HERDMAN SYMPOSIUM 2020

"Climate Variation Throughout Earth's History"

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UNIVERSITY OF LIVERPOOL

Climate Variation Throughout Earth's History 2020

HERDMAN SYMPOSIUM PROGRAMME

Saturday 22nd February

9.30 Arrival (Tea, *Coffee and Soft Drinks Available*)

10.00 Welcome: Alice Glover & Harriet Williams (Symposium secretaries), Janine Kavanagh (Staff representative), Megan Udy & Abigail Plimmer (President and Vice President)

10.05 Professor Bridget Wade (UCL): "What can sea floor sediments tell us about past ocean productivity and climate?"

10.50 *Coffee Break*

11.20 Professor Laura Robinson (Bristol): "Using deep sea corals to understand the last deglaciation"

12.05 Dr Chris Stevenson (Liverpool): "Abrupt climate change in the Cenozoic: A vision for our future?"

13.00 *Lunch*

13:45 Dr Katrien Van Landeghem (Bangor): "Using sound waves to investigate how ice streams retreat"

14.30 *Coffee Break*

15.00 Professor Mark Maslin (UCL): "The Human Planet: How we caused the Anthropocene"

15.45 Dr Will Hutchison (St Andrews): "Unlocking geological archives to understand volcanic impacts on climate and society"

16.30 *Final Remarks & Wine Reception*

Professor Bridget Wade – (UCL) 'What can sea floor sediments tell us about past ocean productivity and climate?'

TALK ABSTRACT: The composition and distribution of deep-sea sediments is the result of a multitude of climatic, biotic and oceanic conditions relating to biogeochemical cycles and environmental change. During the Paleogene, two critical but contrasting boundaries occurred, one characterised by an interval of extreme warmth (Paleocene/Eocene, ~56 million years ago) and the other by global cooling (Eocene/Oligocene, ~34 million years ago). Here I utilize the extensive sediment archives of the International Ocean Discovery Program (IODP) and its predecessors to construct deep-sea maps of the dominant sediment type across these two boundaries. The ocean sediment distribution shows significant divergence across the Paleocene/Eocene and Eocene/Oligocene boundaries, and in comparison to the modern. I will explore the mechanisms that resulted in different carbonate and biosiliceous sediment distributions and the relationship with the carbon cycle and climatic change.

ABOUT THE SPEAKER:

Previous work:

- Undergraduate at University of Leeds
- PhD at University of Edinburgh
- Worked in USA for 5 years
- Her research has involved fieldwork in Europe, Africa, and the Caribbean/Gulf of Mexico.
- She participated as a shipboard scientist on several ocean research expeditions as well as onshore drilling by the International Continental Scientific Drilling Program at the Chesapeake Bay Impact Structure and the Tanzania Drilling Project.

Current work:

- Professor of Micropalaeontology at University College London.
- Uses microscopic fossils and their chemistry to examine changes in the oceans over the last 65 million years.

Professor Laura Robinson – (Bristol) 'Using deep sea corals to understand the last deglaciation.'

TALK ABSTRACT: Deep in the oceans we find beautiful, abundant fields of corals. They live without light and yet they still rely on the sun for energy. The trace metal and isotopic composition of these corals can reveal information on water temperature, circulation rates and the amount of carbon or nutrients in the water in the past. This information is valuable for understanding the interactions of the atmosphere short timescales. By using the chemistry of uranium-series dated fossil coral skeletons collected from the Pacific, Southern Ocean and Atlantic we have the potential to examine the way in which the oceans changed on a common timeframe. In this talk we will look at the current status of deep-sea coral research and how their geochemistry can be used to understand more about how the oceans have behaved during the rapid climate transitions of the deglaciation.

ABOUT THE SPEAKER:

Previous work:

- PhD in Geochemistry at the University of Oxford
- Moved to the California Institute of Technology where she first learnt about the existence of deep-sea corals

Current work:

- Laura Robinson is a geochemist and oceanographer whose research focuses on understanding the climate history of the oceans.
- Leads research teams at Woods Hole Oceanographic Institution and the University of Bristol using deep-submergence tools to map, image and collect deep-sea corals from across the global oceans.
- She and her team use geochemical analyses to extract information on how these corals survive at great depths, and to reconstruct information on the history of the oceans.
- This information is used to understand the interactions between the deep sea and rapid changes in global climate.

Dr Chris Stevenson – (Liverpool) 'Abrupt climate change in the Cenozoic: A vision for our future?'

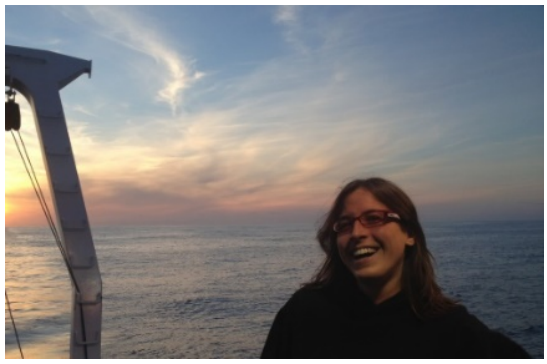
TALK ABSTRACT: Our climate is changing and it's getting warmer. What effects will this have on the Earth and the ecosystems that inhabit it? The only way to predict the future is from what we know from the past. In this talk I'll show you how we use carbon and oxygen isotopes to understand the chemistry (and climates) of ancient atmospheres and oceans. Using these isotopes, I'll whisk you through the changing Earth's climate over the past 40 million years (Cenozoic Period): a hot greenhouse to cold icehouse climate. The climate was governed by a complex interplay of long-term and short-term factors; from the arrangement of the continents that dictated oceanic circulation and mountain erosion processes, through to ice cover albedo and even microscopic plankton in the oceans. Certain factors generate feedback loops, which can trigger abrupt run-away temperature changes. The Cenozoic saw a gradual cooling from a greenhouse climate to an icehouse climate with several abrupt warming and cooling events to boot. Some of these abrupt events share similarities with what is happening in today's modern climate, and can provide us with insights as to what might happen to our future climate.

ABOUT THE SPEAKER:

Current work:

- Chris is a sedimentologist with expertise in deep-water clastic systems.
- His research interests explore the processes that underpin sediment-laden submarine flows and how these processes link to deposits in the geological record.
- His work attempts to bridge the gap between what we can model in the laboratory with what we know happens in the natural world.
- This involves conducting flume tank experiments, numerical models and both onshore and offshore field work.
- His research also has application within the hydrocarbon section and has close connections with industry geoscientists.

Dr Katrien Van Landeghem – (Bangor) 'Using sound waves to investigate how ice streams retreat'



TALK ABSTRACT: Present-day polar ice sheets terminate via ice streams in oceans, seas or fjords. Ice streams drain ice sheets, and when they are marine-terminating, the ice streams are additionally influenced by marine environmental changes and could promote rapid ice stream retreat and collapse. If the large ice sheets become unstable, drain and melt, we face quick sea level rise on a global scale, flooding our coastal regions and causing accelerated climate warming. This presentation explains how sound waves can be used to detail both past and present-day ice stream dynamics. To learn from past ice streams, we look close to home, documenting the evolution of a well-preserved glacial landscape that formed beneath the Irish Sea Ice Stream (ISIS). This paleo-ice stream drained the former British-Irish Ice Sheet (BIIS) after its maximum extend around 24,000 years ago. We infer from our analyses that if the ice stream eroded into bedrock during its advance, this influenced how it subsequently retreated. To monitor present-day ice stream dynamics with sound waves is more difficult as the processes are ongoing and the bed is covered with ice. This presentation is a sneak preview of our recent work in Antarctic fjords, where we were able to look at annual changes in ice front morphology and position using sound waves.

ABOUT THE SPEAKER:

Previous work:

- MSc at Ghent University
- PhD at University College Cork

Current work:

- Katrien is now senior lecturer in Marine Geology and Geophysics at Bangor University
- She works in the School of Ocean Sciences, focussing her research on seabed morphodynamics to gain a better knowledge of sedimentary bedform dynamics, ice stream retreat mechanisms and seabed habitat suitability linked to both processes.
- She also investigates enhanced sediment transport processes for harvesting offshore renewable energy or for flood prevention.

Professor Mark Maslin FRGS, FRSA – (UCL) 'The Human Planet: How we caused the Anthropocene'

TALK ABSTRACT: There is general scientific agreement that human activity has been a geologically recent, yet profound, influence on the Earth System. Humans have in fact become a geological superpower on a par with plate tectonics or a meteorite impact. It has, therefore, been proposed that we should refer to the present, not as within the Holocene Epoch but instead as within the Anthropocene Epoch. To some the Anthropocene symbolises a future of superlative control of our environment. To others it is the height of hubris, the illusion of our mastery over nature. Whatever your view, just below the surface of this odd-sounding scientific word, the Anthropocene, is a heady mix of science, philosophy, religion and politics linked to our deepest fears and utopian visions. By tracing the development of human society through its five major stages (hunter-gatherer, agricultural, mercantile capitalism, industrial capitalism and consumer capitalism) and documenting the dramatic and significant increase in the impact of humans on the Earth Mark Maslin shows what the new epoch means for the future of humanity, the planet and life itself.

ABOUT THE SPEAKER:

Current work:

- Mark Maslin is a Professor of Earth System Science at UCL.
- He is the director of the London NERC Doctoral Training Partnership, a Royal Society Wolfson Research Scholar, a Royal Society Industrial Fellow working with Rezatec Ltd a company he co-founded which is now valued at between £30-50 million.
- Prof. Maslin is a leading scientist with expertise in global and regional climatic change and has publish over 160 papers in journals such as *Science, Nature, and The Lancet*.
- He has been awarded grants of over £60 million, from Research Councils, Industry, NGOs, Charities and the UK Government.
- His areas of scientific expertise include causes of past and future global climate change and its effects on the global carbon cycle, biodiversity, rainforests and human evolution.

- He also works on monitoring efforts to mitigate and adapt to climate change using remote sensing and the development of international and national climate change policies.

Literature:

- He has written 11 books, over 50 popular articles including blogs for *The Conversation* which have been read over 1.8 million times.
- Maslin appears regularly on radio and television including: BBC One Climate Change: The Facts, Dispatches, Newsnight, Time Team, The Today Programme, In Our Time, the Briefing Room as well as the BBC, Channel 5, CNN, BBC World Service, and Sky News.
- His books include 'Climate Change: A Very Short Introduction' (OUP, 2014), 'The Cradle of Humanity' (OUP, 2017) and the bestseller 'The Human Planet' co-authored with Simon Lewis (Penguin, 2018).
- He was one of the lead authors on the 2009 Lancet report "Managing the Health effects of climate change' and is part of the annual Lancet Countdown on health and climate change whose latest report was published in November 2019.
- He was included in Who's Who for the first time in 2009.

Dr Will Hutchison – (St Andrews)
'Unlocking geological archives to understand volcanic impacts on climate and society'

TALK ABSTRACT: Explosive volcanic eruptions loft prodigious quantities of ash, gas and aerosol into the Earth's atmosphere and can have severe impacts on human health, climate and the global economy. Volcanic eruptions have impacted climate and human society throughout history, and our modern globalized world remains exceptionally vulnerable to large volcanic events (as demonstrated by the 2010 Eyjafjallajökull eruption in Iceland). Thus, a key priority for volcanology is to provide a detailed understanding of the magnitude, frequency and impacts of past volcanic events so that we can improve societal resilience to future eruptions.

In this presentation I will explain how volcanologists use geological archives to obtain detailed information about past eruptions. I will initially focus on how we combine traditional geological mapping and cutting-edge geochemistry to unravel the eruptive history at regional scale. I will illustrate this with examples from poorly studied, yet densely populated, volcanic regions (such as East Africa). I will then discuss the challenge of building up a high-quality record of volcanism at the global scale. I will show that the polar ice cores offer the best opportunity for achieving this and will discuss the new geochemical tools we are using to understand the source and eruptive style of past volcanic events. Ultimately, these new methods have the potential to transform our understanding of large magnitude volcanic eruptions and through interdisciplinary interactions (with historians and climate scientists) we will better understand the climate change and societal upheaval that will be wrought by future volcanism.

ABOUT THE SPEAKER:
Previous work:

- During his PhD at the University of Oxford Will studied active volcanoes in the East African Rift and used a variety of techniques to explore structural controls on volcanism, volcanic degassing, causes of ground deformation and the impacts that large explosive eruptions had on our hominin ancestors.

Current work:

- Will's research is focused on understanding the causes and consequences of volcanic eruptions in order to better predict and mitigate their impacts on human society.
- Will joined the University of St Andrews as a postdoctoral researcher and worked as part of the EU funded HiTech AlkCarb consortium developing novel geochemical tools to understand the magmatic processes that form critical metal deposits.
- He was recently awarded a prestigious UKRI Future Leaders Fellowship and will continue to develop new geochemical tools to understand volcanic processes.
- His fellowship aims to calibrate and validate a new isotopic method for fingerprinting volcanic eruptions in ice cores archives. This will allow Will to constrain the magnitude and frequency of past eruptions and help pinpoint their source location. By working closely with climatologists and historians he aims to address major societal questions about the societal impacts of climate-changing eruptions.

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