

**BCA 2007 Spring Meeting**  
**XRF Program**  
**Thursday Morning – Environmental Issues**

11.00 N. G. Marsh Department of Geology, University of Leicester

**Climate records – lurking in the small print? What's at the bottom of your lake?**

Much of the fine detail of the earth's varied climate over its geological history has been inferred from the variations in the stable isotope abundances of oxygen from the preserved debris of planktonic animals and plants. A substantial amount of research has utilised the oxygen recovered from carbonate skeletal remains due to the ease of liberating the CO<sub>2</sub> with dilute mineral acids. However in many horizons of interest carbonate materials have not been preserved. Fortunately several planktonic and other aquatic creatures utilise silica to produce their skeletal matter such as diatoms, sponges and phytoliths. Unfortunately despite many recent improvements in cleaning techniques it is still very difficult to completely remove silica containing contaminants e.g. tephra, silt particles and clays from the biogenic silica. Most of these samples are recovered from boreholes and individual samples are taken from each fine layer discernible e.g. varves. Allowing for the stable isotope determinations the remaining sample amounts are very small, often <<100mg.

A reliable analytical technique capable of determining a wide range of elemental data is required to enable the determination by mass balance calculations of different contaminants in the system. X-Ray Fluorescence analysis of fused glass beads is an established technique that can produce the high quality data required. Conventionally larger sample amounts are used – can the quality of performance be repeated with such small samples? Advances in instrument performance, fusion flux purity and crystallinity plus re-visiting some of the original concepts in XRF geochemical analysis all have a part to play.

The results will be illustrated by the example of the research on Lake Tilo in Ethiopia that started this process off. The techniques developed are now being applied to other similar research projects requiring detailed high quality small sample analysis. The technique has also exposed potential shortcomings in the record of oxygen isotope variation from the carbonate record where LOI determinations alone are commonly used to estimate the biogenic carbonate contamination.

It appears that you need an XRF as well as a Mass Spectrometer to get reliable oxygen isotope based temperature records.