

# CEDAR LAKE, POLK COUNTY SEDIMENT CORE RESULTS

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In order to determine the changes in water quality that has occurred in Cedar Lake since the arrival of European settlers, a sediment core was collected in the northern portion of the deep basin on June 5, 1997. The water depth was 7.1 m and the length of the core 164 cm. The top 100 cm was sectioned into 2 cm intervals while the remainder of the core was sectioned into 4 cm increments. There was no stratigraphy evident throughout the core with the color being a uniform dark brown. The core was dated and analyzed for selected geochemical variables.

The core was dated using the lead-210 method and utilizing the constant rate of supply model. The mean sedimentation rate since the mid-1800's was  $0.036 \text{ g cm}^{-2} \text{ yr}^{-1}$ . This is near the middle of rates measured in 33 lakes that have been analyzed in Wisconsin (Figure 1). More important than the mean sedimentation rate is the changes in the rate that has occurred since the arrival of European settlers about 150 years ago. There was an increase in the sedimentation rate as a result of the initial plowing of the prairie for agriculture (Figure 2) but the sedimentation rate declined during the next 50 years. Beginning around 1960, the rate began to increase and it steadily increased for the next 40 years. The sedimentation rate during the late 1990's was the highest experienced during the last 150 years.

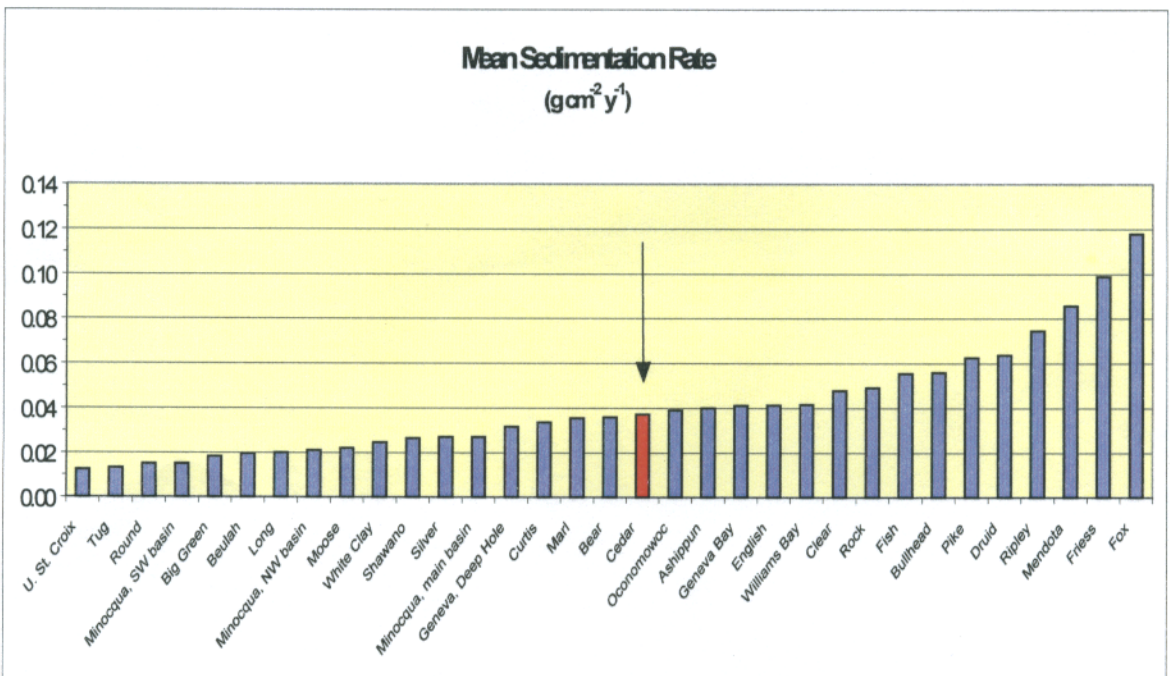
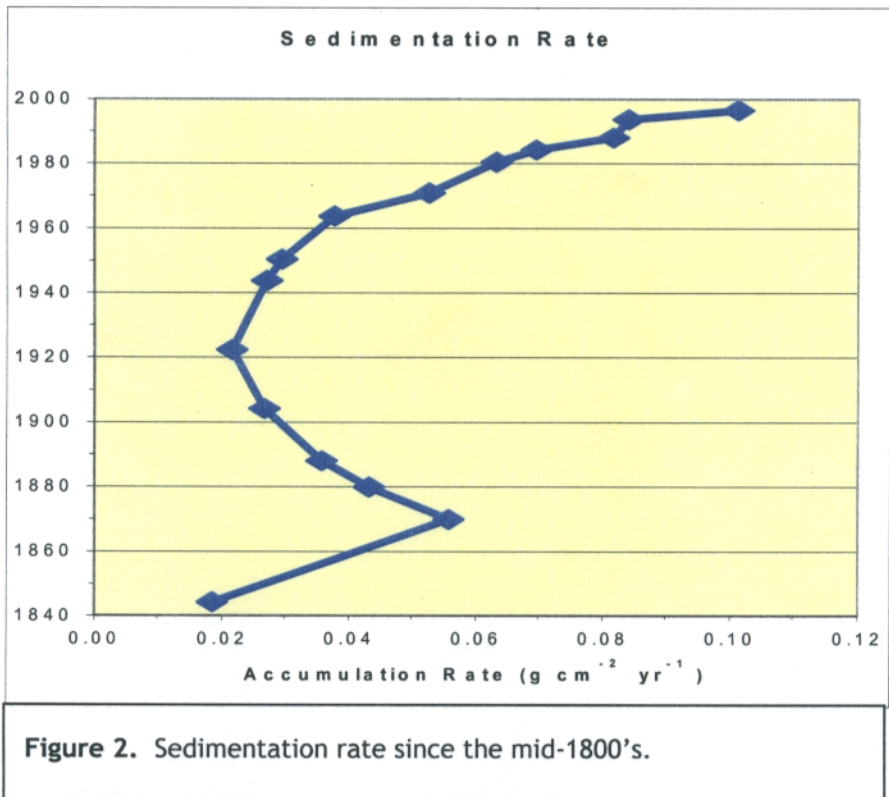
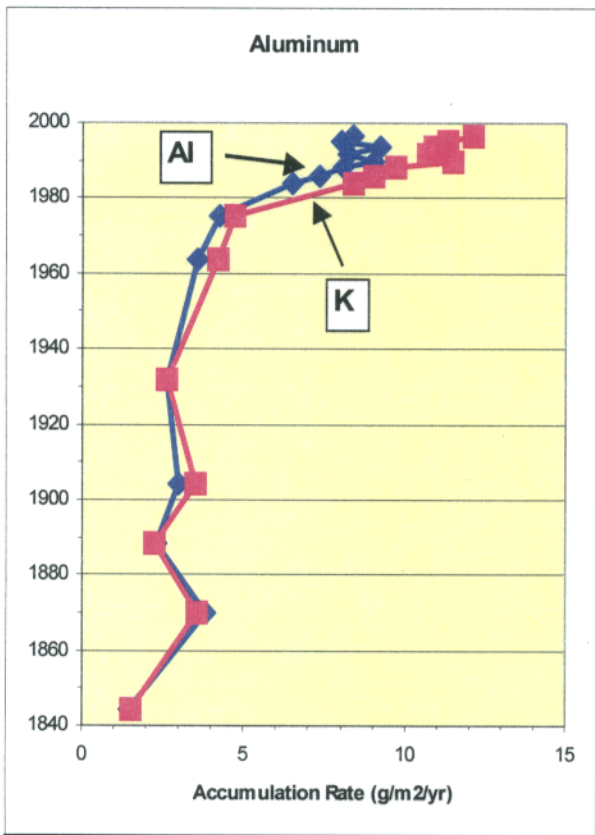


Figure 1. Mean sedimentation rate over the last 150 years of selected Wisconsin lakes.

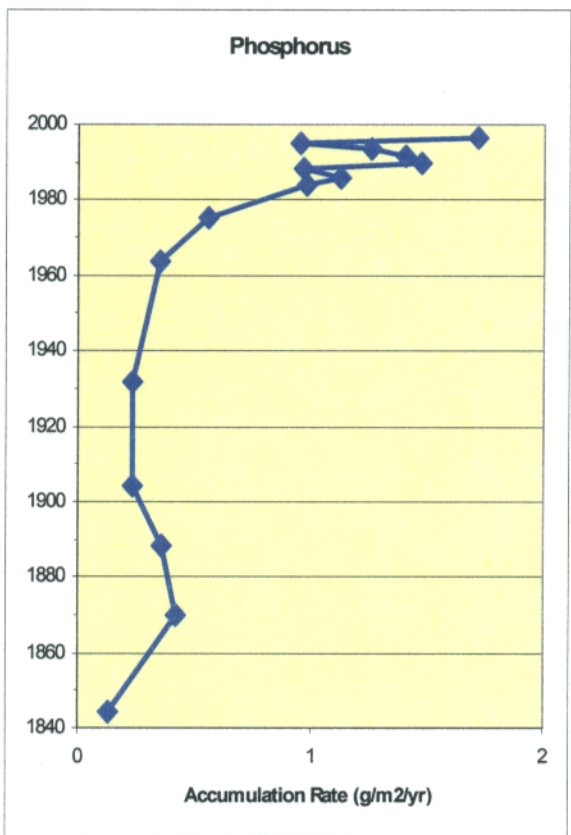


In order to estimate how changes in watershed landuse has affected the lake; the core was analyzed for aluminum, potassium, and phosphorus. The first two variables are an indication of soil erosion since they are a major component of clays. Potassium is also found in the commercial fertilizers. Therefore if the profile of potassium deviates from aluminum it likely is an indication of changes in the application of fertilizer in the watershed.

Both aluminum and potassium accumulation rates were steady from the mid-1800's until about 1970 (Figure 3). Since 1980 these rates have increased significantly. This is an indication of increased soil erosion in the watershed. In the last two decades, potassium has increased more than aluminum, probably as a result of the use of commercial fertilizers. The phosphorus profile is similar to those of aluminum and potassium. While there was a small increase during the initial land clearing in the mid-1800's, by far the greatest increase has occurred since 1970 (Figure 4). Part of the increase in the phosphorus profile is driven by the increased sedimentation rate but phosphorus concentration in the sediment has also significantly increased since 1980. This increased phosphorus probably reflects both increased delivery from the watershed as well as increased internal loading of phosphorus. A further indication of the increased delivery of soil erosion materials and phosphorus is shown in Table 1. A sediment enrichment factor (SEF) of 1.0 indicates a doubling of the current accumulation rate compared with the presettlement rate. Aluminum has increased nearly 6 times while potassium increased more and the phosphorus SEF was 12.



**Figure 3.** Aluminum and potassium are found in soil clays. They are indicative of soil erosion in the watershed.



**Figure 4.** Phosphorus is the most important nutrient causing excessive growth of algae and other plants.

**Table 1.** Sediment enrichment factors. The higher the value the greater the increase in recent times compared with historical levels.

| Aluminum | Potassium | Phosphorus |
|----------|-----------|------------|
| 4.7      | 6.9       | 12.1       |

In summary, the sediment core indicates that Cedar Lake has experienced a significant change in water quality beginning around 1970. This has greatly accelerated during the last 20 years. This is indicated by an increase in the sedimentation rate as well as the phosphorus accumulation rate.