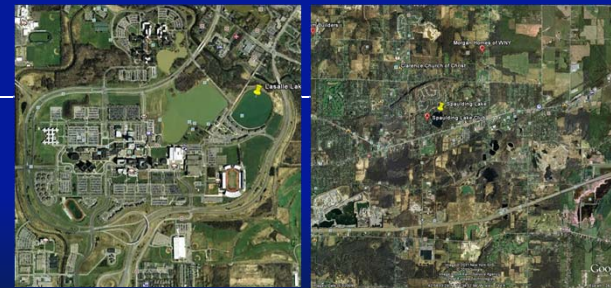




Analysis of Anions in Local Water Bodies

*Yun Zheng, Dr. Valerie Frerichs, Dr. Kenton Stewart

The University at Buffalo Department of Chemistry



Abstract

The sustainability of a healthy ecosystem received greater attention due to recognized climate and industry-related changes. Ion content can serve as a marker of industrial and climate changes, as well as ecosystem health, therefore it is critical to analyze the ion contents in targeted lakes. With enhanced analysis techniques, lower level of critical ions can be monitored. A new Ion-Exchange Chromatographic method has been developed and validated for the simultaneous analysis of inorganic anions from fresh water samples from lakes and streams throughout WNY mostly from 2008 to present. Concentration of two critical markers, chloride and sulfate will be presented from four of these samples sites. Results indicate that even lakes within close proximity have markedly different anion content over a period of three years, indicating different chemistries in these waters that can affect biological and sedimentary changes. With this information, we can begin to determine the local factors that have caused differences in the dynamics and chemical conductivity of these local waters.

Objectives

- Analyze variations in concentrations of anions in local water bodies
- Quantify concentrations of anions from 2008 to present, using Ion-Exchange Chromatography
- Identify possible factors that cause the changes in chemistry

Background

The ion content may serve as a marker of industrial changes, as well as ecosystem health

- Excess chloride concentrations increase the rate of corrosion of metals in water and, when above 250mg/L, cause a detectable taste in water
- Sulfate concentrations above 250mg/L generate a noticeable taste
- In excess of 400mg/L, sulfates impair the potability of water and cause gastrointestinal effects.

Background Cont'd

Four water bodies are included in the research project: Lake LaSalle East, Lake LaSalle West, Ellicott Creek, and Spaulding Lake. All of them are in WNY, most at UB north campus.

•LaSalle East & LaSalle West:

- Artificial lakes
- Located at University at Buffalo North campus
- Dug to have more fill to prevent many of UB buildings from occasional flooding
- Connecting to Ellicott Creek



•Ellicott Creek:

- Natural stream
- Feeds Niagara River/Niagara Falls

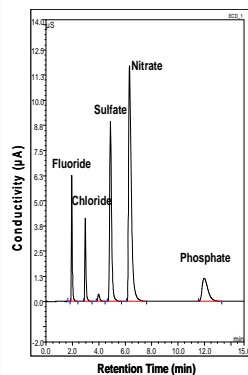


•Spaulding Lake:

- Quarry and fed by ground water
- Depth of 13m
- Approximately 2.2 miles away from University lakes

Materials and Method

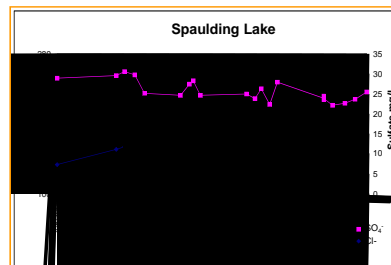
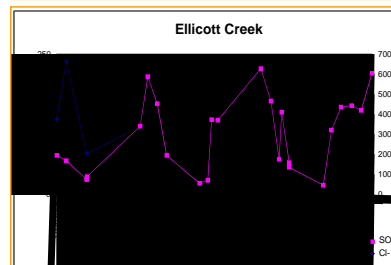
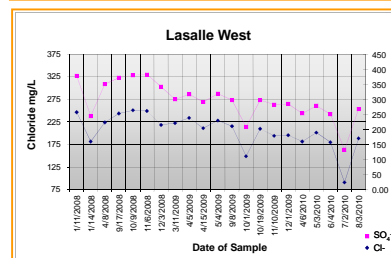
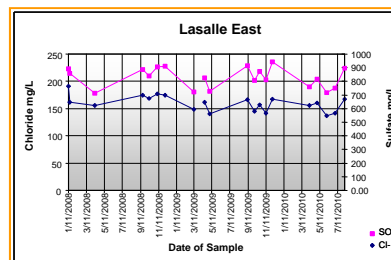
- Flow Rate: 1.5ml/min
- Eluent: 25mM KOH
- Isocratic elution
- Conductivity detection
- 100 mAmp
- 10 µL injection



Targeted ions	Standard Calibration Solution Concentration Range (mg/L)	Quality Control Solution Range (mg/L)
Chloride	20-1920	160-1600
Sulfate	10-960	82-820
Fluoride	0.125-12	0.5-10
Nitrate	0.125-12	0.5-10

Result

The water of the target lakes and stream have anion concentration that are below EPA concerns, but some concentrations need watching in the period of three years



Discussion

- Anion concentration vary substantially in the two lakes (LaSalle East and LaSalle West) over a period of three years, even though the lakes are closed to each
- Spikes and troughs on the graphs: indicators of some of the change
 - Concentrations of chlorides in the winter may reflect the addition to dissolution of deicing salt
 - Concentration of chlorides may also reflect the dilution by rains and melting snow in spring

Conclusion

- Development and validation of a method to quantify anions in water samples -chloride and sulfate
- Some of the water bodies are below the level of EPA concerns, but some concentrations need watching
- Close proximity of three water bodies does not guarantee equal concentrations

Further Study

- We hope to continue:
- Further analyses of anions concentration in the water bodies
 - To identify factors that cause chemical changes
 - To analyze other different kinds of anions, such as fluorides, nitrates
 - To collect more water samples from other lakes in WNY

Acknowledgements

- Dr. Kenton M. Stewart
Professor in Biological Science Dept, UB
- Ivonne M. Ferrer
Graduate Student in Chemistry Dept, UB
- Life Technologies, INC.
- McNair Scholars Program

Reference

http://www.who.int/water_sanitation_health/dwq/fulltext.pdf