



# The Bulletin 391

The Royal Society of New South Wales

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25 August 2015

## Future Events

**Thursday 27 Aug 2015**

Southern Highlands Branch Meeting  
**Discovery of "The Hobbit" *Homo floresiensis***  
**Professor Richard Roberts**  
University of Wollongong  
Performing Arts Centre, Chevalier College,  
Bowral.

Starting Time: **6:30 pm**

**A Report will appear in the September Bulletin**

**Wednesday, 2 September 2015**

1236<sup>th</sup> Ordinary General Meeting

**Trait-based Ecology**

**Professor Mark Westoby**

Macquarie University

*Union, University & Schools Club*

*25 Bent St, Sydney, 6.00 pm for 6:30 pm*

Royal Society of NSW and Four Academies  
Forum

**"The Future of Work"**

8 am – 4 pm, Tuesday, 15 September,  
Government House

Attendance is by invitation only

**Thursday 24 Sep 2015**

Southern Highlands Branch Meeting

**To Be Announced**

**Professor Mary O'Kane**

NSW Chief Scientist and Engineer  
Performing Arts Centre, Chevalier College,  
Bowral.

Starting Time: **6:30 pm**

**Patron of The Royal Society of NSW**

His Excellency General The Honourable  
David Hurley AC DSC (Ret'd)  
Governor of New South Wales

## PUBLIC LECTURE – Wednesday, 2 September 2015

### "Trait-Based Ecology"

Distinguished Professor Mark Westoby

Macquarie University

*Union, Universities, & Schools Club, 25 Bent St, Sydney*

**6:00 for 6:30 pm, Welcome drink at 6:00 pm**

**Fellows & Members \$5; Guests, \$20**

*Please note dress code: jacket and tie*

*Please join us for dinner afterward, \$75 per person*



Professor Mark Westoby is one of the world's most influential ecologists. He came to Australia in 1975 with his late wife collaborator, Barbara Rice in 1975. He is now an ARC Laureate Fellow, a Fellow of the Australian Academy of Science, and the recipient of the Society's 2005 Clarke Medal. He has been the leader of "Genes to Geoscience," which is a federation of research labs aimed at incubating future leaders in research that fuses genomics, functional ecology, earth system science, and paleontology.

Prof. Westoby is a pioneer of 'trait-based ecology.' This approach arranges the world's 300,000 plant species into functional types on the basis of their traits. Traits can summarize major trade-offs faced by plants. What emerges is a picture of the variety of different ways plant species make a living, sometimes adapting to different habitats, but also via different approaches to shared habitat.



# From the President

We have just received news that the Dirac Lecture will be held little earlier than usual this year – Tuesday 1 September at UNSW. In recent years, it has become the custom that the lecture, hosted by UNSW, is jointly supported by Society and the Australian Institute of Physics. This year's lecturer and recipient of the Dirac Medal will be Professor Subir Sachdev of Harvard University.

Professor Sachdev's area of research is quantum mechanics, in particular development of condensed matter theory. His lecture is entitled "Quantum entanglement and superconductivity" and will explore the phenomenon by which particles are deeply correlated even when separated

by vast differences, even to the extent that measurement of one particle instantaneously determines the state of the other.

The Dirac Lecture is an opportunity to hear one of the finest physicists in the world talk about his work – these are always very interesting evenings.

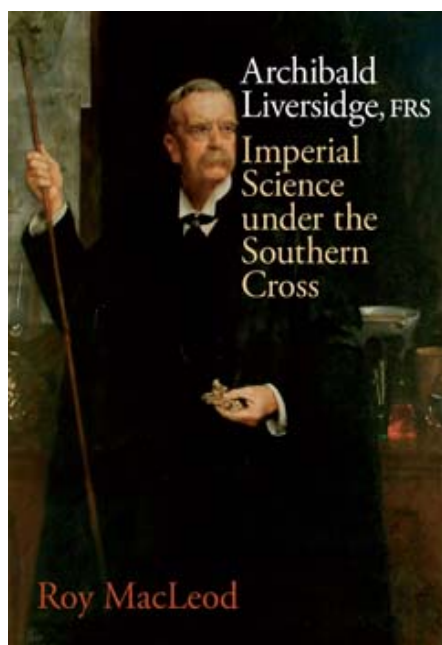
The Royal Society of NSW and Four Academies Forum will take place on Tuesday 15 September. Our patron, the Governor, has kindly offered to host the event at Government House, with a reception the evening before. The topic, "The future of work" promises to be a particularly interesting one and we are delighted that the event was over-subscribed.

Please keep in mind that nominations are now open for the Society's 2015 awards. These are some of the most prestigious awards in Australian science and every year we have a very strong field of candidates nominated. If you are aware of worthy individuals, we encourage you to submit a nomination. Details are available on the website.

The new website is nearly finished and is expected to go into production within the next two weeks. We expected to provide much greater reliability and functionality than the current version.

As always, I am easily contacted at: [president@royalsoc.all.au](mailto:president@royalsoc.all.au) and would like to hear from you.

Donald Hector  
August 2015



Roy MacLeod's *Archibald Liversidge, Imperial Science under the Southern Cross*, chronicles the life (1847-1927) of a leading researcher in geology and a leading exponent of science education at the secondary and tertiary levels.

He was three times President of the Society. He did much to invigorate the Society.

The book can be bought at OGM, or ordered from the office. Cost: \$39.95

## Dates for Your Diary

24 September – SHB Lecture

7 October - 1237th OGM

15 October – SHB Lecture

4 November- 1238th OGM

17 November –AIP Postgraduate Awards Day and Jak Kelly Award judging

19 November – SHB Lecture

2 December - 1239th OGM (Jak Kelly Award, Christmas Party)

# Government Signals Intentions for the Role of Science in Industry

Mr IAN MACFARLANE, the Minister for Industry and Science, submitted on 17 August 2015, a statement entitled “Science and Innovation: Building Australia's Industries of the Future.”

The complete statement may be found at: <http://www.minister.industry.gov.au/ministers/macfarlane>  
See below for links to the Leader of the Opposition’s response and submissions by the Chief Scientist

Here is an abridged version of the Ministerial Statement:

“Australia's science policy, and its connection to industry policy, has never been more important. ... We must use science and innovation to drive a dynamic, entrepreneurial start-up system to secure future growth and jobs. ... The OECD has shown that innovation accounts for around half of total economic growth. ... It is estimated that, for every \$100 million invested by business in R&D, a return of \$150 million to \$200 million is generated to the economy. ... At the moment, our businesses do not invest enough in R&D and are less likely than our competitors to create new and improved products. ... [Australian enterprises] rank 29th out of 30 OECD countries on innovation collaboration between industry and research.

We [the Government] are implementing new measures to boost the commercial returns from Australia's research. ... building a culture of entrepreneurship through changes to employee share schemes, encouraging investment in innovative Australian businesses through reforms to the significant investor visa and regulatory reforms to facilitate access to crowd source equity funding ... We are also encouraging businesses to innovate by providing the R&D Tax Incentive for eligible R&D investments ... And we are promoting entrepreneurship through the Entrepreneurs' Programme which helps firms with advice, business reviews and limited financial support for employing researchers and to commercialise new ideas.

This government appreciates that reducing the time from invention to drawing board to market is critical. That is why we have the Accelerating Commercialisation element of the Entrepreneurs' Programme. I recently announced \$33.6 million in matched Accelerating Commercialisation funding to help 31 innovative Australian businesses turn their inventions into commercial realities. [For example,] Smart Steel Systems Pty Ltd, of Yatala in Queensland, has developed a fully automated steel fabrication system, which has the potential to generate major productivity benefits for the industry. Accelerating Commercialisation support will be used to complete the final pre-production development and trial phase.

Australia has an unprecedented opportunity to align industry, universities, the research sector and the science community to turn great ideas and breakthroughs into great leaps forward for business, for industry, for local communities and for every Australian.”

Link to response by Mr William SHORTEN (Leader of the Opposition):  
[http://parlinfo.aph.gov.au/parlInfo/search/display/display\\_w3p;db=CHAMBER;id=chamber%2Fhansardr%2F1fd076c1-3286-4f4f-97a1-dd0e93035019%2F0152;query=Id%3A%22chamber%2Fhansardr%2F1fd076c1-3286-4f4f-97a1-dd0e93035019%2F0000%22](http://parlinfo.aph.gov.au/parlInfo/search/display/display_w3p;db=CHAMBER;id=chamber%2Fhansardr%2F1fd076c1-3286-4f4f-97a1-dd0e93035019%2F0152;query=Id%3A%22chamber%2Fhansardr%2F1fd076c1-3286-4f4f-97a1-dd0e93035019%2F0000%22)

Links to advice, submissions, and reports from the Chief Scientist, Prof. Ian Chubb, AC FRSN:  
<http://www.chiefscientist.gov.au/category/archives/chief-scientists-submissions/>  
<http://www.chiefscientist.gov.au/category/archives/occasional-paper-series/>

Of particular relevance, see his Senate Inquiry submission on the state of the Australian Innovation System, 23 July 2014.

## REPORT

### The 2015 Clarke Lecture

## "From the Solar Nebula to the Deep Earth – a Geological Journey"

**Speaker: Professor Bill Griffin**

Distinguished Professor of Geology,  
Macquarie University

Thursday 6 August



Geology is a wonderful research field; it can take you on strange journeys. In the mountains of southern Tibet, large massifs ( $\geq 1000$  km<sup>3</sup>) of ultramafic rocks, fragments of Earth's mantle, contain mineral assemblages that require both exhumation from very great depths ( $>500$  km down) and extremely low oxygen fugacity (reducing conditions) not ordinarily expected within the mantle.

To learn the story of these remarkable rocks, we have had to investigate both the mechanisms that have brought them up to the surface, and the origins of super-reducing conditions in the mantle. This has involved field studies, geodynamic modeling, a range of techniques for micron-scale chemical, microstructural and isotopic analysis, and a bit of good luck. One of the keys to the Tibetan riddles lies near the Sea of Galilee in Israel, and involves a remarkable, still poorly-understood type of volcanic activity, which resembles the conditions within in solar nebula. The colloquium will lead you through this story, which is still evolving by the day; it illustrates the diversity of approaches required in modern geological research, and some of the excitement of that research work.

Bill Griffin was born and educated in the USA, and took his PhD from the University of Minnesota for studies of the Precambrian rocks of the Superior Craton. He then emigrated to Norway, and spent the next twenty years at the University of Oslo, mainly in the Geological Museum, the center of geochemical research in Scandinavia. He moved to Australia in 1985, to be with his new Aussie wife and to help develop geological applications for the CSIRO's new proton microprobe. When the GEMOC Key Centre was established in 1985, he moved to Macquarie, seconded from CSIRO. After leaving the CSIRO in 2006, he accepted a contract from Macquarie University, and has been here since, currently as Distinguished Professor of Geochemistry.

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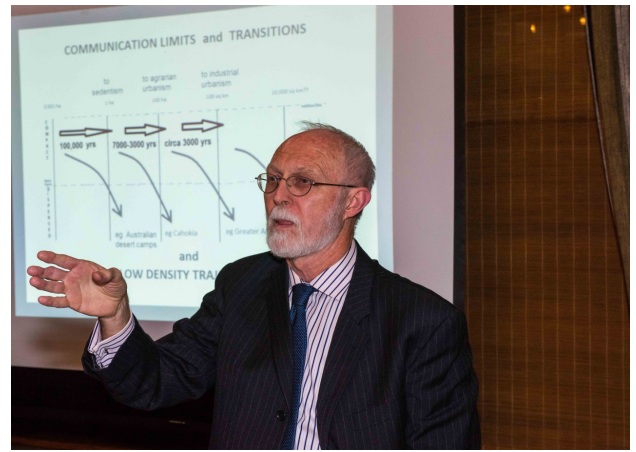
For further information: <http://www.royalsoc.org.au/>



## REPORT

# 1234<sup>th</sup> Ordinary General Meeting Complexity in Cultural Transitions 100,000 BP to Present

**Speaker: Professor Roland Fletcher**  
University of Sydney  
Wednesday 5 August 2015



When the Conquistadores invaded South America they found that there was no wheel. If the Incas had been able to use draught animals and wheeled vehicles, they may well have defeated the Spaniards. Yet, as early as the first century BC, South Americans did know about rotary motion and children's toys were known to have wheels. The explanation that has been accepted is that there are no draught animals in Latin America and therefore no use for wheeled vehicles. But that is inconsistent with the history of China where the wheelbarrow was invented in very early times.

In 1901, a highly complex clockwork mechanism composed of about 30 meshing bronze gears was recovered from a shipwreck off the Greek island of Antikythera. The Antikythera mechanism has been dated between 150 in 100 BCE and was an extremely sophisticated and complex device, probably used for astronomical measurements. Why did it disappear? One explanation is that the Greek accounting system had no zero and the computing machine would have limited application

So, it simply disappeared. Such sophistication did not appear again until the Renaissance.

The current theory explaining these phenomena is that civilisation progresses in stages. There are three broad phases of development: from village, to city, to conurbation. In each, there is evidence in the fossil record that marks evolutionary progress: evidence of the village is the evolution of pottery and durable houses. As cities developed, so too did literacy – the fossils are written records. And conurbation is evidenced by mechanisation.

But Roland Fletcher presents a different way of looking at these phenomena. His view is that the markers of these transitions have been misinterpreted. Rather than the fossil record being the product of the transition, it actually represents the necessary conditions for cultural and material foundations to change. Modern cities and their fossils are not a record of markers, rather they are record of the pre-requisites emerging for the transition to take place.

The key determinant of settlements is their size. Villagers typically occupy no more than about 1 ha; the first cities occupied about 100 ha and the large cities of the current year typically are up to 100 km<sup>2</sup>. The first villages of old date gradually to the period up to about 4000 BCE and the first cities emerged between 4000 BCE and 1000 BCE. And the metropolitan areas of today only started to develop in the 19<sup>th</sup> century, initially only in one location – London – but rapid transportation in the 20<sup>th</sup> century saw these increase in number.

As the transition takes place from village, to city, to metropolis the area occupied increases by a factor of about 100 but for each transition, the rate of development is 1000 times faster.

The question this raises is: can this development continue at such an exponential pace? Will settlements of greater than 10,000 km<sup>2</sup> eventually develop? It's possible to envisage this but clearly there must be limits – perhaps ultimately the earth will end up like Coruscant the fictional "ecumenopolis" from Star Wars.



Professor Ian Wilkinson FRSN presents Professor Roland Fletcher with a Society Medal to mark the occasion of his paper “Complexity in Cultural Transitions 100,000 BP to Present” delivered at the 1234<sup>th</sup> OGM, 5 August 2015.