Diatom paleoecology reveals anthropogenically driven changes at Jackson Lake (Wyoming)

John Dilworth, Jefferey Stone, Michael McGlue, Kevin Yeager, Ryan Thigpen
* University of Kentucky, 121 Washington Ave Lexington, KY 40508  † Indiana State University, 600 Chestnut St - Science 159 Terre Haute IN 47809

Abstract
Jackson Lake, located in northwestern Wyoming, is the largest piedmont lake in the Grand Teton National Park and is a crucial reservoir for the upper Snake River Valley. Damming of the lake’s outlet from 1908-1916 resulted in a ~12 m increase in lake level elevation, drastically changing lake surface area and morphology by flooding marginal environments. To investigate paleoecological changes associated with dam installation, we compiled historical hydrologic data, and developed new diatom assemblage and geochemical data on a well-dated deepwater sediment core. This paper presents the termination of the Little Ice Age and external factors of Jackson Lake damming. Diatom assemblages indicate high relative abundance of planktonic species indicative of low nutrient availability, perhaps during a single, chronosequence of partial lake stratification. Following dam construction, Jackson Lake’s basin underwent dramatic transformation to dominance by planktonic species commonly associated with nutrient-rich waters. The diatom flora suggest that since emplacement of the dam, the lake’s nutrient concentrations have increased, likely a result of the change in lake level elevation and a possible reduction in nutrient loss at the outlet, which has been restricted due to dam emplacement. Geochemical indices obtained from the lake’s sediments, show an increase in nutrient concentrations and organic matter content post-dam emplacement, supporting the interpretations of the diatom paleoecology. Changes in Jackson Lake paleoecology and geochemistry have occurred as a direct result of the anthropogenic modifications to the lake’s outlet resulting in lake conditions changing dramatically from post-LIA conditions to present day.

1 Site characterization

Jackson Lake Dam is located on the Snake River at Jackson Lake, located in northwestern Wyoming, is the largest piedmont lake in the Grand Teton National Park and is a crucial reservoir for the upper Snake River Valley. Damming of the lake’s outlet from 1908-1916 resulted in a ~12 m increase in lake level elevation, drastically changing lake surface area and morphology by flooding marginal environments. To investigate paleoecological changes associated with dam installation, we compiled historical hydrologic data, and developed new diatom assemblage and geochemical data on a well-dated deepwater sediment core. This paper presents the termination of the Little Ice Age and the transition into the modern era.

2 Age model

3 Lindavia and Stephanodiscus characteristics

Diatoms: Lindavia and Stephanodiscus
- Dominates in poorer nutrient conditions
- Dominates in the post dam period

4 Diatom Stratigraphy

5 Paleocology

Acknowledgements
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References

Discussion
- D1: Abundance of Lindavia species suggest the lake was generally nutrient deficient. Settlement was minimal during this time. The diatom flora captures the end of the Little Ice Age.
- T2: Succession of Lindavia, Stephanodiscus as dominate species. Suggests nutrient conditions are becoming more eutrophic. Completion of Jackson Lake dam 1916.
- D2: Dominance of Stephanodiscus species in the diatom assemblage. Suggest lake conditions are more eutrophic than conditions from D1.

Conclusions
- The paleoecology is representative of diatom flora from the end of the Little Ice Age and the transition into the modern era.
- Diatom flora suggests more nutrient deficient conditions prior to 1916 CE and more eutrophic conditions post 1916 CE.
- The emplacement of the Jackson lake dam has resulted in Jackson Lake experiencing a eutrophic shift within the oligotrophic state.

Future work
- Sampling from shallow water sections should enable a distinct diatom signal that is presently not present in the deeper core record.
- Collection and analysis of diatom assemblages from longer core will demonstrate how the paleoecology has evolved into the modern era.

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