Evaluating the Use of a Marine Paleo-temperature Proxy in the Chesapeake Bay

Temperature and environmental records on a decadal time scale are critical for understanding and predicting the behavior of climate phenomena such as the North Atlantic Oscillation (NAO). With very high sedimentation rates, coastal areas may provide baseline records on short time scales. However, there are few high-resolution temperature records available for coastal areas due to the difficulty in applying proxies to these ever-changing environments. In addition, advances in this area are difficult due to the impact of anthropogenic activity on the environmental conditions over the last 300 years and thus on the response of certain climate and environmental proxies.

One such proxy is the $^{37}$K index, a well-established paleo-temperature proxy for open-ocean waters. My research has focused on evaluating the application of the index by assessing its utility in sediment samples from the Chesapeake Bay. The Chesapeake Bay is the largest estuary in the Eastern U.S. and was chosen because it is a well-studied system that has undergone significant environmental changes since European settlement and is also affected by short-term climatic variations such as the NAO. Results suggest that while the $^{37}$K index seems to be affected only by temperature variations in the open ocean, it also seems to be affected by nutrient concentrations in coastal areas. There are strong correlations between $^{37}$K, temperature and nitrate concentrations in Chesapeake Bay particulate matter and evidence suggests that lower-than-normal $^{37}$K values are related to elevated nutrient concentrations. Down-core analysis shows a significant decrease in $^{37}$K values starting around 1700 AD, the time of settlement and deforestation. These decreases have been attributed mainly to elevated nutrient input to the Chesapeake Bay inferred from other proxy studies.