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HERDMAN SYMPOSIUM

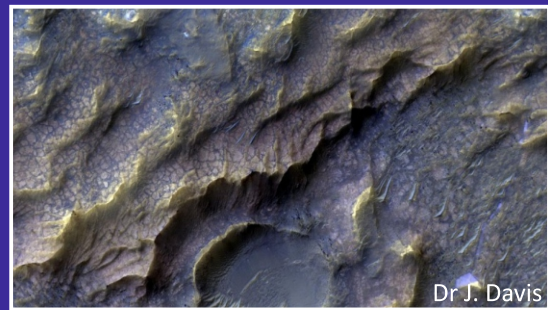
INSIDE OUT

16/02/19

10.00-16.45

Wine reception: 16.30-17.30

LOCATION:
CENTRAL TEACHING HUB
UoL BUILDING 221



Dr J. Davis

Prof. J. McElwain

Prof. C. Ballentine

Inside Out 2019

HERDMAN SYMPOSIUM PROGRAMME

Saturday 16th February

09:30 *Arrival (Tea, coffee & soft drinks available)*

10:00 Welcome: Millie Burridge & Dan Harrison (Symposium secretaries), Jim Marshall (Staff representative), Bradley Falcus & Kate Foster (President and Vice President)

10:05 Chris Davies- (Leeds) 'Powering Earth's Magnetic Field over Geological Time'

10:50 *Coffee Break*

11.20 Chris Ballentine- (Oxford) 'Old Water in Ancient Continental Crust- Why the excitement!'

12:05 Yan Lavallee- (Liverpool) 'New Frontiers in Volcanology and Energy'

13:00 *Lunch Break*

13:45 Jennifer C. McElwain- (Trinity College Dublin)- '400 Million Years of Lost Landscapes and Climate'

14:30 *Coffee Break*

15:00 Sarah Boulton (Plymouth)- 'When did the Moroccan High Atlas Mountains get high?'

15:45 Joel Davis- (Natural History Museum) – 'The Surface of Mars: Ancient and Modern Processes on the Red Planet'

16:30 *Final Remarks & Wine reception (Wine and soft drinks available)*

Chris Davies- (Leeds) 'Powering Earth's Magnetic Field over Geological Time'

TALK ABSTRACT

The fact that Earth has possessed a global magnetic field for at least the last 3.5 billion years provides fundamental insight into the dynamics and evolution of our planet. The field is generated some 2800 kilometres below our feet in the liquid core by turbulent motion of molten iron. Keeping the core in motion requires a substantial and long-lived power source. In the standard model, the power is derived from the slow cooling of the whole Earth: heat lost from the surface drives slow motion of the solid mantle, which causes heat extraction from the core and subsequent motion of the liquid iron. Initially the core was entirely liquid, but cooling eventually led to freezing at Earth's centre and growth of the solid inner core, which provides additional power to maintain the magnetic field. However, recent advances in our understanding of the properties of liquid iron alloys at the extreme pressure and temperature conditions that exist in Earth's deep interior have called the standard model into question. In particular, it seems that a new power source may be needed to explain the existence of the magnetic field before inner core formation. Now, an emerging alternative class of models advocate that solids formed at the top of the core early in Earth's history, creating chemical anomalies that provided much-needed power to the early magnetic field. In this talk I will discuss these different scenarios and their implications for our understanding of the dynamics and evolution of Earth's deep interior.

ABOUT THE SPEAKER

Previous study:

- BSc, Computer Science, University of Leeds
- MSc, Computational Fluid Dynamics, University of Leeds
- PhD, Geophysics, University of Leeds

Previous institutes:

- Scholar at the Scripps Institution of Oceanography, San Diego

Current institute:

- Associate Professor in Theoretical Geophysics and NERC Independent Research Fellow, University of Leeds

Current work:

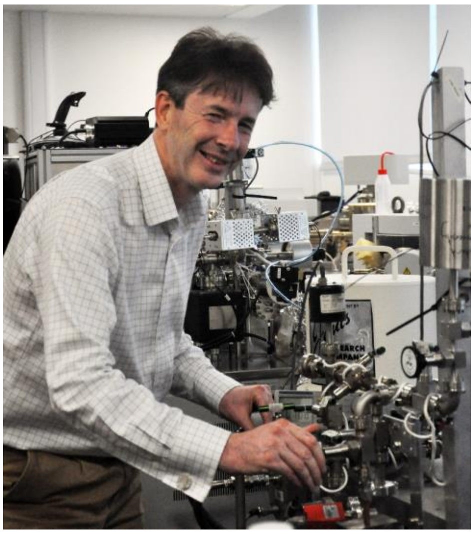
- Focuses on a new energy budget for the Earth's core

Notable achievements:

- Winton Capital Award (G) of the Royal Astronomical Society (RAS) of the United Kingdom
- Doornbos Memorial Prize of the Committee on Studies of the Earth's Deep Interior (SEDI)

Chris Ballentine- (Oxford) ‘Old Water in Ancient Continental Crust- Why the excitement!’

TALK ABSTRACT



When we think of the crystalline rock that lies underneath sedimentary basins, we don’t immediately think ‘water’. If you are mining an ore seam in the crystalline continental crust, you nevertheless still find water in the rock fractures and fluid inclusions. Typically, the fracture fluids are highly saline and often contain gases at high pressure that present a substantial danger to miners. They are also scientifically fascinating. The water can be incredibly old, up to billions of years in age. The water reacts slowly with mafic (magnesium and iron rich) rocks to form hydrogen, and simple hydrocarbons like methane. These gases are available to some microbes as an energy source and can support subsurface microbial communities that have evolved in the dark. These provide an analogue environment for understanding how life can survive and evolve on planets where the surface no longer supports life. Because of the age of the water, natural levels of U and Th in the rock decay and produce helium that forms a substantial part of the gas composition. In most of the deep crust where these gases are uniformly distributed they form little of commercial interest. Processes that heat large volumes of ancient crust can mobilise these hydrogen and helium rich fluids and transport them to the near surface - and concentrated in trapping structures similar to oil and gas that make commercial exploitation viable. Developing exploration strategies, related to continental rifting, to identify hydrogen gas fields (clean energy source) and new sources of helium (a $6billion/year industry) has made understanding how these ancient waters form in the continental crust, chemically evolve, and migrate to the surface – very exciting indeed.

ABOUT THE SPEAKER

Previous study:

- PhD, University of Cambridge

Previous institutes:

- Worked in Paul Scherrer Institute and ETH Zurich (Switzerland)
- University of Michigan
- University of Manchester

Current institute:

- Chair of Geochemistry, University of Oxford

Current work:

- Using noble gases to understand how natural gas fields form inside the Earth

Notable achievements:

- Won the ENI Award in 2016 for “New Frontiers in Hydrocarbons”
- A past president of the European Association of Geochemistry
- A member of the board of governors for the American Geophysical Union
- Won the Geological society of London Bigsby medal for significant contributions to geology.

Yan Lavallee- (Liverpool) 'New Frontiers in Volcanology and Energy'

TALK ABSTRACT

Magmatism and associated volcanism are central in defining the Earth as a habitable planet. Yet today, with approximately 800 million people living with 100 km of an active volcano, it becomes imperative to monitor and examine volcanic systems, and to explore ways forward. Indeed, magma represents the next frontier and opportunity in the exploration of our planet. Why so? It is the step necessary to improve volcano monitoring strategy and increase our preparedness and resilience to volcanic hazards, and because magma offers a tremendous amount of energy.
Magma transport and eruption are associated with a range of monitored signals, which can be deciphered through field and laboratory experiments. Integrating what we've learnt from extensive geological surveys of volcanic provinces, field monitoring of volcanic unrest, and spectacular laboratory testing of rocks and magma under controlled conditions, we will paint a new portrait of volcanic activity and discuss how this experimental knowledge lends opportunities to access magma safely and reap its benefits as we enter a new generation of energy demands and resilience strategy.

ABOUT THE SPEAKER

Previous study:

- Bachelor, Earth and Planetary Studies, McGill University, Canada
- Masters, Space Studies, University of North Dakota, USA
- Doctorate, Volcanology, Ludwig Maximilan University of Munich, Germany

Previous institutes:

- University of Strasbourg, Guest Professor, 2012
- Ludwig-Maximilan University of Munich, Guest Professor, 2013 – 2015
- Michigan Technical University, Honorary Professor, 2016

Current institute:

- Chair of Volcanology and Magmatic Processes, University of Liverpool

Current work:

- Experimental volcanology and geothermal research

Notable achievements:

- James B. Macelwane Medal (American Geophysical Union 2017)
- Wager Medal (International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) 2017)
- Keynote Speaker on "Towards New Magma Monitoring and Energy Frontiers" (Invitation to Speak, Academia Europaea 2017)
- Thermo-Fischer Award (Volcanology and Magmatic Study Group (VMSG) 2016)

Jennifer C. McElwain- (Trinity College Dublin)- '400 Million Years of Lost Landscapes and Climate'

TALK ABSTRACT

Have you ever wondered what the world looked like 300 million years ago or 200 million years ago or any time in the past for that matter? Was the whole world forested or did vast savannah grasslands spread from pole to pole? What did the world smell like? How hot was it? What was the predominant colour of the landscapes from the past? How extreme were the most extreme environments of the past and could life survive in these hostile environments? What do lost landscapes and past climates and past life tell us about our future? Can we use the past as a key? This talk will delve into the science and art of lost landscapes. It will take the audience on a fast faced journey over the past 400 million years of earth and climate history using fossil plants excavated from Greenland, North America, Yorkshire, Aberdeen and Ukraine. The stories behind the science of high arctic Greenland expeditions will also be revealed.

ABOUT THE SPEAKER

Previous study:

- BA, Botany, Trinity College Dublin
- PhD, Royal Holloway University of London

Previous institutes:

- Curator of fossil plants, Field Museum of Natural History in Chicago, 2000–2006
- Post-doctoral researcher, University of Sheffield, 2003 – 2006
- Professor, University College Dublin, 2006 – 2017

Current institute:

- 1711 Chair of Botany at Trinity College Dublin's School of Natural Sciences and Head of Botany

Current work:

- Using both fossil plants and modern experimentation to investigate how fluctuations in atmospheric composition and climate have influenced plant evolution and ecology throughout Earth history

Notable achievements:

- Elected a member of the Royal Irish Academy in June 2017
- Awarded for Excellence in EU research by the President of Ireland in 2012
- Board member of the Mary Robinson Foundation for Climate Justice and a member of the Royal Irish Academy Committee on Climate Change and Environmental Science

Sarah Boulton (Plymouth)- ‘When did the Moroccan High Atlas Mountains get high?’

TALK ABSTRACT

The uplift of mountain belts can have profound effects on precipitation patterns and moisture distribution, potentially resulting in the development of orographic rain shadows and aridification. Understanding the timing and magnitude of rock uplift can also inform models of plate tectonic evolution and allow understanding of the underlying mechanisms of uplift. However, deriving an understanding of the timing and pattern of rock uplift is difficult, as is determining the palaeoelevation for a mountain range at a given point in time. In this talk, I will present a range of direct and proxy data (structural, sedimentologic, isotopic, geomorphic) to explore the topographic development of the Moroccan High Atlas Mountains from the Eocene to the present day.

ABOUT THE SPEAKER

Previous study:

- MSci, Geology, University College, London
- PhD, University of Edinburgh
- Post-graduate certificate in Teaching and Learning in Higher Education, University of Plymouth

Current institute:

- Associate Professor in Active Neotectonics, University of Plymouth

Current work:

- Cenozoic (Miocene to present day) tectonics of the Eastern Mediterranean region especially concerning active faulting, palaeoseismology, tsunamis and geoarcheology. As well as the geodynamic and palaeogeographic evolution of the area and, in particular, the Messinian Salinity Crisis.

Notable achievements:

- Fellow of the Geological Society of London
- Member of the British Geomorphological Research Group
- Member of the American Geophysical Union
- Fellow of the Higher Education Academy
- Current chair of the South West regional group of the Geological society.

Joel Davis- (Natural History Museum) – 'The Surface of Mars: Ancient and Modern Processes on the Red Planet'

TALK ABSTRACT

Mars is currently a hyperarid, cold desert, but since the 1970s, we have seen evidence for past liquid water. Today, we are in a golden era of Mars exploration – a combination of satellites, landers, and rovers provide us with a plethora of evidence for both past and present water on Mars. Low erosion rates have preserved geomorphological indicators that suggest rivers, lakes, and seas may have covered much of the surface of the Red Planet ~ 3.7 billion years ago and intermittently since then. The nature of exactly how Mars transitioned from this "warm and wet" climate to a cold and dry desert remains unclear. Despite the current instability of water at the surface, Mars continues to be modified by numerous processes including geologically recent glaciers and active sand dunes.

ABOUT THE SPEAKER

Previous study:

- MSci, Earth Sciences, University College London
- Caltech, for a study abroad programme
- PhD Geology, University College London

Current institute:

- Postdoctoral research assistant, Department of Earth Sciences, Natural History Museum

Current work:

- Using remote sensing data from satellites to further understand the geology of ancient and modern Mars