Paleoclimatology: Data Collection and Analysis

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College Park Scholars Academic Showcase, May 4, 2017

What is Paleoclimatology?
Paleoclimatology is like stepping into an environmental time machine; a way for scientists to go back in time and study past climates. They do so through paleoclimatic proxies, or geologic records of physical, chemical, and biological materials that are analyzed for their relationship to modern environmental forcings. We can acquire paleoclimatic records from many materials found on our Earth, including corals, tree rings, ice cores, etc. For my project, I worked in a paleoclimatic laboratory learning how to process data by stable isotope analysis. I then examined Vostok ice core data that has undergone similar stable isotope analysis processes to understand what the data means and how it is useful on a global scale to make educated predictions about our past, current, and future climate.

Responsibilities and Activities

In the Paleoclimate Colaboratory ....

- Derive proxy records of tropical hydrometeorology and sea surface conditions using tree and coral measurements.
- Responsible for sample preparation, weighing of standards, and planning sample lists for future runs.
- Responsible for instrument operation/maintenance for continuous flow carbonate and organic sample isotope analysis using the Costech-IRMS and Isoprime machines, as well as using MatLab to process the data.
- Calibration and validation of sample data on international reference scales.

Outside of the laboratory...

- Analyzing and researching Vostok ice core data using skills I obtained from working in the Paleoclimate Colaboratory.
- Defining and understanding glacial and interglacial periods within the data, and how deuterium measurements can constitute these trends.
- Recognizing and understanding impurities in the data and visualizations, and developing teaching methods to highlight these aspects.
- Developing a lab based on data analysis and background understanding of Vostok data that relates to climate change for an “Introduction to Geology” 100 level lab manual.

What is Vostok and why is it important?
In January 1998, at the Vostok station in East Antarctica, collaboration between the United States, Russia, and France, recovered the deepest ice core to date, reaching a depth of 3,623m. Because of the depth of this ice core, we are able to examine climate farther into the past than ever before by deriving atmospheric trace-gas compositions from many of its layers.

Impacts and Relationship Between Paleoclimatology and Vostok
The processes I used in the Paleoclimate Colaboratory to derive proxy records are very similar to the processes scientists used to derive the ice core deuterium (a stable isotope of hydrogen) data. Therefore, I was able to interpret the stable isotope analysis of the Vostok data that was already completed and graph/provide corresponding questions that would help other geology students understand paleoclimatology on a more basic level.

Future Work
I believe it is an important part of science and data analysis to present the data in a way that is understandable to anyone who may come across the subject. Being a student, I have faced the difficulties of understanding and interpreting large data sets, understanding why they are important, and drawing conclusions and making accurate assumptions about the data. I hope in the future I will be able to develop better and more uniform ways of processing and teaching complex data and their backgrounds to those of all skill levels and interests.

Acknowledgments
I would like to thank Dr. Michael Evans for giving me the opportunity to work in the Paleoclimate Colaboratory this semester. I would also like to thank Alex Lopatka and Tracey Centorbi for co-developing my project and taking much time out of their weeks to assist me. Finally, I would like to thank Dr. Holtz and Dr. Merck for their consistent advising and help throughout the past two years in SGC.

Sources

Figure 1: Redfern, S. (2013, August 13). Ice Core Data Supports Ancient Asteroid Impact. Retrieved April 18, 2017, from https://www.bibliotecapleyades.net/ciencia/ciencia_asteroids_comets70.htm
Figure 4: Vostok station location on a map of Antarctica.
Figure 5: Picture of Vostok drilling station in East Antarctica.