

LINNEAN SOCIETY OF NEW SOUTH WALES

LINN S'O'C' NEWS

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NEW MEMBERS

We welcome new members:

Mr Matthew J Nimbs of Southern Cross University. Fields of interests: malacology, taxonomy and biogeography of heterobranch sea slugs, ecology of temperate rocky reefs.

Mr Ross Pogson, Australian Museum. Fields of interests: general geology, mineralogy, palaeontology, cave minerals, historical geology.

DONATIONS TO RESEARCH FUNDS

Members who donated to the research funds early in the year were acknowledged in the April newsletter. Since then, more donations have arrived. Members have donated a total of \$3,175 for the year and we thank everyone for their generosity.

Donations since April have been received from Dr J.M.E. Anderson, two anonymous donors, Dr Donald S. Horning, Dr Patricia Hutchings, Dr David Keith, Mr Matthew Nicolson, Mr W.S. Semple, Dr Lawrence Sherwin and Dr Susan Turner. Your generosity is much appreciated.

All donations are fully tax deductible.

EUREKA AWARD TO PROF DAVID KEITH

Professor David Keith and his IUCN Red List of Ecosystems team were awarded the **NSW Office of Environment and Heritage Eureka Prize for Environmental Research** “for their establishment of a universal standard for assessing ecosystem risks”.

Similar to the influential Red List for the world’s threatened species, it allows environmental threats to different ecosystems to be compared, making it easier to persuade politicians and the public of the need for policy change. This year the team published [the first study](#) implementing the new system, identifying ecosystems at high risk of degradation in Australia, particularly from climate change.

David Keith is a member of the Council of the Linnean Society of New South Wales.

LINNEAN MACLEAY FELLOWSHIP

Applications are invited for the Linnean Macleay Fellowship for the year 2016. Applicants must be Members of the Society, reside in New South Wales, and have a degree in Science or Agricultural Science from the University of Sydney. Applicants are required to outline the proposed research and where it will be carried out. The Fellowship pays \$3,200 per annum, and the Fellow must engage in full time research on the project. The regulations governing the Fellowship are available on request from the Secretary or the Society’s web site. These regulations were stipulated in Sir William Macleay's will and the Society is obliged to adhere to them.

Applications close 15 November, 2015

BELUBULA RIVER SYMPOSIUM A GREAT SUCCESS

The Symposium *Natural History of the Belubula River Valley and adjacent area of central waetern New South Wales*, held on 7-10 September was very successful. Seventy three people attended. It enabled our Society to contribute to the debate concerning this area of outstanding importance through the provision of scientific assessment of the caves, the river and the surrounding region. A highlight was the excursion to the fossil sites. It has raised the profile of the Society in our traditional support base but also beyond that. The attendance of community members from the surrounding area was very gratifying.

We all owe a very considerable debt of gratitude to Dr Mike Augee, Dr Ian Percival and Mr Bruce Welsh for organizing the event. Special thanks to Wellington Caves Fossil Studies Centre (Mike Augee and Christine Robinson) for sponsoring a great "reception" at the Fossil and Mineral Museum.

REPORTS FROM RECIPIENTS OF RESEARCH GRANTS

A condition of an award of a research grant is that the recipients report on the results of their endeavours.

Dr Fernando Soley (Macquarie University) studies the assassin bug *Stenolemus giraffa* that preys on spiders, even spiders in webs. His grant was to work out how they did it in the field. He observed 38 predatory interactions between the assassin bug and the spider *Parasteatoda* sp., a formidable predator also. He found that the assassin bug captures its prey by stealth, but in about

10% of the encounters, the prey captured the predator. Thus pursuing this spider is dangerous for the assassin bug.

Georgia Roberts (Latrobe University) was awarded a grant to study the long term adaptability of the common wombat (*Vombatus ursinus*) in Tasmania, using stable isotope analysis on teeth from archaeological sites ranging in age from ~35,000 to 11,000 years ago, compared with modern wombats. The money has been used to pay for the stable isotope analysis and the results are being written up for publication.

Dr Scott Fabricant (Macquarie University) investigates the colour changes in the *Kosciuscola* grasshoppers in alpine areas. They are black when cold and turquoise when hot, but only the males change colour and in only one of the four species. It was thought that the colour change was a thermoregulatory mechanism. The colours are produced by the array of adjustable granules in the cuticle and epidermis. It was found that all of the grasshoppers in all of the species have the same sub-cellular array of granules, hence possess the machinery to change colour. Colour change is not a thermoregulatory mechanism but what purpose it serves remains a mystery.

CONFERENCE: INVERTEBRATE BIODIVERSITY AND CONSERVATION: SASB 2015 NEW GENERATION | NEXT GENERATION

The Organizing Committee is pleased to invite you to the upcoming Society of Australian Systematic Biologists Biennial Conference combined with the 11th Invertebrate Biodiversity & Conservation Conference. **It will be held on the 6-9 of December at the Esplanade Hotel in Fremantle, Western Australia.**

The conference is the national forum to discuss research on systematic biology and invertebrate biodiversity conservation, which have formed a productive and passionate scientific community.

We encourage you to visit the website and subscribe to the SASB 2015 Mailing List.

<http://sasb2015.org>

Once you have been added to the list, all conference information will be sent to you via email. You will ONLY receive further information about the conference if you subscribe to the mailing list.

We hope to see you at the upcoming SASB & IBC 2015 combined event. If you have any questions, please feel free to contact Promaco@promaco.com.au

EARLY LIFE ON EARTH: EVIDENCE FOR A DIVERSE BIOSPHERE 3.5 BILLION YEARS AGO: a talk by Prof Martin J Van Kranendonk

The oldest rocks on Earth are about 3.5 billion years old, and this is about the age of the crust on Mars. Studying early life on Earth may assist us in understanding life, if it is present on Mars.

The Universe began about 9.2 billion years ago and there have been many cycles of star formation and collapse. These cycles serve to concentrate heavy elements that are essential for life. The planet Earth is just right for habitation: the right size, the right distance from the Sun and the right temperature.

The first ingredient for life is liquid water. The second ingredient is plate tectonics. Heat is lost through spreading at zones of divergence and material, including water is dragged down into the mantle at zones of contraction. This incorporation of water into the earth's mantle saves it from being lost to space by evaporation. Plate tectonic can only function if there is water: it softens the earth's crust. Plate tectonics makes new minerals, including clay that is probably critical for life. Oxygen is also necessary, but very little has been formed outside of biological systems.

Cyanobacteria split water and release oxygen that has accumulated over time. The change has been from an atmosphere rich in carbon dioxide and sulphur dioxide to one rich in oxygen. For the first two billion years of life, Cyanobacteria, Archea and Bacteria were the major forms of life. Then complex forms of life developed.

The Pilbara has the best record, and living stromatolites of cyanobacteria show us what early life may have been like. The cyanobacteria grow in layers alternating with fine sediment layers to

produce laminated structures that may have up to 10,000 organisms embedded in them and are thus complex ecosystems. They are found in pools where the salinity is up to three times that of sea water and this hypersalinity suppresses grazers that would otherwise destroy them. When a stromatolite from the Pilbara is taken out and examined, it has a pillar shape with a flange at the bottom, and this flange is attributed to uplift by tilting of the land.

Ancient stromatolites are dated using zircon crystals that have uranium trapped in them and the ratio of the two isotopes of uranium in the crystals indicate its age. The biggest problem is proving biogenicity of structures in the rocks, and that they were actually formed by living organisms. Calcium carbonate crystals formed by living organisms are different to those formed by physical processes and are thus a good indicator of biogenicity.

In an exposure of rocks of the Ediacara period, 600 million years ago, the biota was mainly soft-bodied multicellular organisms living on the mud, and stromatolites lived on the beach. Rocks 1.4 billion years ago show domed stromatolites at the base of upright corals. Rocks 2.4 billion years ago show aggregates of filaments with predator filaments living off them in a complex community.

Before oxygen became a substantial part of the atmosphere, the water was a green colour, rich in iron and silica and the atmosphere rich in carbon dioxide. The land was mostly like new volcanic islands. Stromatolites appeared over three billion years ago, although the first appearance is being pushed back and back. In the Pilbara, 3.4 billion years ago, tightly packed cone shaped stromatolites with curved laminations showed that life was already complex. The exposure in the rocks showed beach, deep water and marine environments and there was life in all of them. The stromatolites were different shapes with different patterns of the lamellae, depending on growing conditions. Cone shaped stromatolites grew straight up through the sediment towards the light. Asymmetrical cones grew on slopes.

The oldest rocks in the Pilbara are 3.5 billion years old and ripples in the sandstone are still visible. A large, arching rock structure has veins in the basal layers, probably of hydrothermal origin. The region was probably volcanic instead of a quiet marine environment. When hot springs erupt as geysers, very fine layers of titanium and clay are formed as geysers are seasonal. Perhaps the stromatolites were utilising minerals brought up by the hot springs.

Preservation is remarkable and these rocks were not subjected to temperatures above 150°C at any time in their history. This evidence suggests that life did not originate at the deep sea black smokers where it would have been much hotter, but at the surface. In hot springs, there is no life in the boiling water part. Around the edges where temperatures are lower, starting about 70°C, microbial mats flourish. In storms, platy pieces of bacterial mats are broken off and deposited elsewhere. Prof Van Kranendonk will be comparing structures seen in the Pilbara rocks with structures around New Zealand hot springs.

Small one-centimetre cones had layers of sulphur recycling microbes. Dendritic patterns of haematite were made by iron cycling microbes. Tourmaline crystals contain boron – are there boron cycling microbes? All of these were formed around hot springs.

Was there life on Mars? Mars has three of the largest volcanoes in the solar system and a very large fissure, formed in the last expansion and loss of heat of the planet. Mars is now geologically dead. But there are signs that water has been there in rivers and has formed sedimentary rocks. The study of Astrobiology is growing and it is well funded, all to do with space exploration.

Prof Van Kranendonk and his colleagues are trying to have the sites protected. At present, their remoteness gives them some protection, but this cannot be counted on to keep them safe from fossil hunters. There is still much to be found for the keen eye.

LINNEAN SOCIETY OF NEW SOUTH WALES

For Security reasons, there is now a locked gate between the carpark and the Classroom. If it is locked when you come to a lecture, just wait and someone will come and let you in.

PROGRAMME

**Wednesday 21 October, at 6 pm, in the Classroom, Royal Botanic Gardens.
Enter through the gate to the Herbarium Carpark, on Mrs. Macquaries Rd.**

A/PROF SHAUNA MURRAY

**ARC Future Fellow, Plant Functional Biology and Climate Change Cluster, University
of Technology, Sydney**

**THE MOLECULAR ECOLOGY OF PHYTOPLANKTON AND
IMPACTS ON SEAFOOD SAFETY**

Phytoplankton produce approximately half of the world's oxygen through their photosynthesis, and include representatives of most of the major groups of eukaryotes. Ecological interactions among phytoplankton species are complex, and involve similar mechanisms to those in multicellular organisms, including the evolution of chemical and physical defense mechanisms. Some of the compounds involved in chemical defense have proved to be a problem for our fisheries and aquaculture industries, as they can lead to harmful algal blooms (HABs), which result in the deaths of marine life or in the uptake of toxins in seafood. Aquaculture continues to increase in importance worldwide, as fisheries catches are in decline. Ocean temperature changes and human assisted introductions appear to be impacting the distribution and abundance of some HAB species. Information from emerging molecular genetic techniques, such as transcriptomics and environmental sequencing, have provided the first information on the genetics of marine biotoxins and the presence of previously undetected cryptic species. The harnessing of such information allows for the development of rapid tools to protect seafood safety, and to build our understanding of marine microbial ecology. I will discuss examples of tools recently developed for the detection of *Alexandrium* blooms and cryptic species of *Gambierdiscus*, both of which appear to be increasing their ranges in Australian waters, with corresponding recent spikes in ciguatera fish poisoning and paralytic shellfish toxin incidences.

Refreshments will be served from 5.30 pm

EVERYONE WELCOMED