Characterizing Western Atlantic SST and Ocean Variability: Replicating and Extending a ~440-yr-long Coral-based SST Reconstruction at Bahamas

Delia Oppo, Geology & Geophysics
George P. Lohmann, Geology & Geophysics

Our goal was to replicate our published >400-yr-long SST reconstruction from the Bahamas, which takes advantage of a correlation between coral linear-extension (growth) rates and sea surface temperature (SST) to estimate past SST (Saenger et al., 2009). This grant funded fieldwork near San Salvador Bahamas, to collect coral cores to replicate and perhaps extend our published record. Multiple coral records are needed to infer SST with confidence. Our coral coring was successful, and several new long coral cores from the Bahamas are now at WHOI.

With NSF funds from a collaborative grant with Anne Cohen, we generated CT-scans of the whole coral cores. Whole cores provide a large cross section approximately perpendicular to the growth axis, facilitating estimating extension rate. However, perhaps because the skeleton of these corals is very dense, the annual bands were not well resolved in our initial the CT-scans. We have since cut the coral cores in half, and the cores are in the CT-scanning queue. It is still our plan to generate extension rate estimates on the new coral cores.

What were the primary questions you were trying to address with this research? (Or, if more appropriate, was there a hypothesis or theory that you were trying to prove or disprove?)

Are coral extension rate records from the Bahamas reproducible, and do they provide a measure of SST variability?

What have you discovered or learned that you didn't know before you started this work?

Aside from the practical lesson that this species of coral is best scanned in core halves (we hope, as we don't have the results yet), we have not made scientific progress. However, progress should be quick once we have high quality digital images.

What is the significance of this research for society?

High resolution coral SST records help place recent warming in the context of natural variability. This helps us understand whether today's conditions are similar to those that the earth experienced in the recent past, or are unique. In addition, our work provides a longer-term perspective on the persistence of multidecadal climate modes and whether factors such as global warming and ocean acidification are more or less significant than natural ocean/climate variability, for the growth of the major reef-building corals in the Atlantic.

When and where was this investigation conducted? (For instance, did you conduct new field

research, or was this a new analysis of existing data?)

The grant exclusively funded fieldwork offshore San Salvador, Bahamas.

What were the key tools or instruments you used to conduct this research?

Large hydraulic drill.
Post-fieldwork: CT scanning and computer software.

Is this research part of a larger project or program?

Yes this is part of a larger effort with Anne Cohen to understand which oceanographic and climatic factors significantly influence coral growth rates in the Atlantic and to apply this knowledge to reconstruct past ocean conditions. For example, CT scans on the corals (and some costs associated with shipping) were funded by our joint NSF grant.

What are your next steps?

After the new CT-scans are available, we will generate new extension rate records to compare to our published record. This will give us an idea of how reproducible our published reconstruction is.

Have you published findings or web pages related to this research? Please provide a citation, reprint, and web link (when available).
Please suggest or provide photographs, illustrations, tables/charts, and web links that can help illustrate your research.

Please provide some biographical information, such as place of birth, degrees earned, significant awards or honors, research interests, reasons why you became a scientist or why you are interested in this line of research, and any personal interests, hobbies, or details that you are willing to share.

I always enjoyed math and the outdoors. However, the decision to become a scientist involved serendipity and good fortune. I am especially interested in using marine archives such as corals and sediment to contribute to our understanding of modern oceanography and climate, and ongoing climate change.