RESULTS OF SEDIMENT CORE TAKEN FROM BONY LAKE, BAYFIELD COUNTY, WISCONSIN

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Aquatic organisms are good indicators of a lake's water quality because they are in direct contact with the water and are strongly affected by the chemical composition of their surroundings. Most indicator groups grow rapidly and are short lived so the community composition responds rapidly to changing environmental conditions. One of the most useful organisms for paleolimnological analysis are diatoms. These are a type of algae which possess siliceous cell walls, which enables them to be highly resistant to degradation and are usually abundant, diverse, and well-preserved in sediments. They are especially useful, as they are ecologically diverse. Diatom species have unique features which enable them to be readily identified. Certain taxa are usually found under nutrient poor conditions while others are more common under elevated nutrient levels. Some species float in the open water areas while others grow attached to objects such as aquatic plants or the lake bottom.

By determining changes in the diatom community it is possible to determine water quality changes that have occurred in the lake. The diatom community provides information about changes in nutrient, water color, and pH conditions as well as alterations in the aquatic plant (macrophyte) community.

On 16 August 2007 a sediment core were taken from near the deep area (N46.31600° W91.50255°) of Bony Lake in about 57 feet of water using a gravity corer. Samples from the top of the core and a section deeper in the core were kept for analysis. It is assumed that the upper sample represents present conditions while the deeper sample is indicative of water quality conditions at least 100 years ago. Diatoms were plentiful in the top of the core but there were none in the deeper sections. A second core was extracted on 16 October 2007 from a different area of the lake (N46.31978° W91.51113°) where the water depth was 36 feet. A top and bottom sample was also extracted from this core.

Results

While diatoms were plentiful in the top sections of both cores, they were not found in the bottom sections. This is unusual but it does occasionally happen. This is more common in very hardwater lakes where the higher pH values facilitate dissolution of the siliceous shells of the diatoms. It is less common in softwater lakes like Bony Lake but I have seen it in 2 other softwater lakes. It is unclear why there was dissolution of the diatom shells in Bony Lake but it may be related to the high iron levels in this region of the state. Another lake which had high sediment iron levels also experienced complete dissolution of the diatom shells.

Because of the lack of diatoms in the bottom pre-settlement, section of the core it is not possible to exactly compare the present day diatom assemblage with the historical community. Fortunately, other similar lakes have been cored in the region. Two examples are Whitefish Lake, Douglas Co. and Lake Owen, Bayfield Co. Both of these lakes are deep lakes of high water quality like Bony Lake. It is likely that the diatom assemblage in the bottom of these cores is typical of what would have been present in Bony Lake.

The surface sample of Bony Lake was dominated by the planktonic diatoms *Fragilaria crotonensis* and *Asterionella formosa*. Pictures of these diatoms are shown in Figure 1. These are commonly found diatoms in this region. They were a small part of the diatom community in the bottom samples of Whitefish and Owen lakes. They were found in larger amounts in the surface sample of both of those lakes. The increase in these diatoms most likely indicates a small increase in nutrients, especially nitrogen. Other studies have indicated they respond to increased nitrogen levels. In Bony Lake the increase in nitrogen may be from septic systems or lawn fertilizers.

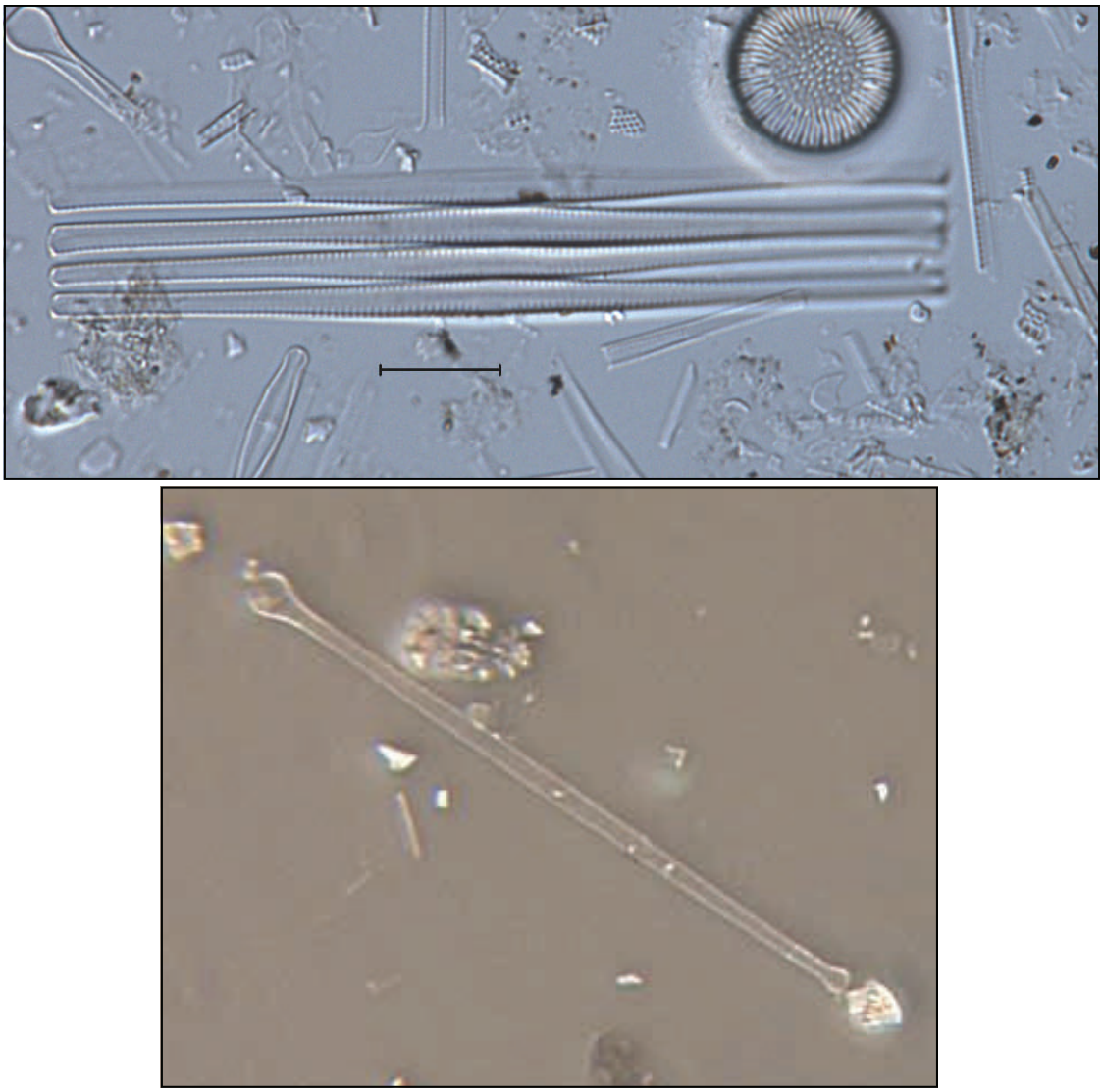

Figure 1. Photomicrographs of the diatoms *Fragilaria crotonensis* (top) and *Asterionella formosa* (bottom). These were the most common diatoms in the surface sample from the core.

Another diatom which was found in the surface sediment sample that indicates small increases in nutrients was *Cyclotella comensis* (Figure 1). This diatom is thought to have been introduced into North America in the 1950s. This diatom was the dominant species in the northern basin of Lake Owen where leachate from a campground was thought to enter the

lake. Because of its relatively low numbers (3%) in Bony Lake it should serve as a warning that septic systems should be monitored around the lake.

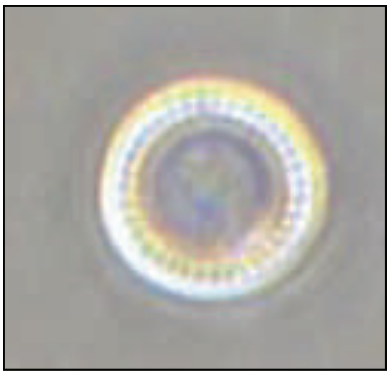

Figure 2. Photomicrograph of *Cyclotella comensis*. This diatom is thought to be an invasive from northern Europe.

It is likely that if diatoms had been preserved in the bottom sample of the core that the most common species would have been *Aulacoseira ambigua*. This is very common in the historical sediments of many lakes in the Upper Midwest, including Whitefish and Owen lakes. It is a planktonic diatom and indicates low nutrient levels.

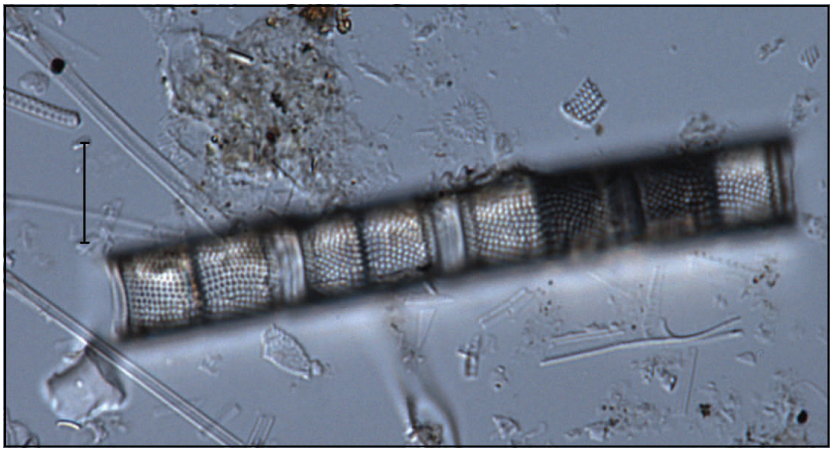

Figure 3. Photomicrograph of *Aulacoseira ambigua*. This likely was the dominant diatom in Bony Lake 100 years ago.

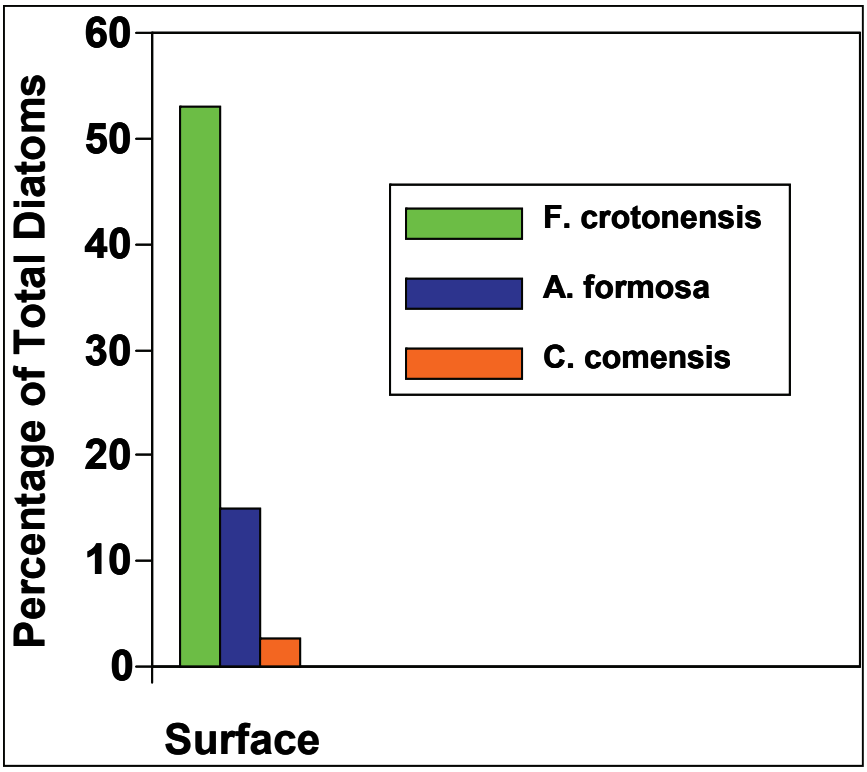

Figure 3. Graph of most common diatoms found in the surface sample. It is very likely historically these diatom would have been present, if at all, in much lower concentrations.

In summary, the surface sample from Bony Lake indicates that the lake is in good water quality condition but there are signs that some changes have occurred. It is likely that there has been a small increase in nutrients, most likely nitrogen. Septic systems and lawn fertilizers are likely sources.

Bony Lake		
Bayfield County		
0-1 cm		
	COUNT TOTAL	
	Number	Prop.
TAXA		
Achnanthes suchlandtii Hustedt	1	0.002
Achnanthidium cf. strictum Reichardt	3	0.007
Achnanthidium minutissimum (Kützing) Czarnecki	1	0.002
Achnanthes spp.	2	0.005
Amphora ovalis (Kützing) Kützing	3	0.007
Asterionella formosa Hassal	60	0.149
Caloneis undulata	1	0.002
Cyclotella bodanica var. lemanica Müller	15	0.037
Cyclotella comensis Grunow et Van Heurck	11	0.027
Cyclotella glomerata Bachmann	1	0.002
Cyclotella michiganiana Skvortzow	6	0.015
Encyonopsis minuta Krammer et Reichardt	1	0.002
Fragilaria cf, capucina var. vaucheriae (Kützing) Lange-Bertalot	3	0.007
Fragilaria crotonensis Kitton	213	0.530
Fragilaria crotonensis var. oregona Sovereign	26	0.065
Fragilaria nanana Lange-Bertalot	6	0.015
Gomphonema spp.	1	0.002
Navicula cryptotenelloides Lange-Bertalot	5	0.012
Navicula tantula Hustedt	2	0.005
Navicula spp.	2	0.005
Nitzschia spp.	2	0.005
Pinnularia gibba var. linearis Hustedt	1	0.002
Pseudostaurosira brevistriata (Grunow) Williams et Round	2	0.005
Rossithidium linearis (Smith) Round et Bukhtiyarova	1	0.002
Sellaphora cf. pupula (Kützing) Meresckowsky	1	0.002
Staurosira construens Ehrenberg	4	0.010
Staurosira construens var. binodis (Ehrenberg) Hamilton	1	0.002
Staurosira elliptica (Schumann) Williams et Round	2	0.005
Staurosirella pinnata (Ehrenberg) Williams et Round	4	0.010
Synedra delicatissima Smith	1	0.002
Synedra demerarae Grunow	1	0.002
Synedra radians Kützing	6	0.015
Synedra ulna (Nitzsch) Ehrenberg	2	0.005
Synedra ulna var. oxyrhynchus (Kützing) Van Heurck	2	0.005
Tabellaria flocculosa (strain IIIp) sensu Koppen	4	0.010
Unknown	5	0.012
TOTAL	402	1.000
Planktonic diatoms		0.881
Nonplanktonic diatoms		0.107
Chrysophyte scales	21	
Chrysophyte cysts	17	
Scenedesmus coenubia	1	