Variation in Trace Element Geochemistry of Freshwater Mussels Lampsilis, Lasmigona complanata, and Potamilns alatus from the Cannon River, Faribault, MN

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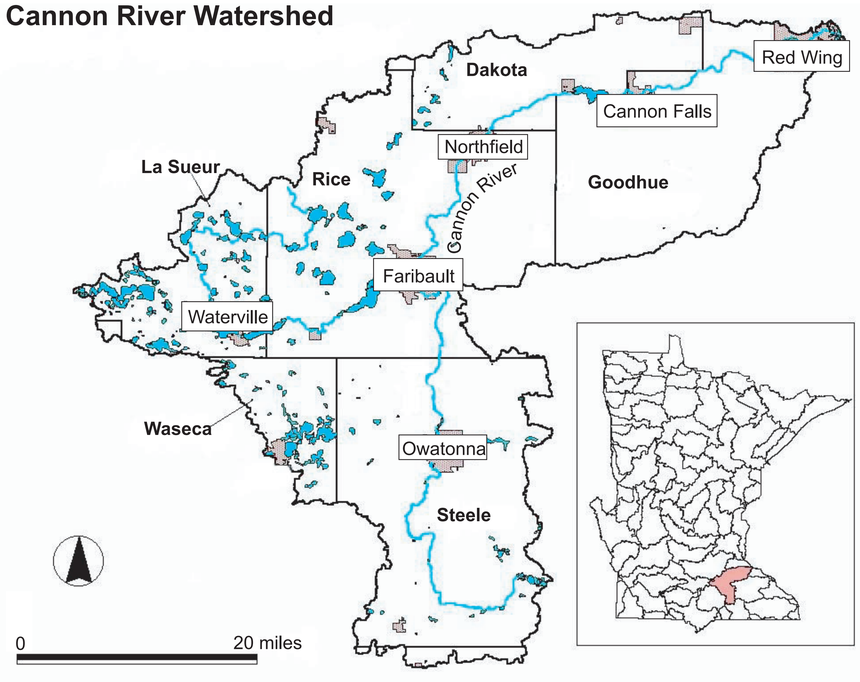
Introduction

The shells bivalves, whose skeletons are built of successively deposited layers of carbonate that accumulate over the organism's lifetime can be used as proxies for variations in the living conditions of these organisms. Growth layers can be grouped into discrete bands with distinct thickness, color and chemical composition. This banding occurs on both macroscopic and microscopic levels revealing details about the organism and its environment. Changes trace element compostition across microscopic layers within seasonal growth banding reflects changing environmental parameters on a more detailed scale over the life span of a given mollusc. Although compositional patterns can reflect a mix of environmental and biological factors, high resolution studies of compositional changes offer a preliminary understanding of how these two factors are recorded in freshwater molluscs.

Cannon River Watershed



The map, displaying a section of South Central Minnesota, shows the areas in which the sample clams were collected. tTwo samples were designated for use in the microprobe analysis (CRML5 and CRML1A). Three samples, one of each species present in the study area, were designated for use in the bulk analysis portion of the study (CRML5, CRMP3 and CRMW2A).

Photos of the sample clams prior to processing show the inner and outer shells.

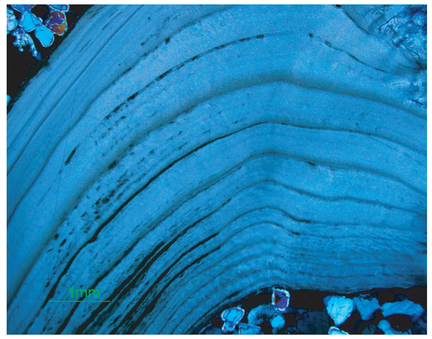
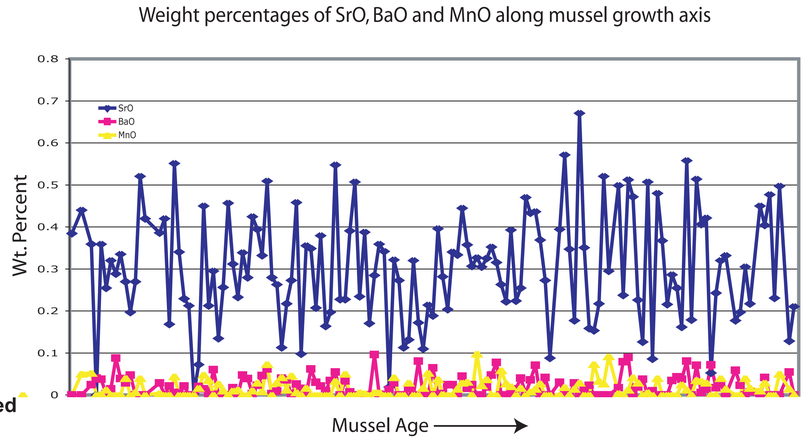


Photo micrographs of the sample clam in thin section show millimeter scale banding.

Methods

Samples were prepared for bulk chemical analysis by grinding whole shells into a fine powder. Results of bulk chemical analysis were examined and trace elements appearing in consistently measurable amounts were designated for further study under the microprobe. All microprobe analyses were done using a Cameca SX-50 Electron Microprobe. Transects were analyzed running perpendicular to growth banding along the length of the thin section of shell.

Data & Results



A representative transect from CRML1A showing weight percentages of SrO (blue), BaO (pink) and MnO (yellow).

Discussion

Trends in Sr variability should be interpreted with caution. Sr/Ca ratios may be affected by seasonal changes in the environment. Because we are unable to link Sr values to seasonal banding, we are unable to relate the fluctuations in strontium content to seasonal environmental changes. Changes in Sr values across growth banding in mussel species that have a high amount of mantle metabolic activity is affected by the rate at which Ca is pumped across the mantle . Therefore, growth banding in species with more mantle metabolic activity exhibits variations in Sr that do not necessarily reflect any environmental trend. Due to limitations we cannot draw any strong conclusions about the role of biological factors versus environmental factors in controlling the incorporation of Sr.
Concentrations of Ba in freshwater clams have been known to reflect the level of dissolved Ba in the given environment, however, no specific seasonal pattern in the amount of dissolved Ba in freshwater environments has been identified. Instead ba levels are often associated with exogenous factors such as input from industrial activity. Our data does not suggest major or systematic fluctuation in Ba and Mn levels across time. Since it is likely that Ba and Mn values in a shell are directly related to the amount of these trace elements in the surrounding environment, the relatively consistent values we received for both elements can be used to explain a constant level of Ba and Mn in the environment.

Conclusions

Freshwater mollusc (lampsillis) shells from the Cannon River record variation in the levels of Sr, Ba, and Mn. This variation does not appear to follow any clear, systematic trend. While other studies have identified and explained some of these fluctuations in terms of environmental and biological factors, our study was too limited to draw similar conclusions. Additional research is needed in order to verify such relationships for our data.