Sediment Provenance and Weathering in Kongressvatnet, Western Spitsbergen, Svalbard

Maya Wei-Haas (mweihaas@smith.edu) and Robert Newton

Department of Geology, Smith College, Northampton, MA 01063

Introduction

The study area is a cold-based, thrust-faulted, and ice-marginal basin 150 km west of Longyearbyen, Svalbard. The basin has a coldest-month mean temperature of -20°C and an annual mean temperature of -5°C. Kongressvatnet, the largest lake in the area, is 200 m deep and is situated in the center of the Svalbard archipelago. The lake is surrounded by the Abisko and Langfjellet mountains, which form a low barrier to the east of the lake. The basin is long and narrow, with a maximum width of 4 km and a maximum depth of 215 m. The lake has a surface area of approximately 0.82 hectare with a maximum depth of 126 m. The lake is both thermally and chemically stratified and has a summer thermocline at approximately 100 m and a chemocline at approximately 50 m.

Methods

Sample collection:

The lake is a meromictic, oligotrophic lake that is stable on a seasonal time scale. Surface and bottom water samples were collected to determine the chemical composition of the lake. The samples were collected using a lake bottom sampler and a CTD (conductivity, temperature, and depth) profiler. The samples were analyzed for pH, temperature, and salinity using a multiparameter probe. The samples were preserved in 10% formalin and stored at 4°C for further analysis.

Sediment provenance:

X-Ray Fluorescence analysis of the White and Black Fan surface sediments reveals distinct chemical compositions, suggesting that the core sediment chemistry should reflect these areas. Uniquely, the X-Ray Fluorescence analysis of the core sediment chemistry is characterized by a C/D ratio, which is related to the weathering of the sediment. The C/D ratio is a measure of the relative abundance of carbonates and silicates in the sediment.

Sediment weathering:

X-Ray Diffraction analysis of the White and Black Fan surface sediments reveals distinct mineralogical compositions, suggesting that the core sediment mineralogy should reflect these areas. Similarly, the X-Ray Diffraction analysis of the core sediment mineralogy is characterized by a C/D ratio, which is related to the weathering of the sediment. The C/D ratio is a measure of the relative abundance of clay minerals and quartz in the sediment.

Conclusions

1. The core sediments lack the Black Fan chemical signature. Possible reasons for this include:
   a) The presence of carbonates and coal in the catchment area, which causes the core sediments to contain higher levels of carbonates.
   b) The presence of calcite precipitation and/or periods of calcite dissolution, which causes the core sediments to contain higher levels of calcite.

2. The core sediments contain organic matter, which suggests a period of increased organic input and decomposition.

Future Research

Due to the presence of carbonates and coal in the catchment, dating of sediments is necessary. Advances in dating techniques, such as 14C dating and 210Pb dating, could be used to determine the age of the sediments.

Acknowledgments

This research was supported by the National Science Foundation, the Andrew W. Mellon Foundation, and the Smith College Geology Department. The support from the Mellon Mays Foundation and the Smith College Geology Department is gratefully acknowledged. The authors would like to thank Maya Wei-Haas and Robert Newton for their contributions to this project.