



Natural Systems and Processes Poster Session 2012

in

Great Hall, Wills Memorial Building

Monday 19th March, 2-5 pm



Presenters and Posters - Abstracts

1. Peter Adamson

Research Masters

Namacalathus: The evidence for the oldest skeletonised animal

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2. James Armstrong

1st Year PhD

Stem cell priming with Protein-Surfactant Bioconjugates

Stem cells offer great potential in regenerative medicine, but clinical applications are hindered by certain issues; including hypoxic environments, untargeted delivery and immune rejection. Addition of functional proteins to the cell surface may help to overcome these issues.

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We have constructed protein-surfactant conjugates of enhanced green fluorescent protein(eGFP), in anticipation that the surfactant may facilitate insertion of proteins into stem cell membranes.

3. Mariosol Correa Ascencio

2nd Year PhD

Pulque, the Meso-American Elixir of Life. An Organic Residue Analysis Approach

The identification of absorbed organic residues of alcoholic beverages in archaeological material represents a big challenge because its main components are sugars which usually do not preserve within time. However, the complicated fermentation process involved in the production of pulque might lead to the signature of this prehispanic drink. Herein, we present a novel proxy for the identification of absorbed organic residues of pulque in archaeological ceramics of the ancient city of Teotihuacán (150 B.C.-700 A.D.).

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4. Beth Atkinson

3rd Year + PhD

Restoration of Native Woodland

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5. Chuck Bacon

2nd Year PhD

Mineralogy and Controls on Pb and Cd Mobility in Contaminated Soils in the Mendip Hills

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6. Alice Banks

Research Masters

Drug Discovery in Mushrooms

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7. James Barnett

Research Masters

Multiple Function Morphology: Combining Camouflage and Aposematism

Camouflage and aposematism have long been thought of as mutually exclusive strategies in predator defence but recent studies have shown a continuum of conspicuousness to be a more accurate model. By combining aposematism and

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crypsis into one morphology defended and mimic species can minimise costs from both strategies. The survival benefits of spatial frequency derived distance dependant dual signalling of aposematism and crypsis are tested using artificial moths and natural avian predators. A combined strategy where a prey is cryptic from a distance but aposematic at close proximity is shown to be more successful in terms of survival. The optimal visual radius of a prey species will be a product of the costs and benefits associated with aposematism and camouflage; as influenced by defence strength and the predator assemblage.

8. Calum Baugh

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2nd Year PhD

Quantifying the Role of the Amazon Floodplain in Routing Surface Water

The Amazon river basin contributes ~20% of global surface water river discharge to the oceans but very little is known about how much of this is routed through the floodplain. Accurately understanding how much surface water is routed through the Amazon floodplain is important for two reasons: 1) Carbon Dynamics - flooded areas can contribute large amounts of CO₂ and CH₄ to the atmosphere, 2) Ecosystem Services - flooding is important for the survival of wetland ecosystems. Currently there is large uncertainty in how much surface water is routed by the Amazon floodplain, estimates range from 5% to 30%. This research aims to reduce this uncertainty through the development of a computer model of flooding processes whose results are tested against in-situ and satellite observations of flooding in the Amazon basin.

9. Harriet Benbow

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1st Year PhD

QTL Mapping and Grain Yield in Wheat

Using SNP markers found in the wheat genome I have created a genetic linkage map for a population of 202 lines from a cross between two doubled haploid lines of the wheat varieties Avalon and Cadenza. Using available yield data from these lines I have mapped 4 quantitative trait loci onto the linkage map. I eventually hope to identify candidate genes involved in yield.

10. Ravneet Bhuller

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Research Masters

Bioinformatic Identification and Analysis of the Excretory/Secretory Gene Products of the Genome of *Strongyloides ratti*

11. Charlotte Bickler

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2nd Year PhD

Evolutionary Responses in Habitat and Ecological Networks

In a rapidly changing world, conservation management must focus on preserving ecological and evolutionary processes in an increasingly modified landscape. Adaptation provides opportunity for population persistence yet may itself be limited by anthropogenic drivers such as habitat fragmentation. Evolutionary responses to abiotic factors such as temperature have been recorded globally across broad taxa; however knowledge of their role in biotic interactions is still limited. Understanding the genetic and demographic parameters which promote or limit adaptation will improve our ability to predict species' responses to environmental change.

This project explores the impact of phenotypic variation and evolutionary change within and between populations of the cowslip *Primula veris* in the Avon Wildlife Trust's 'Living Landscapes' habitat network. *P. veris* is an obligate outbreeder fully dependent on foraging insects, commonly found in fragmented UK grasslands. Preliminary data indicates significant divergence in floral traits between sites over a small geographical area. Families from these sites are being grown in a common garden experiment to quantify levels of heritable variation. Molecular analysis will assess population genetic structure. This research should aid in understanding the potential role of evolution in maintaining connectivity between populations and biotic interactions.

12. Victoria Bird

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Research Masters

Blowfly Strike and Resistance

Ovine cutaneous myiasis, also known as sheep blowfly strike, is currently found on about 75% of farms in the UK and affects 1.4% of ewes and twice as many lambs (Bisdorff 2006). Consequently this makes it the most prevalent

ectoparasite disease and of high veterinary importance. It is caused by the larvae of the blowfly *Lucilia sericata* feeding on the epidermis of sheep and lambs. If the infestation is light and treated quickly the sheep will recover. However if a heavy infestation is able to take hold the effects can be detrimental to the health of the sheep. Like with many diseases there is the risk of resistance developing to the insecticides used to treat blowfly strike. In Australia and New Zealand this has already become an issue.

13. Verity Bonnell

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3rd Year + PhD

Investigating the Control of Stomatal Development and Function in Wheat and Barley

14. Fran Bragg

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2nd Year PhD

Modelling the Pliocene Climate and Carbon Cycle

The mid-Pliocene (3.3 to 3 million years ago) was the most recent sustained period of Earth history which is believed to have been significantly warmer than the present and with higher atmospheric concentration of carbon dioxide. Understanding the climate system of this time may provide valuable insights into possible future climate change. A substantial global database of proxy information, PRISM3, has been assembled describing the land topography, ice sheet extent and topography, vegetation and sea surface temperatures to facilitate study of this period. These data are used as boundary conditions to the UK Hadley Centre Model, providing a highly relevant test of the model's ability to simulate a warm climate and insights into the differences in the operation of the primary climate system mechanisms as predicted by the simulation.

15. Victor Brena-Medina

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3rd Year + PhD

Morphogenesis on Plant Root Hair Initiation: A Reaction-Diffusion Perspective

16. Catie Butler

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2nd Year PhD

Natural Chemical Tracers on the Greenland Ice Sheet

Measuring chemical changes in glacial meltwater over a summer season is a natural method of deducing the structure and evolution of the subglacial drainage system, which is challenging to observe directly. Monitoring meltwater chemistry can be used as an alternative to, or in conjunction with, artificial tracer methods such as injecting dye or gas into moulins on the ice and measuring their transit times and dispersion.

The impact of climatic forcing on subglacial hydrology is currently poorly understood, and chemical changes can provide an indication of varying residence times, rock:water ratios and biological activity in subglacial meltwater. High resolution temporal sampling is needed to capture short-lived events, potentially caused by lakes on the surface of the ice sheet draining, which can lead to rapid changes in transit times indicating drainage system evolution to a more efficient configuration. This could affect basal lubrication and thus glacier sliding and melt rates.

This poster demonstrates the usefulness of continuous monitoring technology and automated water sampling in generating a picture of how subglacial hydrology develops as summer begins, including a novel use of chlorophyll as a potential tracer for surface waters.

17. David Button

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1st Year PhD

Continuous Character States and their Impact on Pterosaur Phylogeny

Recent years have seen the publication of numerous cladistic analyses of pterosaurs, but consensus remains elusive. The high proportion of continuous characters in pterosaur analyses is a potential root of this problem. The use of continuous characters in phylogenetics is controversial primarily as there is no reliable or objective method for coding them into discrete states for analysis. Inappropriate and inconsistent delimitation of states may hence be contributing to the lack of reconciliation between different analyses. In order to test this possibility the two most recent contrasting analyses of the Pterosauria were repeated in TNT, which is capable of handling raw values, circumventing the need to delimit states. Experimentation with continuous character inclusion and exclusion indicates that whilst continuous characters do provide some phylogenetic signal, many characters and the majority of character states are irrecoverably flawed. Varying

the treatment of continuous characters demonstrates they have had little role in the conflict within pterosaur phylogenetics, this due to fundamental differences in general character selection and coding between analyses. Some theoretical and practical issues with continuous characters, especially for groups with small sample sizes such as pterosaurs, prevent their use from being generally recommended, but that some show phylogenetic signal prevents them from being omitted outright. Rather than ruling out entire classes of data based on presumed weaknesses it would seem more prudent to critically evaluate all characters on the grounds of the hypotheses of homology they present. Such transparent and thorough reappraisal of character selection and coding would seem necessary to reach consensus in pterosaur phylogeny.

18. Christina Carter

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Research Masters

Identifying Tick of Veterinary Importance

19. Frances Cartwright

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1st Year PhD

Crops Against Climate Change

20. Martin Chavez-Hoffmeister

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1st Year PhD

The Fossil Record of Penguins in South America

South America has been recognised as one of the richest areas with fossil penguins worldwide, but until the late twentieth century this record was limited to the Argentinian Patagonia. Eighteen palaeospecies have been described for South America, with a chronostratigraphic range from Middle Eocene to Late Pliocene. The Paleogene is characterised by the dominance of medium to large size taxa of stem-Sphenisciformes, from the Eocene of southern Peru (*Perudyptes*, *Icadyptes* and *Inkayacu*) and from southern Chile and Argentina (*Palaeudyptes* sp., *Sphenisciformes* indet. and *Pansphenisciformes* indet.) and the Oligocene of the Argentinean Patagonia (*Arthrodytes* and *Paraptenodytes*). The Early Miocene of Argentina is dominated by small and medium species of the stem-Sphenisciformes (*Paraptenodytes*, *Palaeospheniscus* and *Eretiscus*) and since the Middle Miocene the small sized species of the crown-Spheniscidae becomes dominant in Peru (*Spheniscus*), Chile (*Spheniscus* and *Pygoscelis*) and Argentina (*Madrynornis*). Finally, the richness of species decreases during the Pliocene in northern Chile and southern Peru, as a prelude to the current condition with only two species presents about 45°S.

21. Broderick Coburn

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1st Year PhD

Venus Flytrap – A Bistable Orthotropic Shell Structure

22. Olivia Cooke & Samantha Weaver

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Research Masters

Natural Hazards in Guatemala: A Field Study

Geological and meteorological hazards such as earthquakes, volcanic eruptions, mass movement and severe storms continually threaten the Guatemalan population. These hazards will be addressed in terms of their impacts, risk to communities and the mitigation strategies implemented by government organisations such as INSIVUMEH and CONRED. Details will be drawn from the field study conducted by the 2012 Natural Hazards MRes class.

23. Katherine Cooper

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2nd Year PhD

Investigating the Spatial Distribution of Meteoric Diagenesis: Reactive Transport Modelling of Carbonate Island Systems

24. Elena Couce

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3rd Year + PhD

A Tale of Two Futures: Climate Change, Geoengineering and the Fate of the World's Coral Reefs

25. Gemma Coxon

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1st Year PhD**Spaced Out: Linking Model Space to Catchment Space within an Uncertainty Analysis Framework**

Catchment classification is considered a fundamental step towards improved catchment hydrology science; however little is understood about the differences and similarities of catchment behaviour and how these are then linked to model predictions. Experimenting with different model structures in multiple catchments can improve our understanding of why different catchments exhibit different runoff characteristics as a result of landscape and climatic characteristics.

In this study, the flexible modelling framework, FUSE, is applied to fifteen catchments which represent significant hydrologic and climatic diversity across the UK. Our aim is to quantify the dissimilarity between catchments by evaluating multiple model structures and parameter sets within the GLUE framework, explicitly accounting for model structural errors. To allow a meaningful evaluation of model 'realism', the ability of the models to capture the hydrologic behaviour of the catchment will be assessed against a number of hydrologic signatures. These results will be a first evaluation of how multiple model structures can be used to group catchments by exploring the similarities and differences in the resulting uncertainty cloud of behavioural models for each catchment based on the concept that the behavioural models reflect similarities in hydrologic behaviour. Importantly, we explore whether different model structures envelope similarity metrics and recognise dissimilarity between catchment behaviours. Thus we explore whether we can identify the dominant hydrological processes, how uncertain these relationships are and if this approach allows us to build a framework for extrapolating our understanding and for improving local predictions. This approach further advances our ability to link model space to catchment space whilst being realistic about the uncertainties involved.

26. Katherine Daniels

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3rd Year + PhD**Modelling Dyke Injection through Numerical Heat Flow Models, Laboratory Analogue Models and Fieldwork****27. James Davies**

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2nd Year PhD**Time-Resolved Measurements of Evaporation and Condensation in Single Aerosol Droplets****28. Anna Davies**

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2nd Year PhD**Behavioural and Physiological Indicators of Motivation during Animal Decision-Making**

Decision-making is likely to be influenced by individual motivation, but few studies of non-human animals have investigated this. I conducted several experiments which have monitored behavioural and physiological indicators of motivation in chickens. This poster will focus on an experiment which monitored these indicators during different categories of decisions. Categories included various forced and free choice tests.

In this first experiment I used non-invasive monitoring techniques to assess heart rate and took behavioural measures of latency to choice and head movement during decision-making in choice tests. A suite of correlated behavioural and physiological changes were observed when hens were highly motivated to reach a reward.

29. Taraka Davies-Barnard

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1st Year PhD**Climate Cooling and Yield Changes from Natural Variations in Wheat Reflectance****30. Mathieu Depoorter**

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1st Year PhD**Resolving Grounding Line Ambiguities around Antarctica from Inter-Comparison and Driving Stress Mapping**

Delineating the Grounding Line (GL) in Antarctica is a challenging issue. The accurate positioning of the GL is crucial to ice sheet and GL migration modelling, to mass budget calculation of ice sheets, as well as to the planning of an Ice Penetrating Radar (IPR) or an ice coring campaign. Efforts into defining and mapping the GL have been made using a range of methodologies. Here, we analyse different GL data sets based on optical imagery, satellite altimetry, and SAR

interferometry. We use driving stress mapping derived from a 1km DEM to investigate and resolve discrepancies in GL positioning around Antarctica from different methods. Typical driving stresses are calculated at GL for different ice dynamics and regions of Antarctica. The benefit of our approach to slope based technique is that we identify patterns and not only sharp linear transitions. Driving stress mapping allows us to discriminate between grounded and floating ice in a quantitative manner, as opposed to subjective interpretation. We also detect ice plains that have been reported and suggest the existence of new ones along the Siple Coast.

While the various data sets agree on slow moving ice within a few kilometres, we find that the only reliable technique to delineate GL on fast flowing ice is Differential SAR Interferometry (DInSAR). DInSAR GL data, however, are not available everywhere as they require at least two SAR image pairs. ICESat repeat tracks of the grounding zone can help in certain places but coverage is discreet and scarce for fast moving ice. We find that the Antarctic Surface Accumulation and Ice Discharge (ASAI) GL usually does a better job than MOA GL on fast flowing features.

31. Celia Duff

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3rd Year + PhD

Pepino Mosaic Virus: From Genotype to Phentoype

32. Alex Dunhill

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3rd Year + PhD

The Phanerozoic of Great Britain: Biodiversity, Sampling Proxies and the Quality of the Fossil Record

Most studies of the quality of the fossil record have identified positive correlations between biodiversity and sampling proxies. This has been interpreted as either; (i) geological megabias overprinting any true biological pattern of diversity; (ii) a common-cause where sea level has driven both the rock and fossil records simultaneously; or (iii) redundancy where biodiversity and sampling proxies covary because they are measures of the same signal. Here, I present data from the Phanerozoic of Great Britain, making use of a well documented fossil record and precise sampling proxies. Although positive correlations are detected between biodiversity and many sampling proxies, single or combinations of sampling proxies can only predict a relatively small proportion of diversity variation. Therefore, it is premature to assume we can rely on untested sampling proxies to prove the presence of, and correct for, significant sampling biases in palaeodiversity data obtained from the fossil record.

33. Julie Dunne

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2nd Year PhD

First Dairying in 'Green' Saharan Africa in the 5th Millennium BC

In the prehistoric 'Green Sahara' of Holocene North Africa, in contrast to the Neolithic of Europe and Eurasia, a reliance on cattle, sheep and goats emerged as a stable and widespread way of life long before the first evidence for domesticated plants or settled village farming communities. The remarkable rock art, surviving widely across the region, depicts cattle herding amongst early Saharan Pastoral groups, and includes rare scenes of milking; however, these images can rarely be reliably dated. While the presence of domesticated cattle bones provides further confirmation of the importance of cattle (and other domesticates), their scarcity makes it impossible to ascertain herd structures via kill-off patterns, thereby precluding interpretations of whether dairying was practiced. Since pottery production begins early in northern Africa the potential exists to investigate diet and subsistence practices using previously applied molecular and isotopic analyses of absorbed food residues. This approach has been successful in determining the chronology of dairying beginning in the 'Fertile Crescent' and its spread across Europe. Here we report the first unequivocal chemical evidence, based on the $\delta^{13}C$ and $D^{13}C$ values of the major fatty acids of milk fat, for the adoption of dairying practices by prehistoric Saharan African people in the 5th millennium BC. Interpretations are supported by a new database of modern ruminant animal fats collected from Africa. These findings confirm the importance of 'lifetime products', such as milk, in early Saharan pastoralism, and provide an evolutionary context for the emergence of lactase persistence in Africa.

34. Sophie Edwards

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Research Masters

A Finite Element Validation of Buzzards

35. Samantha Engwell

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3rd Year + PhD**The Campanian Ignimbrite Eruption: Inferring Eruption Characteristics from Distal Submarine Deposits****36. Davide Foffa**

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Research Masters

Digital Modelling Reveals Soft Tissues in a Giant Pliosaur**37. Kathryn Ford**

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1st Year PhD**The Honey Fungus - *Armillaria*****38. Jonathan Forth**

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Research Masters

Reconstructing *Pantyraco caducus* for better Understanding of the Early Dinosaurs**39. Jennifer Frost**

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3rd Year + PhD**The Lower Mantle – Earth's Water Tank?****40. Edward Gasson**

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3rd Year + PhD**Modelling the Onset of the Cenozoic Antarctic Glaciation****41. Ken Groom**

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3rd Year + PhD**Understanding Root Hair Development in Barley****42. Amanda Hall**

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3rd Year + PhD**Observing the Amazon Floodplain with Remote Sensing: ICESat, Radar Altimetry and SRTM**

The behaviour of water fluxes in the Amazon floodplain is still poorly understood. With few in-situ gauging stations, and with the ones that are present being on the main channel, understanding the flow dynamics of the floodplain is difficult. This study uses the ICESat (Ice, Cloud and land Elevation Satellite) sensor GLAS (Geoscience Laser Altimeter System) to observe changes in water levels in the floodplain. Complementing this data with radar altimetry, such as ENVISAT, enables us to gain an insight into the complex connectivity of the floodplain.

Due to sparse observations available within the floodplain, current modelling efforts are still unable to simulate floodplain flow complexity. By using remote sensing a comprehensive data set of floodplain water dynamics can be built up. Investigating lake water levels over several years and comparing this with nearby lakes, floodplain channels and the main channel can provide us with unprecedented detail, aiding us in understanding the dynamics of the Amazon floodplain inundation process.

43. Becky Harrison

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2nd Year PhD**Pesticide Dynamics in Natural Systems: A Catchment Perspective**

Transport of pesticides in runoff and subsurface flow during rainfall events poses a significant concern for water quality with adverse effects on drinking water and aquatic life which may lead to serious and long-lasting ecotoxicological effects. Pesticide transport to surface water has been shown to be highly facilitated by sediment movement through erosional processes and sediment-bound pesticides can be a significant component of surface-water contamination and off-site pollution. Quantifying the relative contributions of runoff- and erosion-driven pesticide transport at the catchment scale and understanding the role of sediment-bound pesticide dynamics can therefore lead to better management of surface-fed drinking water reservoirs.

This study investigates spatial patterns of pesticide transport in a lowland agricultural catchment (17km²) in Somerset

upstream of a drinking-water reservoir. Soil, sediment and water samples from slopes, rivers and the reservoir are analysed for a number of major pesticides to determine the relative importance of dissolved and sediment-bound pesticide dynamics seasonally and during individual storm events.

44. Scott Hayes

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1st Year PhD

How do Plants Judge Sunlight Signals?

45. Patrick Hayes

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3rd Year + PhD

Exploring and Manipulating Pleuromutilin Biosynthesis

46. Brioch Hemmings

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2nd Year PhD

Volcanic Island Hydrology

47. James Hickey

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1st Year PhD

Ground Deformation at Uturuncu Volcano, Bolivia: Insights from Finite Element Analysis

This study focuses on a Finite Element Analysis of large-scale ground deformation at Uturuncu volcano in the Altiplano-Puna region of southern Bolivia, for the period 19th May 1996 to 24th December 2000. The amplitude of the line-of-sight displacement from InSAR is 7.4 cm, with a wavelength of around 70 km for that period. We present a series of forward models that explain the observed ground displacement using COMSOL Multiphysics and accounting for both homogeneous and heterogeneous crustal mechanics. The source geometry is approximated using spherical, prolate and oblate source shapes. Crustal heterogeneity is constrained by published seismic velocity profiles that indicate the presence of a large low-velocity body at depths of 17 km below the surface. We deduce that the observed uplift is best explained by a single prolate source, in a heterogeneous medium, centred between 16.1 and 18.9 km below local elevation, with a semi-major axis of 5.2 - 9.8 km, semi-minor axes of 2.9 - 5.5 km and a uniform pressure change of between 5.6 and 29.1 MPa, as determined by bootstrapping of the best-fitting models at 90% confidence. This model can be interpreted to reflect pressurisation, at very modest levels, of a magma chamber within the Altiplano-Puna Magma Body. Further efforts to explore the sensitivity of the model fits to the required source excess pressures are obtained by first-order approximations of varying Poisson ratio with depth, host rock viscoelasticity and source multiplicity. We find that such mechanisms play a primary role in explaining the observed deformation at Uturuncu. However, to further constrain the most likely causative source parameters the full three-dimensional displacement field is required.

48. Paul Hope

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3rd Year + PhD

An Entrained Circadian Cycle of Peak Activity in a Population of Hibernating Bats

Biological rhythms exist in many diverse forms of life. Individuals must remain entrained to environmental changes if they are to survive by exploiting competitive opportunities. Hibernating mammals have been shown to maintain biological rhythms even during deep torpor, but which cues are used for entrainment is poorly understood. We studied activity in a population of hibernating bats over 3 consecutive winters using both ultrasound detectors and a series of active infrared motion detectors. Here we demonstrate that a biological cycle of peak activity remains entrained with a changing time period that is most advantageous for winter foraging, and that a clear pattern of diurnal activity exists throughout winter.

49. Gordon Inglis

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1st Year PhD

The Evolution of an Early Eocene Peatbog: Insights into the Paleo-Environment using a Multiple-Biomarker Approach

50. Alia Jasim

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1st Year PhD

Hydrothermal Alteration: Rock Properties and Modelling

There are six volcanic systems involved in the VUELCO project, representing a wide range of active volcanoes. Two of these are composite cones in a continental arc tectonic setting: Popocatepetl (Mexico) and Cotopaxi (Ecuador); then

there are two island arc volcanoes located in the British West Indies: Soufrière Hills volcano, in the southern area of Montserrat island, and Morne aux Diabls, in the northernmost part of Dominica. Additionally, the project aims to study Teide volcano, on the intra-plate oceanic island of Tenerife (Canary Islands, Spain), and the volcanic system of Campi Flagrei (Italy), a type example of large, silicic, caldera-forming volcanism. Taken together, these volcanoes represent a snapshot of the diverse volcanism occurring today.

51. Sarah Jones

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1st Year PhD

Carbon Geoengineering: Implications for Ocean Acidification?

A range of carbon dioxide removal (CDR) techniques, such as ocean fertilisation, the creation of biochar, or the addition of CaO or CaCO₃ to the surface ocean, have been proposed in order to avoid 'dangerous climatic changes' over the next few centuries. At present, these proposals are being assessed for their effectiveness, in terms of decreasing the rate of climate change, as well as their side-effects e.g. potential impacts on the current trend of ocean acidification. This poster outlines a range of current CDR proposals and considers the potential implications that each may have for ocean acidification, should we choose to geoengineer the climate at some future point.

52. Nancy Jones

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1st Year PhD

Modelling Coral Reefs in a Changing Climate

Coral reefs are the most diverse ecosystems on Earth providing millions worldwide with food and income. These precious ecosystems are very sensitive to change and have already shown significant declines following natural disturbance (hurricanes and disease epidemics) because of the stress caused by local human activities (over fishing, sedimentation and water pollution). As atmospheric CO₂ rises, causing seas warm and acidify, it is likely that coral reefs will start to collapse. Mass coral mortality due to bleaching (coral's thermal stress response), slow calcification or dissolution due to ocean acidification and increased frequency of hurricane scour are the most likely consequences of climate change. Ecosystem models provide a powerful tool to determine how the distribution of coral reefs will be affected by climate change. To date, coral reef models have advanced the mechanistic understanding of reef degradation but lack the precise predictive capacity to make future state projections. Recently, several studies using general circulation model (GCM) predictions for sea temperature and ocean carbonate chemistry have examined the future risk of bleaching and dissolution for existent reefs. However, there is need for a model that includes the underlying biological processes that will be affected by climate change to make future state prediction and so that hypothesis generated in other studies can be tested.

53. Natalie Jones

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Research Masters

Reproductive Success and Mating Behaviour in *Drosophila birchii*

54. Emma Kerridge

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Research Masters

Fish can Talk too!

Many species of fish communicate with one another. These communications are used for mate choice and attraction, territorial defence, during aggressive encounters and foraging. However as anthropogenic noise, that is any sound produced by the activities of humans, increases in the ocean; communication can become masked. It is already known that some species of terrestrial birds and whales will change specific characteristics of their vocalisations, such as frequency, amplitude and duration, in the presence of noise to enhance the transmission of their vocalisations. What is not known is whether fish can also change the characteristics of their vocalisations in the presence of noise. In consequence, I am working with a vocal species of clownfish, the Ocellaris Clownfish (*Amphiprion ocellaris*) to determine whether they can alter their vocalisations during exposure to noise. Any alterations in the vocalisations produced by the fish may have knock-on effects upon the outcome of any aggressive encounter; induce a change in the identity of the territory holder and bias mate choice.

55. Magdalena Koziol

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2nd Year PhD

Construction of Hybrid Enzymes for Production of Novel Secondary Metabolites

56. Stephan Lautenschlager

2nd Year PhD

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Cranial Myology of *Erlikosaurus andrewsi* Visualised in Three Dimensions

57. Robert Lemanis

Research Masters

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Cranial Functional Morphology of the Phytosaur *Ebrachosuchus*

58. Jeanette Di Leo

3rd Year + PhD

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Deformation and Mantle Flow beneath Eastern Indonesia from Seismic Anisotropy

59. Boo Lewis

3rd Year + PhD

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Characterising Mismatch Repair in Bread Wheat

60. Jamie Lewis

2nd Year PhD

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Strontium Diagenesis in Teeth

61. Katie Lim

3rd Year + PhD

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Investigating the Microbial Populations Controlling the Production and Oxidation of Methane in Water-Saturated Mineral Soils

62. Susan Little

3rd Year + PhD

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The Isotopic Mass Balance of Zinc in the Oceans

Zinc isotopes represent a new tool that could track biological usage of trace metals in the ocean through time. Such an endeavour, however, must rest on a sound understanding of the biogeochemical cycling of zinc isotopes. Here we summarise our current understanding through an analysis of the inputs and outputs of zinc to the modern ocean.

63. Shanna Ludwig

3rd Year + PhD

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Whitebeam (*Sorbus*) Evolution in the Avon Gorge

Why are Whitebeam (*Sorbus*) trees so successful at diversifying in the Avon Gorge? Previous work has shown that the current species that make up this local complex of Whitebeam species arose as a result of polyploidy and inter-species hybridisations. My current work, involving paternity analysis using the seed tissue endosperm, flow cytometry, and pollen-flow analysis, is helping us get to grips with the finer details of how the Whitebeams interact to create novel taxa.

64. Liz Martin

Research Masters

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Pterosaur: A Massive Problem

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The Effect of Viruses on Polarisation Reflection from Plants

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Begging for Complexity?

Carbonate Globules in Calatrava Tuffs: Melts or Solids?

Carbonate globules found in mantle xenoliths, as inclusions in mantle minerals and in juvenile silicate melt lapilli are possible examples of primitive carbonatitic melts from the mantle [1]. As such, their investigation may provide clues to source conditions for carbonatites. First to be considered is whether these globules represent primary or secondary features, and if they are primary, how and where did they form? Here we present findings from carbonate globules from the Calatrava Volcanic Province in central Spain; an alkaline mafic-ultramafic province comprising over 250 monogenetic cones and vents [1]. Carbonate globules are prolific within silicate melt lapilli. Similar examples from other carbonatite localities, such as the Limagne Province in France, shall also be discussed.

However, it is important that carbonate globules are not considered in isolation. The abundance of globules in the Calatrava samples is just one facet of the carbonate-rich volcanism in this region [2]. Possible multi-phase immiscibility with at least two globule types, in addition to the presence of phenocrysts and mineral inclusions of carbonate all indicate a significant volume of carbon in the source region.

A variety of techniques have been employed to investigate the nature of these globules, including SEM, EMPA and cathodoluminescence analyses. Globule textures including curved menisci against silicate melt, budding, and coalescing of the globules, are compelling evidence for liquid immiscibility. However, recent experimental results suggest that similarly-shaped globules formed as solid calcite crystals in equilibrium with silicate melt [3]. Many, but not all, globule interiors in the Calatrava lapilli are apparently nearly pure calcium carbonate with minor Mg, but Si, Al, and Na are virtually absent. Yet experiments show that carbonatitic melts equilibrated with mantle silicates or silicate melts can dissolve significant amounts of these elements, suggesting that the globules may have originated as solid calcite. The 'pure' globules are in fact compositionally heterogeneous on a micron scale. Initial findings made on the basis of sub-micron elemental mapping using a FEG-SEM [4] demonstrate that considerable quantities of additional components of Si and Al, amongst other major elements, appear to have been exsolved and segregated to the globule rims during crystallisation. Such a mechanism may explain the observed 'pure' calcium carbonate composition of many globule interiors, and supports an immiscible liquid model for carbonatite tuff genesis at Calatrava.

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68. Harriet Mills**Respondent Driven Sampling and Community Structure in a Population of Injecting Drug Users, Bristol, UK****Background:**

A 2006 Respondent Driven Sampling (RDS) survey of injecting drug users (IDUs) in Bristol, UK, estimated 40 per 100 person years (py) HCV incidence but in 2009 another RDS survey estimated only 10 per 100py incidence amongst the same population. Estimated increases in intervention exposure do not fully explain the decrease in risk. We investigate whether the underlying contact network structure and differences in the structure of the RDS trees could have contributed to the apparent change in incidence.

Method:

We analyse the samples for evidence that individuals recruit participants who are like themselves (assortative recruiting). Using an assortativity measure, we develop a Monte Carlo approach to determine whether the RDS data exhibit significantly more assortativity than is expected for that sample. Motivated by these findings, a network model is used to investigate how much assortativity and the structure of the RDS tree impacts sample estimates of prevalence and incidence.

Results:

The samples suggest there is some assortativity on injecting habits or markers of injecting risk. The 2009 sample has lower assortativity than 2006. Simulations of RDS confirm that assortativity influences the estimated incidence in a population and the structure of RDS samples can result in bias. Our simulations suggest that RDS incidence estimates have considerable variance, making them difficult to use for monitoring trends.

Conclusions:

We suggest there was likely to have been a decline in risk between 2006 and 2009 due to increased intervention coverage, but the bias and variance in the estimates prevents accurate estimation of the incidence.

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3rd Year + PhD

The Application of Systems Dynamics for Sustainable Development

The need for sustainable development has been well documented especially within the built environment. However, the definition of what sustainable development actually means has not had such universal agreement. This is partly due to its inherent complexity (sustainable development can require the consideration of a vast number of issues); partly due to incomplete knowledge of the interactions and interdependencies of issues (uncertainty); and partly due to people's perception of what it means to them in that context (there are multiple perspectives).

A systems thinking approach has been used to try and define sustainability in context. The process and toolkit generated by this approach is called HalSTAR, an R&D project which has now been running for five years. HalSTAR in its most basic form consists of a process and a framework and exists as a piece of intranet based software. The software currently enables users to identify relevant issues in context and provide indicators and criteria by which to measure and assess the sustainability of a project.

HalSTAR currently applies a type of 'holistic reductionism', in that it narrows the focus from an extremely wide range of issues to select context specific issues and then assesses them separately from each other. What HalSTAR does not currently do is take account of the complexity of the relationships between issues, i.e. how one issue affects another over time and how these relationships can lead to systemic behaviour that can, at times, be unpredictable and undesirable.

The focus of this research project is to identify where it is necessary to understand these relationships, how to identify them and how to produce a process that is effective and efficient that can be used in a project context. The use of system dynamics can help to answer these questions.

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Enigmatic *Ichthyosaurs* from the Late Jurassic

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Large-Scale Folding in Central Shikoku of the Subduction-type Sanbagawa Metamorphic Belt, Southwest Japan

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2nd Year PhD

Climatic Influence on the Distribution and Risk of Ovine Haemonchosis in the UK

With the rapid and widespread increase in the resistance of *Haemonchus contortus* (H.c) to available anthelmintics, there is urgent need to pursue a holistic and integrated farm management practice against H.c. To attain this, a detailed understanding of the epidemiology of H.c particularly its population dynamics in relation to the environment and host is needed to develop a sustainable control strategy. The basic reproduction ratio, Q_0 , was used as a threshold quantity to predict the presence or absence of haemonchosis in sheep population at a specific location and time. The model was validated using climatic (MET) and haemonchosis (VIDA) data from the United Kingdom (UK). Parameters were sourced from literature reviews based on field and laboratory work. The study revealed that Q_0 is correlated with cases of haemonchosis in the UK on a monthly timescale, with the suggestion that temperature is a better predictor of haemonchosis occurrence than rainfall giving the prevailing climate. However, the Q_0 model does not account for hypobiosis, rainfall distribution or immunity. In summation, this model shows promise as a good risk prediction tool for H.c invasion or extinction from sheep population if the prevailing daily farm conditions are considered in a given location and time. As such it could be useful in designing control protocols and daily farm decisions, with further development.

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The Impacts of Increased Winter Temperature on the Lipid Content of the Sheep Bowfly, *Lucilia sericata***74. Rose Murray**

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2nd Year PhD**The Effect of a Virus Infection on Host Stomata****75. Michaela Musilova**

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1st Year PhD**'Cryoconite Casserole' – Investigating the Production of Organic Matter on Glaciers**

Organic matter produced on the surface of glaciers is an important source of nutrients to adjacent starving ecosystems. There is an increasing body of evidence showing that microbial communities are actively influencing biogeochemical cycles in glacial environments and providing the needed nutrients. In particular, significant amounts of microbial photosynthesis, respiration and nitrogen fixation have been found to occur in cryoconite holes. They are aquatic habitats formed by the differential melting of ice below dark organic and inorganic matter of mostly aeolian origin. However, the roles of these microbial 'hot spots' and of microbial nutrient cycling on glaciers are poorly understood, as well as the temporal variation and microbial succession in those environments.

The main scope of this research project, nick-named 'cryoconite casserole', is to study the changes in the structure of microbial communities in cryoconite holes in terms of dynamics, functionality and diversity. Changes, such as net heterotrophy vs. net autotrophy, as well as the reliance on nitrogen fixation are being examined using a combination of field and controlled laboratory techniques. Furthermore, the ability of microbes to respond to the perturbation of numerous parameters is being tested, for instance by varying nutrient status and diurnal melt-freeze cycles. These experiments have been devised to assess the stability and first order feedbacks that define the nature of the microbial succession in glacial environments. Laboratory based research involves the simulation of the conditions on the surface of glaciers in one of the cold laboratories based within the Low Temperature Experimental Facility (LOWTEX). Fieldwork is currently being planned for the 2012 summer season in Greenland as a comparative study to the simulation.

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Helminths of Domestic Chickens in the UK**77. Rachael Ogilvie-Harris**

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3rd Year + PhD**An Experimental Investigation of Phase Relations in Kimberlite Melts****78. Katy Orford**

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2nd Year PhD**Engineering Biodiversity: The Implications of Grassland Management on Pollinator Communities**

Unimproved, species-rich grasslands once had an extensive cover across much of Western Europe. Recent intensification of agricultural practices has resulted in the destruction of these habitats imposing a strong negative effect on many of the taxa they support. Grassland conservation is therefore of high priority in Biodiversity Action Planning and restoration of ecosystem services, such as pollination.

My PhD project asks whether we can practically 'engineer' biodiversity by 'customising' grassland sward types and cutting and grazing regimes to maximise the diversity, resilience and temporal stability of invertebrate pollinator communities and the ecosystem service of pollination.

Pollinator communities were sampled from the manipulative field-scale experiment, The Wide-scale Enhancement of Biodiversity Project (WEB), North Wyke Research, Devon. WEB comprises a split-plot design of grassland plots of different treatments including a) plant diversity: grasses, legumes and forbs b) management: cutting or grazing

The hypotheses tested include:

1: Swards with greater floral diversity and heterogeneity, created by grazing, will support increased pollinator species diversity, abundance, evenness and functional diversity.

2: Greater pollinator diversity (species diversity and functional diversity) will enhance the ecosystem service of pollination (visitation) and its temporal stability.

3: Individual plant species will differ in their functional importance in supporting pollinators.

Summary of the results:

1. Separate orders of pollinators respond differently to grassland treatments. Therefore specific measures may not have universal benefits to pollinators. However, functional diversity of the community and therefore its ecosystem services can potentially be enhanced by manipulation of sward diversity.

2. The strong relationships between the pollinator community diversity and the ecosystem service of visitation and its temporal stability pertains to the 'diversity-stability debate' (Naeem & Li 1997; Loreau, Mouquet & Gonzalez 2003).

3. Functional importance of the plant species in supporting pollinators varied with creeping buttercup supporting the highest number and diversity of pollinator species.

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3rd Year + PhD

Efficient Expression System for Production of Natural Products in *Aspergillus oryzae*

pTAex3 is an expression vector used for heterologous gene expression in *Aspergillus oryzae*. This vector has previously been modified by insertion of a GATEWAY destination module into the strong, starch-inducible amyB expression cassette to produce pTAex3GS. This facilitates directional transfer of genes such as fungal polyketide synthases (PKS) and hybrid polyketide synthase-non-ribosomal peptide synthases (PKS-NRPS) into the expression site. To simplify plasmid construction for whole-pathway expression pTAex3GS was first converted to a yeast-E. coli shuttle vector, pTAYA.GS. An EST database was used to identify genes expressed at a high level under the culture conditions we use for heterologous gene expression in *A. oryzae*, and the promoters of three of them, Padh (alcohol dehydrogenase), Peno (enolase) and Pthia (thiazole synthase), were evaluated. *A. oryzae* transformants expressing eGFP from Padh and Peno exhibited intense green fluorescence. We used homologous recombination in yeast to combine Padh and Peno together with the strong constitutive *A. nidulans* promoter PgpdA in pTAYA.GS-Page, a novel multiple gene expression vector which has AscI sites downstream of each promoter. The system was tested by reconstructing and expressing the *Beauveria bassiana* tenellin and *Aspergillus nidulans* aspyridone synthesis pathways, each of which comprises a hybrid PKS-NRPS together with an enoyl reductase and one or more cytochrome P450s, in *A. oryzae*. Yeast recombination between the AscI-cut vector and three PCR products simultaneously placed the tailoring genes downstream of the promoters, creating pTAYA.GSargTen and pTAYA.GSargAsp. Subsequent introduction of the PKS-NRPS gene by GATEWAY recombination created pTAYAargTenellin and pTAYAargAspyridone. Reconstruction of the tenellin and aspyridone biosynthetic pathways proved the multiple gene assembly concept, and chemical analysis showed that 5 of the 11 pTAYAargTenellin transformants analysed produced tenellin, pretenellin B and prototenellin A. Similarly 13 of 14 pTAYAargAspyridone transformants analysed produced aspyridone A and preaspyridone. The results show that our system allows the rapid and simple reconstruction of whole (small) biosynthetic pathways for heterologous expression from a single plasmid in *A. oryzae*. Further development of the system has included replacement of the arginine selectable marker with basta- and phleomycin-resistance genes to allow expression of biosynthetic pathways of up to 12 genes by co-transformation of *A. oryzae* with just 3 plasmids.

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Fossil Face to Human Face: Dermal Skeleton of *Moythomasia*

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Volcano Monitoring using InSAR: Cascade Volcanoes

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1st Year PhD

The Response of Himalayan Glaciers to Climate Change and its Hydrological Impact

The aim of the project is to evaluate the impacts of different climate change scenarios on hydrological regimes of catchments in the Himalayas which have a significant glacial meltwater input from their glaciated headwaters. This will involve modelling the response of the glaciers to climate change, specifically changes to the glacial runoff, and modelling the impact this will have on the hydrological regimes downstream. The impact of changes to the glacial runoff

component on the hydrological system will be considered alongside other changes to the hydrological system.

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Antibiotic Production in Mushrooms

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3rd Year + PhD

Assessing the Fatty Acyl Components of the Pottery of Çatalhöyük, Turkey

85. Rory Power

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A Platform for Performing Microfluidic Operations in Particle Arrays: A Study of Aerosol Coagulation

86. Andrew Rickards

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Hydroscopicity Measurements of Organic Aerosols with O/C=1

An inverted optical tweezers system has been used to trap single component organic aerosol droplets. The hygroscopic properties of these aerosols were investigated using whispering gallery modes in their Raman spectra to accurately elucidate droplet sizes and refractive indices at different relative humidities (RH). We focus on organic compounds with O/C=1, to ascertain whether a relationship between hygroscopicity and O/C exists. Hygroscopicity data were analysed with the hygroscopicity parameter (κ) model, and a more rigorous κ -Köhler growth factor model.

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2nd Year PhD

Kenyan Volcanism: A Satellite Perspective

88. Christopher Rogers

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Research Masters

How Sure can we be that a Dinosaur Species is Valid?

Almost half of all the dinosaur species ever described are now considered to be invalid. Current work on identifying ontogenetic signals in some dinosaur taxa may invalidate previously well established species. By revealing taxa to be invalid, more accurate estimates on biodiversity can be achieved.

89. Navjit Sagoo

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3rd Year + PhD

Reduced Pole to Equator Temperature Gradients in Past Warm Climates: A Climate Model and Proxy Data Study

Investigating the Range of Climates Possible from Perturbing Uncertain Model Parameters and Boundary Conditions

Geological proxy evidence from past warm climates such as the early Eocene ~55 million years ago (55 Mya) and the Late Jurassic (~154 Mya) indicate polar temperatures that are much warmer than today. For example mean annual temperatures (MATs) up to 18°C are recorded from locations >80°N in the early Eocene. In contrast temperature estimates that exist for the equatorial regions are near modern temperatures, MAT estimates for the early Eocene range between 32-37°C. This indicates a reduced pole to equator temperature gradient in past warm climates. The mechanisms for transporting or maintaining heat at the poles relative to the equator are still unknown although several hypotheses have been suggested.

Climate models are unable to simulate the reduced temperature gradients that are inferred from the geological record. As we move towards a warm climate understanding climate dynamics in warm ice free situations becomes more pertinent. Modern climate models although complex, are only simplified representations of the Earth and climate system; subsequently they are a source of uncertainty in this model-data mismatch. We investigate climate model uncertainty (uncertain parameters and boundary conditions) in order to understand the range of climates that can be produced and also to interrogate what processes may preferentially warm the Polar Regions but not the tropics. We are particularly interested in the role of clouds in warm climates and how clouds vary between our simulations.

The geological proxy record is also incomplete and uncertain. There are spatial and temporal uncertainties and

understanding exactly what is recorded by the proxy may also be unclear. In order to minimise these problems we use multiple sources of proxy data, and use several approaches to compare our model output and the available data. We also attempt to identify and focus on climatically sensitive locations.

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Merging Airborne and Terrestrial LiDAR Data to Determine Geometric Controls on Flood Propagation in Urban Areas

91. David Schlaphorst

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Structure of the Northern Caribbean Plate Boundary Zone from Seismic Anisotropy

92. Anne Schöpa

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2nd Year PhD

The Thermal State of the Crust: A Critical Constraint on the Formation of Large Magma Chambers

More than seven calderas and extensive ignimbrite deposits record the flare-up of the Altiplano-Puna Volcanic Complex (APVC). It is widely accepted that the eruptions forming the calderas were fed by large magma chambers located in the shallow crust at depth less than 8 km.

Using the constraints of the various calderas in the APVC, we calculated the intrusion rates necessary to produce and maintain eruptible magma volumes of 1000 to 2000 km³. The computations are based on a numerical model of conductive heat transfer that assembles crustal intrusions of a maximum final thickness of 4 km by the incremental emplacement of thin sills. The Altiplano-Puna Magmatic Body (APMB), a 1000oC hot sill between 17 km and 19 km depth is used as the lower boundary condition of the models. We compared the volumes of melt in the shallow crust for two scenarios. 1. The crust is cold and is heated by the APMB during the emplacement of the upper-crustal sills. 2. The crust is preheated by the APMB that is emplaced several million years before the first sill intrusion.

The models show that up to 30% more melt can persist in the intruded sills when the APMB preheated the upper crust, in agreement with the observation that volumes erupted during the APVC flare-up increase with time. This implies that the initial thermal state of the crust plays an important role in the formation of large magma chambers, which is facilitated by the presence of a deeper magma body.

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1st Year PhD

Biologically Inspired Synthesis of Functional Nanoparticles

Nature has the ability to carry out complex processes and form detailed structures with a much higher degree of control than can be found in the laboratory. A remarkable example of this is demonstrated by single-cell, marine microbes known as diatoms. Diatoms use a silicon transporter protein (SIT) and utilise a sodium gradient to uptake soluble silicon found in sea water. This soluble silicon is then used to form their protective silica shells which consist of highly intricate nanostructures. It is synthetically challenging to produce nanopatterned silica, however, diatoms are capable of producing such structures with relative ease on the nanoscale. This research has drawn inspiration from diatoms and work has been carried out to express and purify the SIT before reconstituting it within liposomes in order to form an artificial diatom. Here the SIT provides a continual supply of silicon to growing nanostructures within the liposome, offering control over the growth and composition of the forming nanostructures.

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Polarisation Vision and Prey Capture in an Aquatic Predator

95. Jessie Shields

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Mobilisation of Highly Viscous Lava Flows and Domes

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Overwinter Survival Strategies of *Trichostrongylid* Larvae

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Taking Advantage of both U-Th and U-Pb Disequilibrium Methods for Speleothem Geochronology

The success of speleothems as accurate chronological markers of landscape evolution is well acknowledged [1-3], but the accuracy and precision of U-Th dating becomes particularly limited beyond 350 ka, as secular equilibrium for ²³⁴U and its daughter ²³⁰Th is approached (~500 ka). Beyond this limit, U-Pb disequilibrium methods provide scope for dating over time-scales up to the age of the Earth (4.54 Ga). Here, we illustrate plans to date important materials in the range 0.35 to 1.0 Ma using high precision U-Th methods in concert with U-Pb techniques [4-7], which take advantage of community-based inter-laboratory calibration efforts via the EARTHTIME Project.

We are currently optimising a combination of U-Th-Pb techniques that utilise both isotope dilution and in situ laser ablation methods with MC-ICPMS at the Bristol Isotope Group (BIG) and NERC Isotope Geosciences Laboratory (NIGL) to analyse a variety of secondary calcite deposits previously demonstrated to be beyond the age range of traditional methods. The lower limit for U-Pb dating is determined by the amount of common Pb present in relation to that generated by radiogenic decay (²⁰⁶Pb, ²⁰⁷Pb and ²⁰⁸Pb). Thus high U samples which yield more radiogenic Pb are of particular interest. We focus on an unusually U-rich flowstone sample (>75 µg g⁻¹ ²³⁸U) from the Grotte Valerie system in the Mackenzie Mountains, NWT, Canada [8]. Re-analysis of this material by U-series provided a revised age estimate and 2σ uncertainty of 342 ± 10.3 ka (MIS 9) for the youngest phase of growth. U-Th ages for older sub-samples, between 11.7 and 31.4 mm above the basal growth are at secular equilibrium and therefore >500 ka. Here we present preliminary U-Pb ages for in situ laser ablation (LA) and isotope dilution (ID) analyses, demonstrating active growth for the period 600-700 ka, coinciding with the interglacial timings for the MIS 15-17 [9]. These findings are suggestive of predominantly inter-glacial conditions for the Mackenzie Mountains well beyond the 280-400 ka period identified in the original literature [8].

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98. Andy Smith

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Hydraulic Modelling of Future Extreme Flows

Projection future flood frequency is something that has received considerable attention in recent years with the application of climate models, particularly regional climate models, now common place. Here an analysis of the application of climate models in future flood risk projection has revealed the inadequacies of many current methods. An

alternative methodology is presented and applied to cascade flows from climate models down to flood inundation models. This will be used to produce design flood hydrographs for differing exceedance probability events i.e 1:100 1:50, under future climate conditions.

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Engineering Implications of Ground Sulphates

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Experimental Determination of the Hydrous Basalt Liquidus: The Grenadan Perspective

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Camouflage: To Specialise or to Compromise?

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Colour Changes in Juvenile *Tomistoma schlegelii* are Caused by Shifts in Ambient Light Level

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Studying Cultural Evolution Through Science: The Phylogeny of Camouflage Uniform Patterns

The desire to conceal individuals or groups is present throughout the human globe; from hunter-gatherer societies where effective camouflage helps to put food on the table, to modern armies where remaining unseen from the sight of the enemy could mean the difference between victory and defeat. One way to achieve concealment is to wear concealed clothing: garments, which either match the colours of the background or disrupt the shape of wearer. By applying a multidisciplinary approach, we aim to investigate the potential phylogenetic signals of history in the cultural evolution of camouflaged uniforms.

104. Andrew Thomson

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Windows into the Deep: A Study of Sublithospheric Diamond Inclusions from the Juina Region, Brazil

105. Peter Tomiak

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Testing the Limitations of Artificial Protein Degradation Kinetics Using Know-Age Massive Porites Coral Skeletons

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Establishing the Relative Chronology of Raised Reef Terraces on Barbados Using Amino Acid Racemisation in Fossilised *Acropora palmata* Corals

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Tracing Extractable and Non-Extractable Prokaryotic Membrane Lipids in a 600-year-old Welsh Peat Bog

108. Vassil Taznov

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Bifurcation Analysis of a Vertically Excited Cable Close to its Second Natural Frequency

109. Philip Usher

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Measuring Attenuation of Cotton Valley Microseismic Events

Attenuation is a useful property of a seismic waves. There is a loss of high frequency energy as the wave propagates

through time. This is sensitive to the fluid and fracture properties of the rock, and the distance the wave has traveled. Therefore we can use measurements of Attenuation to assess the fluid and fractures within a petroleum reservoir. Attenuation is measured using the spectral ratio method on microseismic events at Cotton Valley hydraulic stimulation field. The attenuation shows a correlation with time which could be due to the hydraulic fracturing, however other key effects such as the distance the wave has traveled, the frequency of the source and the effects of windowing need to be addressed.

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Research Masters

Biological Drivers of Diversity

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3rd Year + PhD

Constraining the Surface Mass Balance of the Greenland Ice Sheet

Greenland is predicted to be particularly vulnerable to climate change over the next century and recent observations suggest that the mass loss from the Greenland Ice Sheet (GrIS) has increased significantly over the last ~decade. The surface mass balance (SMB) of the GrIS has been determined for the last 50 years through a combination of observations and modelling. It has been suggested that the processes controlling SMB, which accounts for roughly half of the ice loss, are well constrained compared to the other component of mass loss: solid ice flux. Observational evidence to support this suggestion is limited, however. One approach to investigating uncertainties is through a model intercomparison. This work compares four different simulations of the SMB of the GrIS over the period 1960-2008. Three use different regional climate models to down scale ECMWF reanalysis (ERA-40) and operational analysis data, while the fourth uses the same inputs but an empirical downscaling approach and melt model. Variation in SMB between models is observed, with significantly larger difference between SMB components such as runoff and refreezing. This suggests that a cancellation of errors in one or more of the models may be responsible for the smaller disagreement in SMB. The aim of this study is to identify and explain the inter-model variations and to validate against a suite of satellite and in situ data sets to improve methodology and better constrain GrIS SMB estimates.

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Research Masters

Crabs Unquiet in Noisy Seas

113. Jack Walpole

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2nd Year PhD

Towards Global Observations of Shear Wave Splitting in the Earth's Lowermost Mantle

114. Tong Wang

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2nd Year PhD

Moisture Requirements for the Migration of *Haemonchus contortus* Larvae

Haemonchus contortus can be regarded as the most important gastrointestinal nematode of sheep in warmer regions and also an emerging threat in Europe. With the rapid development of drug resistance, it is crucial to apply continuable control strategies such as Targeted Selective Treatment (TST) and grazing management. Therefore the effects of environment factors (temperature, rainfall, etc) on larvae development and migration are important. Although larval availability has been well characterised for the development in relation to temperature and rainfall, much less is known about the migration. This is an important deficit in our understanding of epidemiology in arid and summer rainfall dominant regions.

Methods were developed to assess larval migration out of faeces under simulated rainfall conditions in the laboratory. These were applied in a series of experiments (Mar-July, 2011), which proved that rainfall is required for migration. However, a single rainfall event was not sufficient for migration from faeces kept in dry conditions. Light but regular rainfall resulted in rapid emergence from moist faeces kept in humid conditions, but much slower emergence from dry faeces in dry conditions. Ambient relative humidity therefore appears to act through faecal moisture content to modify the effect of rainfall on larval migration. Larvae appeared to survive quite well in dry faeces, ready to disperse after sufficient rainfall, so sheep faeces could potentially act as a larval reservoir in dry conditions, with peaks of infection following rainfall.

Currently another study is carrying out to investigate the fate of larvae migrating out of faeces. Will they climb up to the grass or move down to the soil? With the fully understanding of the dynamic of larvae movement, one can establish a model to predict larval infectious level on pasture and future guide the control strategy.

115. Rachel Warnock

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3rd Year + PhD

Exploring Uncertainty in the Calibration of the Molecular Clock

116. Matthew Whipple

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1st Year PhD

Mantle Seismic Anisotropy Beneath South-Central Chile

117. Matthew Whipple

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1st Year PhD

Antarctic Ice Sheet Melt at the Last Interglacial

118. David Wilby

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1st Year PhD

The Quantum Optics of Insect Eyes

Some insect eyes have been shown to be capable of transducing individual photons. This work aims to prove this ability using a new method of photoreceptor stimulation utilising a heralded single photon source. Following this proof it will be possible to perform quantum photonics experiments using locusts as living detectors.

119. Hazel Wilkie

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Research Masters

Targeted Selective Treatment of Ovine Endoparasites

120. Maria Williams

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1st Year PhD

The Pelagic Record of Ocean Acidification

The current rise in atmospheric pCO₂ and its subsequent dissolution in seawater is reducing the pH and [CO₃²⁻] of the oceans. Anthropogenic ocean acidification is widely expected to affect the ability of marine calcifying organisms to precipitate their CaCO₃ exoskeletons, though species specific reactions are documented (Langer et al., 2006). The aim of this study is to determine whether historical changes in seawater [CO₃²⁻] and pH since the beginning of industrialisation have already had discernible impacts on coccolithophores and foraminifers. We aim to document trends in both plankton groups at the same location to improve our understanding of response to ocean acidification in different species and groups of plankton.

The focus of the study is a core from Erik Drift, south of Greenland. 230Thxs will be used to account for lateral sediment transport as a result of regional dynamic bottom water currents and hence redeposition of the coccolithophores and alteration of their historical record of calcification. Lateral sediment transport can be determined by normalising the activity of 230Th in the sediments to its production rate in the water column. We present down core analysis of plankton mass measurements for both the industrial record and the natural variability throughout the Holocene.

121. Jefferson Wong

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2nd Year PhD

Sensitivity Analysis of Hydraulic Model to Morphological Changes and Changes in Flood Inundation Extent

Recent research into modelling floodplain inundation processes is primarily concentrated on the simulation of inundation flow without considering the influences of channel morphology and sediment delivery from upstream. River channels are often represented by simplified geometry and implicitly assumed to remain unchanged. However, during and after flood episodes the river bed elevation can change quickly and in some cases drastically. Despite this, the effect of channel geometry and topographic complexity on model results has been largely unexplored. To address this issue, the impact of channel cross-section geometry, and channel long-profile variability on flood inundation extent are examined using a simplified 1D-2D hydraulic model (LISFLOOD-FP) of the Cockermouth floods of November 2009 within an uncertainty analysis framework. The Cockermouth region provides a useful test site for such study because of the

availability of channel and floodplain data, the collection of post-event water and wrack marks and the presence of pre- and post-event morphological surveyed data. More importantly, in some areas the river has undergone significant course change and additionally the deposition of stones and debris on the floodplain. The use of relatively simple formulations of critical velocities in the initiation of motion formula enables the construction of a series of hypothetical bedform scenarios among cross-sections. These scenarios can be used as input to LISFLOOD-FP. Slope gradient, Manning roughness coefficients, grain size characteristic, and critical shear stress will be considered in a Monte Carlo simulation framework. The November 2009 Cockermouth flood is simulated and the results are analysed to quantify the accuracy associated with each bedform scenario and to assess how different channel long-profiles affects the performance of LISFLOOD-FP. The study will further analyse and quantify the variability and uncertainty of flood inundation extent resulting from discharge boundary conditions upstream. We shall assess the relative importance of these factors and identify what dominates the uncertainties in flood inundation extent.

122. Sally Wood

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1st Year PhD

Getting Around? Modelling Coral Connectivity Under Climate Change

We aim to provide the first quantified assessment of the impact of climate change and ocean acidification on coral larval dispersal and reef connectivity. To this end, we present a framework for modeling coral dispersal and potential connectivity over a global scale, as relevant to the scale of climate change over the coming century. Planned work will combine this global connectivity framework with habitat models in order to predict reef distributions for the future.

123. Ria Woodfield

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2nd Year PhD

Earthy Taste and Odour in Drinking Water

124. Qian Xue

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1st Year PhD

Holocene Climate Change in Central Asia Inferred from Biomarkers of Peat Deposit in Altay Mountains in Northern Xinjiang, China

Holocene climate change in Asian monsoonal region has been thoroughly studied by varied records, especially the precisely dated high-resolution stalagmite records. What about Central Asia, which currently beyond the northern margin of summer monsoon and is more influenced by westerly? Some suggest a westerly model which is out of phase with the monsoon model, while others propose the monsoon pattern, or mixed influence of both. Recent stalagmite record from Central Asia show synchronous trend with that from monsoonal region at high summer irradiation periods of northern hemisphere, indicating monsoon influence could penetrate far into the Asia interior at its peak time. However, Central Asia is a geographically broad region with complex topography, it is necessary to explore other precisely dated records. This study plans to employ organic geochemical proxies of peat deposit in Altay Mountains in Northern Xinjiang, China, to study Holocene climate change in this region.