ASRJ
Atlantic Student Research Journal

Seek Onward: A Journey Delving Into Paleoecology

November 7, 2017

Fragments of the past linger with us preserved in, among other things, pollen, ancient tree resin, ice, permafrost and sedimentary rocks. These are the bookmarks of biological life that stretch billions of years into the past and contain valuable insights into the Earth's formative changes. The array of scientists who study these phenomena are often considered under the domain of Paleoecology. To study these changes, the science of Paleoecology investigates the patterns and systems of a past environment as seen through the lens of fossils, elemental records and sediment. It is common to wonder, how has our environment changed and how have we changed with it? What initiated or facilitated these changes? These intertwined questions are complex and comprehensive answers demand that Paleoecologists utilize all available pieces of ancient environments; only then offering a glimpse into the past. Paleoecology rises to the challenge of many foundational questions we may have and informs us of our biological past. I will briefly provide some background for research in this field and focus on the research of two professors within the University of New Brunswick, Dr. Les Cwynar and Dr. Audrey Limoges.

Recent Articles

An Interview with Dr. Chris McGibbon

Causes and Consequences of the Miramichi Salmon Decline

Heart Health & Research: Discovery of Electrical Conductivity Between Healthy and

Featured Researchers

Daniel He

Damaged Heart Tissue

Seek Onward: A Journey delving into Paleoecology

Changing how Discoveries are Made

Addressing the question of how things have changed over time, it is crucial to acknowledge the near unfathomable expanse of geologic time. The history of this planet is dominated by particularly tedious stretches. ~4 billion years over which liquid coagulates into rock, volcanoes and meteorites consistently barrage the land and air, Cyanobacteria undertake the huge project of overhauling the Earth's atmosphere, and so on it goes. Given more time, the changes on the planet increasingly became more interesting and as best we can reconstruct, the rapid mobility of organisms, the development of hard bodies that fossilize and vast diversification of species were among these changes. As the geologic time clock ticked its way into the more recent past (~2.6 million years ago), where major continental shifts had already occurred, we now know that changes in the Earth's orbit helped unleashed shifts on the planet's surface in the form of cyclical ice ages. The title for this period is very originally named as the "Quaternary" period, essentially meaning "fourth" to describe rocks that were clearly younger than the previously described "tertiary" rocks. The Quaternary encompasses the recent past and the biological history of our direct forbears. This period is rich in biological life and filled with a history of environmental change, a strong reason why the Quaternary is of great interest to researchers.

Categories

Science

Innovation & Technology

Engineering & Mathematics

Image by Caitlin Sedwick, retrieved from "What Killed the Woolly Mammoth?". *PLoS Biology* 6 (4): e99. DOI:10.1371/journal.pbio.0060099. Image used under a CC BY 2.5 image license.

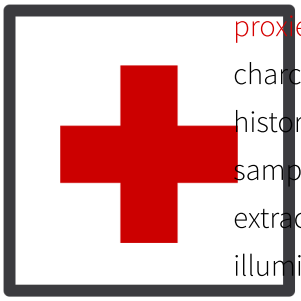
A self-described "accidental botanist" Dr. Les Cwynar has conducted much of his research in pursuit of explanations to changes in vegetation from forces of changing climate. Dr. Cwynar employs traces of biological, chemical and physical activity in an ecosystem that has preserved in one form or another; these traces are referred to as

Daniel has worked ir number of different fie including exploring Biomedical Engineer and Electromyograpl

For More informatic about Daniel, visit th article chronicling his at UNB.

photo by: Adam Travi

NOMINATE A RESEARCHER



Health & Wellness

proxies. Some of these proxies include pollen, spores, plant fossil and charcoal. At first glance, it may not sound so intriguing to know the history of your favorite shrubbery or pine tree. But for example, sampling of preserved vegetation combined with information extracted from sampled sediment, Dr. Cwynar and colleagues have illuminated a previously unrecognized cold snap across North America that lasted ~250 years; Fredericton's very own Killarney Lake was incorporated in this study. I will admit my cheeky grin when I was informed this cold snap is referred to as the "Killarney Oscillation". The significance of this oscillation is the connection it appears to have had with a major climate shift, in which much of North America rapidly returned to near-glacial conditions. This is more startling given the planet, as a whole, appeared to have already been on its way to a warmer, more hospitable climate regime like what we observe today. Clearly, rapid changes in climate are possible and the preserved history of vegetation is a powerful indicator of how our generous atmospheric regulators have responded to these shifts. Human influenced climate change is a dire issue we must address; the nature of Dr. Cwynar's work stresses the importance of understanding how vegetative communities respond to altering climate conditions. Observations of how rapidly climate can alter, raises questions such as; will animal populations be able to respond quickly enough, or at all, to the migration of habitable forest zones? How will an increase in rampant wild fires reshape our forests? Will changing temperature regimes open a chasm for more invasive species? Perhaps only time will tell, but research in paleoecology regards identifying relationships among nature's major revisions as critical to understanding by what mechanism, or what combination of mechanisms, climate has changed.

Dr. Audrey Limoges is a recent addition to the teams of research scientists at UNB. Dr. Limoges brings her experience in Micropaleontology and in September of this academic year was the inaugural speaker at UNB's weekly seminar series, presented through the faculty of Biology. It was in this lecture that Dr. Limoges detailed the basis of her current research pursuing what micropaleontology has to offer in the face of alarming changes to the concentration of Arctic sea ice. Specifically, Dr. Limoges searches for the microbes that had once been frozen within sea ice whilst also inspecting the chemical, biological and physical proxies of the surrounding

ecosystem. Extracting long tubes of sediment (sediment cores) from the ocean floor reveal assemblages of fossils that tell a story. The available research on the ecology and behavior of certain species of microorganisms such as certain Diatoms, Dinoflagellates and Foraminifera, help us recognize patterns among the fossils that the melted sea ice had contained. Patterns such as changes in ocean currents or surface water temperature can be shown from the abundance or lack thereof, in certain species of microorganisms. The overarching intention to all this grave digging, similarly to that of Dr. Cwynar, is the pursuit of mechanisms through which major climate influences and perhaps global climate itself has changed in the past. Uncovering evidence of change to the Earth's systems in the recent past, in our case the Quaternary, can inform us on how it may and eventually will change in the future. Rest in peace microbes; I think not.

Any reader being introduced to this topic may very well ask, why the Quaternary? Much of Paleoecological research that intends to describe changes in the past to infer in some way, the changes we may anticipate seeing, study the Quaternary. It is our most recent past and it was the stage for the most immediate ancestors of all species alive today. Furthermore, the stage we now occupy is comprised of the literal and figurative bedrock of the past. If we wish to further our knowledge of the grander shifts to the Earth, we are also studying the world in which human beings have come to dominate. I do not wish to be overly romantic but I believe Michael McCarthy encapsulates this sentiment beautifully in stating,

“Our unbreakable bond with the natural world is the legacy of 50,000 generations of the Pleistocene - it lies buried in our genes. It might now be covered over by 500 generations of civilization, but it is not destroyed. For nature is where we came from and evolved. It is where the human imagination formed and took flight, not in cities, in front of computers or in cars.”

Let us not forget where we, and everything else has come from, the past. It is our responsibility to unearth its most revealing characteristics; Seek onward.

Author

Liam MacNeil

Entering his fourth year of Biology at the University of New Brunswick, Liam has broad scientific interests strongly geared to the overlap and interplay of academic disciplines and finds most of his excitement in the emerging field of astrobiology. He aspires to pursue his education and to remain in the research sciences. Liam is a long distance runner, rock climber and an utmost admirer of the works of James Baldwin.

References

Hamilton, C. Hamilton, R. (2008). The Geologic Time Scale. Retrieved from: http://scienceviews.com/dinosaurs/geologictime.html

Cho, R. (2015). Climate Change Poses Challenges to Plants and Animals, Earth Institute, Colombia University. Retrieved from: http://blogs.ei.columbia.edu/2015/02/03/climate-change-poses-challenges-to-plants-and-animals/

Graham, S. (2000). Milutin Milankovitch. Retrieved from: https://earthobservatory.nasa.gov/Features/Milankovitch/

Levesque, A.J. Mayle, F.E. Walker, I.R. Cwynar, L. (1993). A previously unrecognized late-glacial cold event in Eastern North America. Nature, 361(18). 623-626.

McCarthy, M. (2016). The Moth Snowstorm: Nature and Joy. Hooder & Stoughton General Divison, John Murray Publisher Ltd.

Pickrell, J. (2006). Timeline: Human Evolution Retrieved from: https://www.newscientist.com/article/dn9989-timeline-human-evolution/

Riebeek, H. (2006) Paleoclimatology: Explain the Evidence. Retrieved from: https://earthobservatory.nasa.gov/Features/Paleoclimatology_Evidence/

Speer, B. (2009) Introduction to Cyanobacteria. Retrieved from http://www.ucmp.berkeley.edu/bacteria/cyanointro.html

Speer, B. Waggoner, B. Smith, D. (2009). The Archean Era and the Headean. Retrieved from:http://www.ucmp.berkeley.edu/precambrian/archean_hadean.php

The Younger Dryas (2011). National Oceanic and Atmospheric Administration, U.S Department of Commerce. Retrieved from: https://www.ncdc.noaa.gov/abrupt-climatechange/The%20Younger%20Dryas

USGS Paleoclimate Research (2016). Proxies. Reston, VA. Retrieved from:

https://www2.usgs.gov/climate_landuse/clu_rd/paleoclimate/proxies.asp

Walker, M. (2005). Quaternary Dating Methods. International Library of Archaeology.

What is Micropaleontology? (2006). Retrieved from: http://www.micropress.org/what.html

In Science Tags UNB Biology Society, Biology, Paleoecology, Les Cwynar, Liam MacNeil, ecology, climate change

Share

← Heart Health & Research: Discovery of Electrical …

Changing how Discoveries are Made →