2.7	0.4	1.9	1.8	0.6	1.2	0.3	4.6	3.9
<i>F. capucina</i> var. <i>rumpens</i>	0.0	0.6	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 7. Percent abundance of diatom taxa from core MAL 4 mid Lake Malawi

Sediment Interval	0-1	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-22	24-26	28-30	32-34	36-38	40-42	44-46	
Sediment Midpoint	0.5	2.5	4.5	6.5	8.5	10.5	12.5	14.5	16.5	18.5	21.0	25.0	29.0	33.0	37.0	41.0	45.0	
Diatom Taxa																		
<i>F. construens</i>	1.8	0.0	4.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
<i>F. construens f. venter</i>	0.0	0.2	0.0	0.4	0.2	0.2	0.0	0.0	6.9	0.2	0.0	0.8	0.0	0.0	0.0	0.4	0.0	
<i>F. heidenii</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.9	0.0	1.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	
<i>F. leptostauron var. dubia</i>	0.0	0.7	0.0	4.2	8.7	3.9	2.9	6.6	0.0	2.5	4.5	4.1	1.7	3.7	0.3	5.7	3.3	
<i>F. pinnata</i>	1.1	5.4	3.1	4.2	6.2	3.9	4.9	4.6	9.4	4.1	3.5	2.0	1.9	3.1	3.7	3.4	3.1	
<i>F. pinnata var. intercedens</i>	0.0	0.6	4.8	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.8	0.0	0.0	0.7	0.0	0.0	
<i>F. PIRLA sp. 2</i>	0.9	3.3	0.0	0.0	5.2	5.9	2.4	0.2	1.2	1.2	1.2	2.0	3.2	1.6	1.5	0.7	0.0	
<i>F. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Gomphonema sp.</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>Navicula atomus</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.5	0.4	
<i>N. bacilloides</i>	0.0	0.2	0.0	0.0	1.8	0.0	0.0	1.2	0.0	1.0	0.0	0.0	0.4	0.0	0.0	0.9	0.0	
<i>N. barbarica</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.4	0.2	0.4	0.0	0.0	0.3	0.5	0.0	
<i>N. cryptotenella</i>	0.0	0.4	0.0	0.0	0.2	0.4	0.0	0.0	0.8	0.2	0.0	0.4	0.0	0.0	0.3	0.0	0.0	
<i>N. decussis</i>	1.3	1.5	0.5	0.6	0.4	1.8	0.5	1.7	1.7	0.8	0.4	0.6	0.6	0.0	0.2	0.0	1.8	
<i>N. exiguiformis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	
<i>N. gastrum</i>	0.0	0.7	1.2	0.6	1.6	1.0	0.7	1.0	1.0	1.2	0.2	0.8	0.4	0.4	0.2	0.7	0.4	
<i>N. gastrum var. signata</i>	0.0	0.2	0.0	0.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.4	
<i>N. ignota var. accepta</i>	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>N. insociabilis</i>	0.0	0.4	0.0	0.0	0.2	0.8	0.4	0.0	0.0	0.6	0.0	0.4	0.0	0.4	0.0	0.4	0.7	
<i>N. minima</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.8	0.0	0.2	0.2	0.0	0.0	0.0	0.0	
<i>N. muticoides</i>	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	
<i>N. nyassensis</i>	0.2	0.0	0.5	0.2	0.2	0.2	0.0	0.2	0.2	0.0	0.2	0.4	0.0	0.0	0.3	0.0	0.2	
<i>N. peliculosa</i>	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>N. pupula</i>	0.2	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0	1.0	0.2	0.4	0.4	0.0	0.0	0.2	0.0	
<i>N. pupula var. pupula</i>	0.0	0.2	0.0	0.2	0.0	0.8	0.0	0.8	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	1.3	
<i>N. rhynchocephala</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>N. rotunda</i>	0.0	0.0	0.0	0.6	1.6	0.6	0.0	0.2	0.0	2.9	0.6	0.0	0.6	0.6	0.0	0.4	0.0	
<i>N. schoenfeldii</i>	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>N. scutelloides</i>	0.2	0.2	1.2	1.0	0.8	1.8	0.5	1.9	1.7	0.8	0.4	1.4	0.4	0.6	0.3	1.3	1.3	
<i>N. seminuloides</i>	0.0	2.4	0.3	3.4	2.6	2.6	2.4	0.8	0.0	2.0	2.7	1.6	0.0	1.6	0.0	1.1	1.3	
<i>N. sp.</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	
<i>N. subatomoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.9	
<i>N. sublucidata</i>	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>N. submiscalia</i>	3.4	0.0	0.5	0.4	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	
<i>N. submuralis</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	
<i>N. subrotundata</i>	0.0	0.0	0.7	1.4	0.0	2.6	0.0	0.2	0.0	0.0	0.0	1.0	0.2	0.2	1.2	0.0	0.0	
<i>N. trivialis</i>	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>N. utermoelee</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	
<i>Neidium ampliatum</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	
<i>Nitzschia amphibia</i>	3.1	0.0	1.7	0.0	0.0	1.6	0.2	0.0	1.0	0.0	0.0	0.6	0.2	0.8	0.8	0.9	0.2	
<i>N. bacillum</i>	0.0	2.6	3.3	0.4	3.0	0.4	3.3	0.4	0.0	1.2	3.5	7.2	2.3	0.8	0.7	0.9	0.4	
<i>N. communis</i>	0.0	0.0	0.3	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	
<i>N. epiphytica</i>	0.0	0.7	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<i>N. fonticola</i>	0.7	0.6	0.2	0.0	1.2	0.0	1.1	0.8	0.0	0.8	1.9	1.6	1.1	0.0	0.0	0.0	0.0	
<i>N. frustulum</i>	0.0	0.7	0.0	0.0	0.2	0.4	0.4	0.0	0.2	0.0	1.6	0.4	0.4	1.0	16.7	0.0	0.4	
<i>N. inconspicua</i>	0.0	2.0	0.3	2.0	1.0	1.4	3.1	0.2	3.1	2.5	1.2	0.8	2.5	1.9	0.0	1.1	1.3	
<i>N. lacuum</i>	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	
<i>N. lancettula</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.4	1.2	0.0	1.2	0.4	0.0	0.0	0.2	0.0	0.0	0.4	
<i>N. leibetruthii</i>	0.0	0.4	0.0	0.6	1.0	1.2	1.6	1.2	0.0	1.6	0.4	0.6	0.0	0.4	0.0	0.4	0.0	
<i>N. nyassensis</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	

Table 7. Percent abundance of diatom taxa from core MAL 4 mid Lake Malawi

Sediment Interval	0-1	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-22	24-26	28-30	32-34	36-38	40-42	44-46
Sediment Midpoint	0.5	2.5	4.5	6.5	8.5	10.5	12.5	14.5	16.5	18.5	21.0	25.0	29.0	33.0	37.0	41.0	45.0
Diatom Taxa																	
<i>N. paleacea</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.8	0.0	0.0	0.0	0.0
<i>N. recta</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>N. sigma</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>N. sp.</i>	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.2	0.4	0.0	0.2	1.0	4.2	0.2	0.0
<i>N. subacicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
<i>N. valdecosta</i>	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhopalodia pusilla</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
<i>Stephanodiscus minutulus</i>	4.5	5.4	8.6	2.0	6.2	8.1	16.2	9.3	2.7	13.7	16.0	9.8	13.8	7.0	3.8	8.9	16.2
<i>S. mulleri</i>	6.7	10.9	10.4	8.8	7.3	16.2	12.0	25.1	16.2	8.4	8.2	9.4	5.3	4.9	10.0	3.9	4.4
<i>S. nyassae</i>	41.6	15.7	19.2	6.0	5.2	3.0	8.2	8.1	10.6	14.3	11.9	10.0	21.6	10.5	10.5	2.5	3.1
<i>Surirella nyassae</i>	0.0	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 8. Percent abundances of diatom taxa from core MAL 10 southern Lake Malawi

Sediment Interval	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17
Sediment Midpoint	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5
Diatom taxa																	
<i>Achnanthes buccula</i>	0.4	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.2
<i>A. clevei</i> var. <i>bottanica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>A. delicatula</i> spp. <i>englebrectii</i>	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. grischuna</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. holsatica</i>	0.0	1.2	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. kuelbsii</i>	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.2	0.5	0.2	0.8	0.4	0.6	0.0	0.3	0.7	0.2	0.7	1.2	0.4	1.1	0.5	0.4	1.0
<i>A. minutissima</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. sp</i>	0.0	0.0	0.0	0.0	0.6	0.0	2.2	0.5	0.0	0.4	0.2	1.4	0.2	0.0	0.2	0.0	1.2
<i>Amphora copulata</i>	0.2	0.9	0.3	0.4	0.4	0.2	0.2	0.0	0.6	0.5	0.6	0.7	0.2	0.0	0.2	0.0	1.0
<i>A. pediculus</i>	0.4	0.9	1.8	0.4	0.6	0.6	0.0	0.0	0.2	0.5	0.9	0.0	0.0	0.4	1.5	0.0	0.9
<i>A. sp</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Aulacoseira ambigua</i>	0.6	0.3	1.0	0.8	0.7	1.2	0.4	0.2	0.2	0.4	0.9	1.2	1.8	0.2	1.9	1.9	2.6
<i>A. ambigua</i> var. <i>angustissima</i>	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.7	0.0	0.0	0.0	0.7	0.0	0.0	1.0	0.8	0.2
<i>A. crassipunctata</i>	0.0	1.2	0.8	0.8	0.2	0.0	1.2	1.4	0.7	1.6	1.7	2.8	1.8	0.0	1.3	1.7	3.1
<i>A. crenulata</i>	0.4	0.0	0.5	0.2	0.0	0.0	1.2	0.0	0.2	0.0	0.9	0.0	0.6	0.2	0.2	0.0	0.3
<i>A. distans</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i>	0.6	0.0	1.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.7	0.0	8.0	0.0	0.0	0.0
<i>A. granulata</i> var. <i>angustissima</i>	2.5	0.6	0.2	0.0	0.6	0.0	0.0	0.5	0.0	0.2	0.4	0.0	0.2	0.9	0.3	0.0	0.0
<i>A. italica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. laevissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lirata</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.2	0.0	0.2	0.0	0.6	0.0	0.0	0.0	0.0
<i>A. muzzanensis</i>	0.2	1.2	3.2	3.0	4.8	6.1	3.0	7.5	4.8	5.7	12.4	8.9	9.6	3.3	7.9	9.5	12.8
<i>A. nyassensis</i>	16.5	19.0	12.1	9.8	13.3	10.7	18.6	8.7	9.8	23.0	12.1	21.7	29.5	37.7	31.0	26.2	16.6
<i>A. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. subarctica</i>	0.0	0.0	1.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	1.0
<i>A. valida</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.2
<i>Caloneis bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>Capartogramma crucicula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>Cocconeis neodiminuta</i>	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0
<i>C. neothumensis</i>	1.1	0.3	1.3	1.6	2.2	2.1	0.2	1.7	2.4	1.4	3.0	1.9	0.0	2.4	1.2	3.5	1.2
<i>C. placentula</i> var. <i>lineata</i>	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.2
<i>Cyclostephanos damasii</i>	0.9	1.1	1.3	1.8	1.1	2.0	2.4	1.2	2.8	2.1	1.3	0.9	1.2	0.4	0.7	1.0	1.2
<i>C. malawiensis</i>	14.2	17.3	11.1	16.1	8.1	13.1	16.2	8.7	7.8	4.1	6.9	4.0	1.8	2.6	1.5	0.8	1.7
<i>C. novaezeelandiae</i>	0.0	0.8	3.7	1.6	7.2	5.9	2.0	3.1	3.3	2.0	1.3	1.2	1.2	0.2	0.7	1.2	0.5
<i>Cyclotella iris</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. krammeri</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>C. meneghiniana</i>	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. ocellata</i>	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.2	0.0
<i>C. tripartata</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cymbella minuta</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. muelleri</i>	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.2	0.0	0.5	0.0	0.2
<i>C. caespitosa</i>	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cymbellonitzschia minima</i>	0.8	1.5	1.2	1.2	0.7	0.4	1.4	0.9	0.2	1.1	2.4	0.3	0.0	0.2	0.0	2.3	0.0

Table 8. Percent abundances of diatom taxa from core MAL 10 southern Lake Malawi

Sediment Interval	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17
Sediment Midpoint	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5
Diatom taxa																	
<i>Diploneis ovalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0
<i>D. pseudovalis</i>	0.2	0.8	1.0	0.4	0.6	0.2	0.4	0.5	0.4	0.5	0.6	0.2	0.0	0.7	0.3	0.2	0.0
<i>Eunotia subarcuatooides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0
<i>Fragilaria africana</i>	7.6	1.5	5.2	4.3	5.0	7.4	3.4	9.9	8.9	6.6	7.1	12.2	12.5	6.3	9.6	11.4	13.4
<i>F. brevistriata</i>	0.0	1.1	1.3	3.7	2.6	1.4	2.4	1.4	3.9	3.2	4.3	3.7	2.9	2.2	3.0	6.0	4.7
<i>F. capucina</i> var. <i>rumpens</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. construens</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	1.1	0.0	0.0	0.5
<i>F. construens</i> f. <i>construens</i>	0.4	0.2	0.0	0.4	0.4	0.2	3.2	0.3	0.0	0.9	0.4	1.6	0.0	10.2	1.2	0.0	0.0
<i>F. heidenii</i>	0.0	0.0	2.2	0.8	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. leptostauron</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
<i>F. leptostauron</i> var. <i>dubia</i>	5.7	4.6	6.2	6.1	3.3	6.6	3.6	5.0	8.7	5.0	11.1	5.1	5.5	1.1	7.2	4.5	12.1
<i>F. pinnata</i>	7.4	2.0	4.4	6.1	4.6	2.9	3.4	5.1	5.5	3.4	3.7	4.4	8.2	5.9	10.4	6.0	7.1
<i>F. pinnata</i> var. <i>intercedens</i>	0.0	1.8	0.0	0.0	0.4	0.0	0.2	0.5	0.9	1.1	0.9	0.0	0.8	0.0	5.4	1.9	0.7
<i>F. PIRLA</i> sp. 2	2.1	0.8	1.7	2.0	0.9	0.2	0.0	0.3	4.3	4.3	0.6	1.7	1.0	0.0	0.2	2.5	1.4
<i>F. sp.</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. ulna</i> var. <i>angustissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>Gomphonema affine</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. clevei</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gyrosigma nodiferum</i>	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>Melosira arentii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>M. undulata</i>	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>Navicula bacilloides</i>	0.0	0.0	0.0	0.6	0.2	0.0	0.0	0.2	0.0	0.0	0.6	0.0	0.0	0.0	0.5	0.4	0.0
<i>N. barbarica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. capitoradiata</i>	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. cryptotenella</i>	0.0	0.0	0.2	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.0
<i>N. damasii</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
<i>N. decussis</i>	0.0	0.2	0.7	0.8	0.4	1.2	0.4	0.2	0.4	0.0	0.2	0.2	0.6	0.0	0.0	0.6	0.2
<i>N. elkab</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. exiguiiformis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
<i>N. gastrum</i>	0.2	0.3	0.3	0.6	0.2	0.2	0.6	0.2	0.4	0.0	0.0	0.0	0.2	0.2	0.5	0.0	0.0
<i>N. gastrum</i> var. <i>signata</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. insociabilis</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.3	0.2	0.5
<i>N. minima</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.3
<i>N. modica</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.5
<i>N. muticoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.0	0.2
<i>N. nyassensis</i>	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0

Table 8. Percent abundances of diatom taxa from core MAL 10 southern Lake Malawi

Sediment Interval	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17
Sediment Midpoint	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5
Diatom taxa																	
<i>N. placentula</i>	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0
<i>N. pupula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pupula</i> var. <i>pupula</i>	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. rotunda</i>	0.4	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.6	0.0	0.0	0.2	0.4	0.0	0.2	0.2	0.0
<i>N. schoenfeldii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2
<i>N. scutelloides</i>	0.6	0.5	0.3	1.2	0.4	0.2	0.8	0.0	1.1	0.9	0.4	1.0	0.8	0.9	0.3	1.4	1.2
<i>N. seminuloides</i>	0.0	0.5	0.8	0.0	0.9	1.6	0.4	0.5	0.6	1.8	0.4	1.2	0.4	0.0	1.2	1.4	1.7
<i>N. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
<i>N. subrotundata</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0
<i>N. trivialis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. vitabunda</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
<i>Neidium ampliutum</i>	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>Nitzschia acicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. adnata</i>	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. amphibia</i>	0.0	2.6	0.0	0.4	0.0	1.6	1.0	0.0	0.2	0.4	0.0	1.4	0.0	0.7	0.0	0.8	0.3
<i>N. bacillum</i>	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. communis</i>	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. dissipata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
<i>N. epiphytica</i>	0.8	2.9	3.2	1.2	0.7	2.1	2.2	1.0	1.7	1.1	1.1	0.7	0.0	0.0	0.0	0.0	0.0
<i>N. fonticola</i>	4.6	0.6	3.7	3.9	5.0	2.3	0.0	3.1	2.0	0.7	2.8	0.0	1.4	0.0	0.0	0.0	0.0
<i>N. frustulum</i>	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.3	1.1	0.0	0.6	0.9	0.2	0.0	0.0	0.4	0.0
<i>N. gracilis</i>	0.8	0.0	0.3	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. inconspicua</i>	0.6	1.1	2.2	0.4	0.0	4.9	0.0	1.5	0.9	1.1	0.9	0.3	0.0	0.0	1.0	0.0	0.3
<i>N. lacuum</i>	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. lancettula</i>	0.0	0.0	0.8	0.6	0.0	0.4	0.0	1.2	0.7	0.0	0.4	0.0	0.4	0.0	0.2	0.0	0.0
<i>N. leibetruthii</i>	0.0	0.0	0.7	0.0	0.4	0.2	0.0	0.3	0.0	0.2	0.4	0.9	0.0	0.0	0.0	0.0	0.5
<i>N. nyassensis</i>	3.0	0.8	0.0	0.2	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>N. palaea</i>	0.0	0.0	0.7	0.0	0.0	0.6	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>N. paleacea</i>	0.8	0.9	1.7	0.4	1.3	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pura</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. reversa</i>	0.0	0.0	0.0	0.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigma</i>	0.0	0.2	0.0	0.4	0.7	0.6	0.6	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.3	0.0	0.0
<i>N. sp</i>	0.2	3.2	1.8	4.1	1.5	2.3	1.6	1.4	0.6	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.2
<i>Orthoseira roeseana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0
<i>Rhoicosphenia abbreviata</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhopalodia gibba</i> var. <i>gibba</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>R. gracilis</i>	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
<i>Stephanodiscus minutulus</i>	6.6	4.5	3.7	5.7	6.3	6.6	7.3	11.1	10.5	4.8	7.6	3.5	4.5	1.3	2.5	2.3	2.9
<i>S. mulleri</i>	5.1	9.7	2.5	4.1	5.5	5.3	7.3	4.8	3.0	7.3	3.5	6.5	4.5	5.0	2.5	3.9	3.1
<i>S. nyassae</i>	10.2	8.2	11.7	9.6	14.8	8.8	4.7	9.4	7.6	6.8	5.4	2.4	2.5	2.8	0.8	0.2	1.0
<i>Surirella nyassae</i>	0.2	0.3	0.2	0.2	0.0	0.2	0.2	0.5	0.2	0.2	0.4	0.0	0.4	0.2	0.0	0.0	0.0
<i>Synedra ulna</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.6	0.0

Table 8. Percent abundances of diatom taxa from core MAL 10 southern Lake Malawi

Sediment Interval	17-18	18-19	19-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42
Sediment Midpoint	17.5	18.5	19.5	21.0	23.0	25.0	27.0	29.0	31.0	33.0	35.0	37.0	39.0	41.0
Diatom taxa														
<i>Achnanthes buccula</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. clevei</i> var. <i>bottanica</i>	0.0	0.0	0.0	0.2	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. delicatula</i> spp. <i>englebrectii</i>	0.0	0.0	0.0	0.6	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>A. grischuna</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. holsatica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. kuelbsii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.0	1.3	0.0	0.4	1.3	1.0	0.8	0.2	0.0	0.6	0.4	0.8	0.4	0.6
<i>A. minutissima</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. sp</i>	0.2	0.0	0.0	0.0	0.0	1.0	0.0	1.1	0.0	0.0	1.0	0.0	0.0	0.0
<i>Amphora copulata</i>	0.6	0.4	0.4	0.4	1.3	0.0	0.4	0.4	1.6	1.0	0.6	0.6	0.4	0.2
<i>A. pediculus</i>	1.2	1.5	0.6	0.6	0.2	0.0	0.4	0.0	0.0	0.2	0.4	0.8	0.2	0.2
<i>A. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Aulacoseira ambigua</i>	3.1	1.9	4.3	5.7	4.3	5.0	6.0	5.3	5.1	3.4	3.7	4.1	4.0	4.0
<i>A. ambigua</i> var. <i>angustissima</i>	0.6	0.0	1.2	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. crassipunctata</i>	2.5	0.0	0.8	0.6	0.4	0.0	1.0	1.1	1.2	1.0	1.9	0.4	0.2	0.0
<i>A. crenulata</i>	3.5	0.4	2.9	1.1	2.2	3.3	2.4	3.4	1.8	1.5	0.0	0.8	0.6	2.4
<i>A. distans</i>	0.0	4.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.2
<i>A. granulata</i>	0.0	1.3	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.4
<i>A. granulata</i> var. <i>angustissima</i>	0.2	0.0	0.4	0.4	0.6	0.4	0.0	0.0	0.2	0.2	0.0	0.0	0.4	0.0
<i>A. italica</i>	0.0	0.0	0.0	0.2	0.6	0.0	2.0	0.4	3.0	1.1	0.2	0.2	2.1	0.0
<i>A. laevissima</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lirata</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. muzzanensis</i>	5.1	8.6	8.4	3.6	2.2	7.5	3.0	7.9	1.8	4.4	3.7	5.4	10.0	6.2
<i>A. nyassensis</i>	20.7	28.4	15.0	23.0	22.8	26.5	22.4	21.2	20.2	22.4	18.9	19.0	19.8	25.1
<i>A. sp</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
<i>A. subarctica</i>	0.0	0.0	0.0	0.6	1.1	0.6	1.2	1.5	0.8	0.2	0.4	0.6	0.6	1.2
<i>A. valida</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Caloneis bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Capartogramma crucicula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0
<i>Cocconeis neodiminuta</i>	0.2	0.4	0.2	0.0	0.0	0.0	0.2	0.0	0.8	0.0	0.0	0.2	1.0	0.0
<i>C. neothumensis</i>	2.5	3.8	2.7	1.3	1.9	1.0	0.8	0.4	0.2	1.0	1.2	0.8	0.0	0.8
<i>C. placentula</i> var. <i>lineata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0
<i>Cyclostephanos damasii</i>	0.8	0.4	1.2	0.2	0.0	1.5	0.2	3.8	0.6	0.6	1.7	0.6	0.0	2.4
<i>C. malawiensis</i>	0.8	3.8	1.9	0.8	0.9	1.0	1.4	0.4	1.8	2.5	3.5	2.9	3.8	2.6
<i>C. novaezeelandiae</i>	1.0	0.0	0.2	0.0	0.2	0.2	0.2	0.8	0.2	0.0	1.0	0.0	0.2	0.6
<i>Cyclotella iris</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>C. krammeri</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>C. meneghiniana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. ocellata</i>	1.0	0.0	1.0	2.3	0.0	0.0	0.6	0.4	0.4	0.4	0.0	0.8	0.4	0.2
<i>C. tripartate</i>	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2
<i>Cymbella minuta</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. muelleri</i>	0.2	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.2	0.4	0.0
<i>C. caespitosa</i>	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cymbellonitzschia minima</i>	0.0	0.0	0.8	0.0	0.2	0.0	0.4	0.0	0.4	0.0	0.0	0.2	0.4	1.0

Table 8. Percent abundances of diatom taxa from core MAL 10 southern Lake Malawi

Sediment Interval	17-18	18-19	19-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42
Sediment Midpoint	17.5	18.5	19.5	21.0	23.0	25.0	27.0	29.0	31.0	33.0	35.0	37.0	39.0	41.0
Diatom taxa														
<i>Diploneis ovalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>D. pseudovalis</i>	0.4	0.4	0.8	0.6	0.0	0.0	0.2	0.4	0.0	0.2	1.0	0.8	0.6	0.6
<i>Eunotia subarcuatoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>Fragilaria africana</i>	15.8	13.0	16.5	18.2	20.9	18.6	26.4	14.0	23.0	19.7	11.6	21.2	13.1	7.8
<i>F. brevistriata</i>	4.7	0.8	4.3	3.4	3.0	2.7	0.8	3.4	1.6	4.4	7.3	5.2	4.0	3.0
<i>F. capucina</i> var. <i>rumpens</i>	0.2	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. construens</i>	0.0	0.4	0.0	1.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8
<i>F. construens</i> f. <i>construens</i>	1.6	4.4	1.2	0.0	0.6	4.6	1.4	0.0	0.8	1.5	3.7	0.2	0.6	0.6
<i>F. heidenii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.6	0.0	0.0
<i>F. leptostauron</i>	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>F. leptostauron</i> var. <i>dubia</i>	9.6	2.9	7.6	7.2	6.7	4.0	4.4	6.8	6.7	13.4	12.0	8.2	8.5	12.0
<i>F. pinnata</i>	7.4	8.0	10.1	10.4	14.2	5.0	10.2	2.8	13.3	5.4	11.0	11.1	6.9	4.0
<i>F. pinnata</i> var. <i>intercedens</i>	4.3	0.0	2.3	1.1	0.4	6.7	0.0	3.4	1.4	1.0	1.2	0.6	0.6	0.4
<i>F. PIRLA</i> sp. 2	0.2	0.0	0.8	0.4	0.0	0.0	0.4	1.1	0.8	1.0	0.0	0.0	3.8	0.8
<i>F. sp.</i>	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
<i>F. ulna</i> var. <i>angustissima</i>	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
<i>Gomphonema affine</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>G. clevei</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>Gyrosigma nodiferum</i>	0.2	0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>Melosira arentii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>M. undulata</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0
<i>Navicula bacilloides</i>	0.4	0.0	0.6	0.0	0.2	0.0	0.8	0.0	0.2	0.2	0.0	0.2	0.4	0.0
<i>N. barbarica</i>	0.0	0.0	0.6	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0
<i>N. capitoradiata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. cryptotenella</i>	0.0	0.0	0.2	1.1	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.0
<i>N. damasii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. decussis</i>	0.2	0.0	0.4	0.0	0.2	0.6	0.0	0.2	0.4	0.0	0.0	0.0	0.4	0.0
<i>N. elkab</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. exiguiiformis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. gastrum</i>	0.4	0.0	0.2	0.0	0.2	0.0	0.2	0.2	0.4	0.6	0.2	0.0	0.2	0.0
<i>N. gastrum</i> var. <i>signata</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. insociabilis</i>	0.4	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.4
<i>N. minima</i>	0.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. modica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. muticoides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. nyassensis</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0

Table 8. Percent abundances of diatom taxa from core MAL 10 southern Lake Malawi

Sediment Interval	17-18	18-19	19-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42
Sediment Midpoint	17.5	18.5	19.5	21.0	23.0	25.0	27.0	29.0	31.0	33.0	35.0	37.0	39.0	41.0
Diatom taxa														
<i>N. placentula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pupula</i>	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.2
<i>N. pupula</i> var. <i>pupula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.4	0.0	0.4	0.2	0.0
<i>N. rotunda</i>	0.6	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. schoenfeldii</i>	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>N. scutelloides</i>	1.4	1.5	0.6	1.5	2.4	2.3	1.0	1.7	1.8	1.0	1.7	1.0	2.5	1.4
<i>N. seminuloides</i>	0.4	0.0	0.6	0.2	0.4	0.0	0.8	0.6	0.2	0.4	0.4	0.0	0.6	0.6
<i>N. sp</i>	0.0	0.8	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2
<i>N. subrotundata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
<i>N. trivialis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>N. vitabunda</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Neidium ampliutum</i>	0.2	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>Nitzschia acicularis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. adnata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. amphibia</i>	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2
<i>N. bacillum</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. communis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>N. dissipata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. epiphytica</i>	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>N. fonticola</i>	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. frustulum</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.4	1.1	0.0	0.4	0.4	0.0
<i>N. gracilis</i>	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
<i>N. inconspicua</i>	0.8	0.0	0.4	0.0	0.4	0.0	0.0	1.1	0.0	0.6	0.0	0.2	0.0	0.0
<i>N. lacuum</i>	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
<i>N. lancettula</i>	0.4	0.0	0.0	0.2	0.2	0.0	0.0	0.8	0.2	0.2	0.0	0.0	0.0	0.0
<i>N. leibetruthii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.0
<i>N. nyassensis</i>	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. palaea</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. paleacea</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pura</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. reversa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigma</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.2	0.0
<i>N. sp</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Orthoseira roeseana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhoicosphenia abbreviata</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Rhopalodia gibba</i> var. <i>gibba</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.2	0.2	0.0
<i>R. gracilis</i>	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0
<i>Stephanodiscus minutulus</i>	3.3	0.2	4.3	2.3	2.4	0.0	2.8	4.0	1.4	1.1	0.8	1.2	2.1	3.4
<i>S. mulleri</i>	2.0	4.8	2.1	4.0	3.4	0.0	4.0	1.1	3.8	4.8	5.2	5.6	7.1	4.4
<i>S. nyassae</i>	0.4	3.4	0.6	2.3	1.7	0.0	0.2	0.2	0.0	0.4	0.0	1.4	1.0	1.6
<i>Surirella nyassae</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>Synedra ulna</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.4	0.0	0.0	0.0

Table 9. Percent abundances of diatom taxa from core MAL 14 southern Lake Malawi

Sediment Intervals	0-1	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-22	24-26	28-30	32-34
Sediment Midpoint	0.5	2.5	4.5	6.5	8.5	10.5	12.5	14.5	16.5	18.5	21.0	25.0	29.0	33.0
Diatom taxa														
<i>A. buccula</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>A. delicatula</i> spp. <i>englebrechtii</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. grischuna</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lanceolata</i> var. <i>rostrata</i>	0.0	0.0	0.4	0.3	0.4	0.2	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. sp</i>	0.6	0.0	0.0	0.0	0.2	0.2	0.6	0.0	0.2	0.5	0.2	0.2	0.2	0.2
<i>Amphora inariensis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. copulata</i>	0.4	0.2	0.6	0.0	0.6	0.0	0.0	1.6	0.2	1.1	0.4	0.0	0.0	0.4
<i>A. ovalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>A. pediculus</i>	0.4	0.0	0.2	0.6	0.4	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Aulacoseira ambigua</i>	0.7	0.4	0.8	0.8	1.6	1.4	1.9	1.8	1.2	7.3	6.0	10.3	8.3	10.9
<i>A. crassipunctata</i>	0.2	0.0	0.0	0.3	0.6	2.3	0.4	0.0	0.0	1.1	0.8	1.6	0.0	1.6
<i>A. crenulata</i>	0.2	0.0	1.7	0.2	1.4	0.7	0.0	0.0	3.8	1.6	3.3	0.0	7.0	4.5
<i>A. distans</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0
<i>A. granulata</i> var. <i>angustissima</i>	0.6	0.6	0.0	0.3	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.4	0.0
<i>A. italica</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>A. lirata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>A. muzzanensis</i>	0.0	1.0	3.7	3.7	8.2	5.1	5.3	0.9	8.1	2.6	4.9	4.7	2.5	3.8
<i>A. nyassensis</i>	10.6	16.3	20.8	22.0	29.6	35.3	31.4	21.0	39.4	24.9	21.4	27.3	36.4	29.7
<i>A. subarctica</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.1	1.0	0.7	0.8	1.4	0.2	0.2
<i>A. valida</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>Capartogramma crucicula</i>	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>Cocconeis neodiminuta</i>	0.0	0.0	0.0	0.3	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>C. neothumensis</i>	1.9	1.6	2.9	1.2	2.4	1.2	0.4	0.7	0.7	0.0	0.4	0.0	0.0	0.2
<i>C. pediculus</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
<i>C. placentula</i> var. <i>lineata</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Cyclostephanos damasii</i>	0.0	0.8	2.1	5.1	2.4	1.8	1.5	0.0	1.0	2.2	4.3	2.3	2.7	2.2
<i>C. malawiensis</i>	14.9	11.1	5.4	5.1	3.4	3.0	0.2	1.1	0.3	0.7	0.4	0.0	1.2	1.3
<i>C. novaezeelandiae</i>	0.0	0.0	0.6	0.5	0.0	2.1	1.1	0.0	1.3	0.2	0.6	0.5	0.4	0.2
<i>Cyclotella ocellata</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.6	0.0	0.0	0.0	1.4	0.0	0.4	1.1
<i>C. radiosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
<i>C. tripartate</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0
<i>Cymatopleura solea</i>	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>Cymbella minuta</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>C. muelleri</i>	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.4	0.0	0.0	0.2	0.0	0.2	0.2
<i>C. caespitosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>Cymbellonitzschia minima</i>	0.4	0.4	0.6	0.2	0.0	0.0	0.0	0.2	0.2	0.4	0.0	0.0	0.2	0.0
<i>Diploneis ovalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.7	0.0	0.0	0.0	0.0
<i>D. parma</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>D. pseudovalis</i>	0.4	0.6	1.5	0.9	0.8	1.2	0.4	1.1	1.3	0.2	0.2	1.4	1.0	0.7
<i>Epithemia adnata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2

Table 9. Percent abundances of diatom taxa from core MAL 14 southern Lake Malawi

Sediment Intervals	0-1	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-22	24-26	28-30	32-34
Sediment Midpoint	0.5	2.5	4.5	6.5	8.5	10.5	12.5	14.5	16.5	18.5	21.0	25.0	29.0	33.0
Diatom taxa														
<i>Eunotia subarcuatooides</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>Fragilaria africana</i>	6.3	4.2	7.3	7.4	8.6	7.6	13.3	21.0	10.0	22.5	27.6	20.3	17.0	13.4
<i>F. brevistriata</i>	0.2	2.4	1.0	2.2	2.0	4.1	4.6	7.4	1.6	5.5	3.3	2.8	1.7	1.1
<i>F. construens</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	2.1	0.2	0.0	0.5	0.0	0.0
<i>F. construens f. construens</i>	0.4	0.4	0.0	1.6	1.2	1.4	1.3	3.1	0.0	0.0	1.4	2.8	1.5	1.1
<i>F. heidenii</i>	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>F. leptostauron var. dubia</i>	6.5	3.8	2.1	5.7	2.8	9.7	5.7	7.6	2.5	2.2	4.3	2.6	3.1	4.5
<i>F. pinnata</i>	8.2	5.0	1.0	5.4	7.6	7.8	8.4	12.5	1.5	5.5	4.3	4.7	6.8	4.9
<i>F. pinnata var. intercedens</i>	0.0	0.0	1.5	0.0	0.0	0.0	1.9	0.7	1.0	0.5	0.0	1.9	0.2	0.0
<i>F. PIRLA sp. 2</i>	3.9	3.2	0.8	2.9	2.8	4.6	3.0	1.8	5.8	6.6	0.8	0.0	0.6	1.3
<i>F. sp.</i>	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
<i>F. ulna var. angustissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>Gomphonema parvulum</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Gyrosigma attenuatum</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>G. nodiferum</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Hantzschia amphioxys</i>	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>Mastogloia elliptica var dansei</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>Navicula absoluta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. arvensis</i>	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. bacilloides</i>	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2
<i>N. barbarica</i>	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<i>N. cincta</i>	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. confervacea</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
<i>N. cryptotenella</i>	0.4	0.0	0.0	0.0	0.0	0.5	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0
<i>N. decussis</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0
<i>N. gastrum</i>	0.6	0.8	0.0	0.3	0.8	0.2	0.8	0.9	1.0	0.0	0.0	0.0	0.0	0.0
<i>N. gastrum var. signata</i>	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. halophila</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. insociabilis</i>	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0
<i>N. kuelbsii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
<i>N. minima</i>	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. modica</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>N. muticoides</i>	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4
<i>N. nyassensis</i>	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>N. platycephala</i>	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. pupula</i>	0.0	0.0	0.0	0.2	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.0	0.6	0.2
<i>N. pupula var. pupula</i>	0.4	0.0	0.0	0.3	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. rotunda</i>	1.1	0.6	0.2	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>N. scutelloides</i>	0.4	0.2	0.4	0.2	0.0	1.2	1.1	1.6	0.8	1.8	1.2	3.3	1.5	2.9
<i>N. seminuloides</i>	0.0	0.2	0.2	1.1	1.6	1.2	1.1	0.4	0.0	0.4	1.0	0.9	0.6	0.2
<i>N. sp.</i>	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0

Table 9. Percent abundances of diatom taxa from core MAL 14 southern Lake Malawi

Sediment Intervals	0-1	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-22	24-26	28-30	32-34
Sediment Midpoint	0.5	2.5	4.5	6.5	8.5	10.5	12.5	14.5	16.5	18.5	21.0	25.0	29.0	33.0
Diatom taxa														
<i>N. subatomoides</i>	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. submiscula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. subrotundata</i>	0.9	0.0	0.0	0.0	0.0	0.5	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. vitabunda</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0
<i>N. zanonii</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>Neidium ampliatum</i>	0.0	0.0	0.0	0.5	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.4	0.0
<i>Nitzschia amphibia</i>	0.0	0.0	2.5	0.5	1.0	0.0	0.0	0.0	0.2	0.4	0.2	0.0	0.0	0.0
<i>N. dissipata</i>	0.7	1.8	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. epiphytica</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. fonticola</i>	2.4	1.6	0.0	0.2	0.0	0.5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
<i>N. frustulum</i>	0.7	0.0	0.0	0.9	0.0	0.0	0.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0
<i>N. inconspicua</i>	0.9	1.4	0.0	0.0	0.0	0.5	0.0	0.2	0.0	1.5	0.0	0.0	0.0	0.4
<i>N. lacuum</i>	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. lancettula</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. leibetruthii</i>	0.2	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>N. nyassensis</i>	2.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. paleacea</i>	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sigma</i>	0.6	0.4	0.0	0.0	0.0	0.5	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. sp</i>	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>N. vermiculus</i>	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Pinnularia mesolepta</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
<i>Rhopalodia gibba</i> var. <i>gibba</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
<i>R. gracilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
<i>Stephanodiscus minutulus</i>	8.9	14.5	8.5	7.6	5.4	0.0	3.0	2.9	1.0	3.1	1.4	0.5	2.3	4.2
<i>S. muelleri</i>	2.6	3.4	8.7	7.0	6.8	0.0	3.2	3.4	8.6	3.5	5.8	6.1	1.7	4.0
<i>S. nyassae</i>	20.1	18.5	18.7	12.7	4.2	0.0	1.1	1.6	1.6	0.4	0.8	0.7	0.2	1.1
<i>Surirella nyassae</i>	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.2
<i>Tabellaria fenestra</i>	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0