LINNEAN SOCIETY OF NEW SOUTH WALES

LINN S'O'C' NEWS

NEWSLETTER NO: 168 JUNE 2018

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IN THIS ISSUE

NEW MEMBERS

We welcome our new members:

Ms Margarita Gil **Fernández**, Macquarie University. Fields of interest: ecology, conservation, carnivore ecology, natural history of carnivore.

Dr Glynn **Maynard**. Fields of interest: entomology, Hymenoptera (bees, ants), quarantine, survey, biosecurity, plant protection.

Notice to members
Proceedings of the Linnean Society of NSW

Since the Linnean Society of NSW moved to electronic publishing of our Proceedings we have been able to reduce the membership fees and keep them low. From this year a CD of the proceedings will no longer be sent to members.

As each paper is refereed and typeset it is uploaded to the Open Journal system at Sydney University library and are available for free download.

The link is https://openjournals.library.sydney.edu.au/index.php/LIN/index

To gain access to years 2011 to present select <Browse . . . By Issue>

Issues prior to that (from 1877) are available free from the Biodiversity Library.

The link is https://www.biodiversitylibrary.org/bibliography/6525#/summary

PROGRESS REPORTS FROM RECIPIENTS OF RESEARCH GRANTS

Ms Victoria **Austin**, from Western Sydney University, 2017 recipient of the Joyce W Vickery Fund, sent her progress report for her project titled: *The function of vocal mimicry in female superb lyrebirds* (Menura novaehollandiae).

Miss Claudia **Santori**, from University of Sydney, 2017 recipient of the Joyce W Vickery Fund, sent her progress report for her project titled: *Halting the decline of Murray River turtles.*

ENDANGERED ECOLOGICAL COMMUNITIES (EECs) AND ARCHIVES OF CHANGE: UPLAND SWAMPS IN THE SYDNEY REGION:

A talk given on 10 April at 6pm by Dr Ann Young

Dr Young has retired from the University of Wollongong and is now a member of the Independent Expert Panel on Mining in the special areas of Sydney's drinking water catchment. This Panel is chaired by the NSW Chief Scientist and advises the State Government.

Upland swamps of the Woronora Plateau are characterised by a sharp boundary between surrounding Eucalyptus forests and a sedge-dominated low heath community forming a continuous ground cover. Developed on large areas of sandy sediment and without distinct channels, some wetter areas develop very tall, thick vegetation. In the western areas towards Picton, the swamps are slightly drier and scattered Scribbly Gums appear (and wombats!).

Headwater upland swamps sit up high in on plateaux and slopes close to ridgelines. Rather than forming surface channels, the water moves through cracks in sandstone blocks, seeping out horizontally into wet sandy masses. Headwater swamps are sometimes erroneously called hanging swamps, but the latter are different – they hang on steep to even vertical sandstone faces with the top matched to thin claystone beds which constrain groundwater flow. These types of swamps are common in the Blue Mountains, often seen in the sandstone unit above the Banks Wall Sandstone.

Valley floor swamps are different again, formed where sediments accumulate in the valley floors without channels that would otherwise erode the sediment and drain the area. They are found mainly in the Blue Mountains (Newnes Plateau) and Woronora Plateau.

Swamp sediments build up over several thousand years, starting with sands and gravels. Organic matter starts to accumulate, and the anaerobic environment inhibits decomposition; this is the peat layer, with C:N ratio greater than 27. The top layer is the root zone. Sandstones are nutrient-poor; swamp plants with cluster roots compensate for this by spreading over all available surfaces.

Many parameters in the hydrology of swamp systems are poorly known, as are many ecological aspects. A few unique species are well known, such as the Giant Dragonfly (*Petalura gigantea*) which is entirely dependent on swamp habitats and the endangered Blue Mountains Water Skink (*Eulamprus leuraensis*). There is also a distinctive group of birds that occur in swamp habitats, including New Holland Honeyeater (*Phylidonyris novaehollandiae*).

Fire is a major concern – in shrubby swamps, fire can readily lead to erosion of exposed sand. After severe fire, ants are the only visible living thing to initially recolonise the swamp floor, although it is unclear what they are doing there. But if there is no heavy rain after a fire, then swamps are very resilient, and plants will quickly regrow provided the root zone remains wet.

Sediment cores provide an archive of climate and fire history. In most areas, sediments began to accumulate in swamps during the late glacial stage of the Pleistocene into the Early Holocene (i.e. 15,300 to 9,000 years ago). There are some outlying radiocarbon dates of ~43 KA from Gooch's Crater swamp and Stockyard swamp. Gooch's swamp is characterised by 6 m of humified peat, with the upper 3.6 m accumulating over the past 5,000 years. Due to the general impermeable nature of sandstone it is unlikely that swamp formation is a recent phenomenon,

in fact there is evidence from Blue Mountains Water Skink population genetics that there have been swamps in the Blue Mountains for at least 2 million years.

Generally, a very low charcoal content is seen in swamp sediments during the wetter Climatic Optimum, until 5,700 years ago. Since then, a higher and more variable charcoal content suggests frequent intense fires – but there is no clear pattern relative to human occupation.

Threats to upland swamp communities include lowering of the water table due to damage to bedrock by mining, and drainage by channelization. Swamp collapse can be catastrophic and very rapid once the underlying peat layers have dried; this may occur slowly over several years. Longwall mining, which removes very elongate panels of coal leading to subsidence of overlying rock layers, is particularly of concern for swamp ecosystems and around Sydney's water catchment areas. Damage to the bedrock is irreversible but some other damage can be remediated.

Drying of the peat dramatically changes the type of plant communities that depend on the hydrologic regime in undisturbed swamps; carbon storage capacity of swamp systems will also change. Other land-use changes such as pine plantations and changes to pH due to run off from urbanisation or mines threaten some areas. Pines are invasive and nearby swamps require continual maintenance to remove pine seedlings.

Upland swamps are fascinating, complex and still poorly understood environments.

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.

CURRENT IDEAS ON THE GEOLOGICAL EVOLUTION OF THE BLUE MOUNTAINS, NEW SOUTH WALES

A talk given on 23 May at 6pm by Dr John Pickett (Geological Survey of NSW, ret'd)

A brief outline of the regional geology of the Sydney and Blue Mountains areas is followed by presentation of the traditional ideas on the development of the Blue Mountains. It is generally accepted that the Blue Mountains proper begin west of the Nepean River at Penrith. In that area, the rise, or front, of the Blue Mountains coincides with a fold of the simplest kind, known as the Lapstone Monocline. This feature is oriented north-south, persists for many kilometres, and shows prominently on satellite and aerial photographs. The traditional view presents this feature as a post-depositional phenomenon, resulting from relatively recent crustal movements known collectively as the Kosciusko Uplift. Coarse gravels, which occur patchily at different altitudes along the monocline, and extensively on the Cumberland Plain, are interpreted in the traditional view as post-dating the monoclinal fold.

Some evidence, particularly from geophysical surveys, suggests that the folding along the monocline is actually syn-depositional, though some recent publications dispute this. The age of the folding is critical to interpretation of the post-depositional history.

The Nepean River has a course which can only be described as bizarre. Whereas most rivers rise in a mountainous area, flow through foothills, onto a plain and then into the sea, the Nepean rises not far from the ocean and flows INTO the mountains, a feat it performs no fewer than THREE times! A satisfactory explanation of this behaviour is a necessary corollary of any explanation of the post-depositional history. Age control on the timing of the significant events of this history is poor.

In the Blue Mountains themselves, the only dates are yielded by Jurassic spores recovered from the matrix of breccia within the volcanic necks scattered through the region, and an isotope age of Early Miocene. On the coast, estuarine sediments, also of Early Miocene age, imply minimal vertical movement of the terrain since that time. On the other hand, recent work on young sediments in Mountain Lagoon indicates movement of as much as 15 m along the Kurrajong Fault since that time.

The location of many of the basalt highs of the Blue Mountains, immediately adjacent to the gorges of the Grose and Wollangambe Rivers, implies that the gorges have developed since the Early Miocene.

A coherent explanation of all these phenomena is still lacking; an attempt is made to bring as many as possible of these together.

CRETACEOUS FLAMMABLE VEGETATION

Fire is an integral part of the Australian sclerophyll ecosystem and the vegetation quickly recovers after being burnt. But when did this tolerance, and indeed reliance on fire for maintenance of the ecosystem develop?

During the Tertiary (last 66 million years), rainforests were widespread until about 20-15 million years ago (mya), when sclerophyll forests became predominant. The charcoal content of the sediments increased along with this change in the vegetation: it was low with rainforest, becoming much higher with the sclerophyll vegetation. But this record is for southeastern Australia and variations are to be expected in distant parts of the country. A few Tertiary records from central Australia are similar, with certain differences but the evidence is too sparse to construct a detailed record.

Angiosperms first appeared in the early Cretaceous, some 120 mya. Then, the vegetation was forests of mainly podocarps, araucarians and other gymnosperms, with ferns, some as tree ferns, fern allies, cycads and a wealth of the lower plants. The angiosperm content gradually increased until it was the dominant content of the Tertiary vegetation at 66 mya. By the late Cretaceous (80-66 mya), there was a rich assortment of angiosperms, including the taxa Proteaceae and rare *Nothofagus*. Again, this record is for southeastern Australia with little evidence from elsewhere in Australia.

However, a recent study (Carpenter et al., 2015) reports on late Cretaceous age (about 70-80 mya) pollen, foliar and other remains recovered from a bore sunk by a mining exploration company about 140 km northeast of Alice Springs. The fossil bearing sediments were intersected at depths of 96-108 m and represent a swamp in what was a small late Cretaceous basin.

Proteaceae was the most diverse group amongst the fossils with at least 12 foliar taxa recovered, including two amphistomatic (stomates on both sides of the leaf) leaves that were only 1.0-1.5 mm wide. Sunken stomates and thick cuticles were also found: all features of taxa of open habitats. Some conform closely with open habitat genera such as *Stirlingia, Isopogon* and *Conospermum*, and others are consistent with Grevilleoideae.

Fossil pollen of Proteaceae was very diverse and usually amounted to more than half of the pollen present: an exceptionally high content. Pollen representative of *Franklandia, Beauprea, Faurea* and *Protea* or subfamily Proteoideae, all open habitat taxa, are present. Embothriineae (*Embotherium* and *Telopeia*), the Australian rainforest genus *Alloxylon* and rare *Banksia*-like pollen are also present.

Freshwater, aquatic and wet habitat fossil taxa were common, especially Cyatheaceae, Gleicheniaceae and Sphagnum. Podocarps, araucarians, an extinct conifer and cycads were

present but not abundant. Minute-leaved gymnosperms (possibly including *Microcachrys*) also suggest open habitat. Liliales, palm pollen and Ericaceae were also present.

The authors of this study (Carpenter et al., 2015) suggest that open sclerophyll vegetation is of great antiquity. The environment was a *Sphagnum* fenland with raised areas supporting heath dominated by Proteaceae with Ericaceae, Liliales and low-growing gymnosperms. Elsewhere, there were taller trees and/or closed thickets with some rainforest taxa. Relatively open vegetation with Proteaceae and gymnosperms dominant were probably more widespread over larger areas of inland Australia.

Similar late Cretaceous pollen assemblages rich in Proteaceae have been found in the Ayers Rock (Uluru) and Olga's (Kata Tjuta) region of central Australia.

There were abundant burnt fragments, including charcoalified wood fragments. Evidence of burning is confirmed by the presence of combustion-related hydrocarbons (Carpenter et al., 2016). Globally, the late Cretaceous was subjected to periodic dry climates and is regarded as a "high-fire" era.

Similar swamp deposits formed the Yallourn brown coals in Victoria, but they are much younger, Miocene to Pleistocene (25-2 mya).

In contrast to central Australian in the late Cretaceous, southeastern Australia in that period was largely forest, but it would have been open forest with conical or linear shaped canopies for Australia was then adjacent to Antarctica, at about 65° S. Southeast Australia was also rich in Proteaceae, but it had the canopy taxa *Knightia, Macadamia, Gevuina/Hicksbeachia* and possibly others, in addition to the taxa found in central Australia (Dettmann, 1994).

The Southwest part of Western Australia is a centre of ancient phylogenetic diversity of the Proteaceae. Possibly, such vegetation represents a vestige of a once more widespread inland Australian flora and is a testament to the long and continuous stability of the landscape.

References

Carpenter, R.J., Macphail, M.K., Jordan, G.J. and Hill, R.S. (2015). Fossil evidence for open, Proteaceae-dominated heathlands and fire in the Late Cretaceous of Australia. *American Journal of Botany* **102**, 2092-2107.

Carpenter, R.J., Holman, A.I., Abell, A.D. and Grice, K. (2016). Cretaceous fire in Australia: a review with new geochemical evidence, and relevance to the rise of the angiosperms. *Australian Journal of Botany* **64**, 564-578.

Dettmann, M.E. (1994). Cretaceous vegetation: the microfossil record. *In* R.S. Hill (Ed.) *"History of the Australian Vegetation, Cretaceous to Recent"* (Cambridge University Press, Great Britain).

Dr Helene Martin

PLEASE NOTE:
THERE WILL BE NO TALK IN JULY

2018 LINNEAN SOCIETY OF NSW NATURAL HISTORY FIELD SYMPOSIUM
VOLCANOES OF NORTHWEST NEW SOUTH WALES: EXPLORING RELATIONSHIPS AMONG GEOLOGY, FLORA, FAUNA AND FIRES

Dates: Icebreaker - Monday evening 24 September (Coonabarabran Visitors Centre)
Symposium sessions - Tuesday & Wednesday 25-26 September 2018
Optional Field trip to Warrumbungle National Park Thursday 27 September 2018
Venue (Symposium sessions): Coonabarabran Bowling Club Auditorium, Edwards Street, Coonabarabran NSW.

REGISTRATION FORM

Name (please print): E-Mail:

Affiliation:

Fee category (please circle): Full member / Student member / Retired member / Non-member

I wish to present a talk yes / no If yes, please complete Abstract template

Abstract title & authors (Abstract submission deadline 31st July):

Attending fieldtrip? yes / no

Please send completed registration form to
i) linnsoc@iinet.net.au as attachment (indicate date & method of payment), or
ii) Linnean Society of New South Wales, PO Box 82, KINGSFORD NSW 2032.

Payment options	up to July 31		August 1 – September 24	
Fee category	Symposium	Field Trip	Symposium	Field Trip
Student member	$35	$40	$45	$45
Retired member	$45	$45	$55	$50
Full Member	$55	$55	$65	$60
Non-member	$90	$70	$100	$75

1) Bank transfer: St George Bank. Account name "Linnean Society of NSW" BSB 112-879, Account # 466447867. Please label payment 'Warr_yoursurname'

2) Cheque made out to "The Linnean Society of NSW", posted to the above address.

Registrants must make their own travel and accommodation arrangements. Lunches during the Symposium Sessions are not included in the Registration Fee, but are available for purchase at the Bowling Club bistro.