PREFACE

Promoting Science in Western Australia
A review of some achievements

The year 2014 marks the one hundredth anniversary of the granting of the Royal Charter to the Royal Society of Western Australia (RSWA). There had been several forerunner societies to the RSWA—Western Australian Natural History Society, Mueller Botanic Society, West Australian Natural History Society with which is incorporated The Mueller Botanic Society, and Natural History and Science Society of Western Australia: indeed the Society published a centennial issue of the Journal in 1998 to mark the foundation of the Mueller Botanic Society in 1897 from which the RSWA eventually evolved. Nevertheless it is approporiate to also celebrate 100 years of promoting science in Western Australia under the Society's Royal Charter.

Now is also the time to look forward to the next hundred years of science in Western Australia. To this end Council has decided to change the name of the Journal to WA Science (while retaining the Journal of the Royal Society of Western Australia as a subtitle) to emphasise the Society's role as set out in its Constitution 'to promote and assist in the advancement of science'. This is the first issue of the Journal under its new title and cover and contains papers reviewing significant aspects of scientific research that have been undertaken in Western Australia. A glance at the contents shows the breadth of research covered in this issue: a perusal of the list of authors reveals that many are members of the Society, demonstrating the active involvement of the Society in WA Science.

Bevan, in the introductory History and roles of the Royal Society of Western Australia, outlines the history of the Society; its formation, Journal, insignia and scientific role. He also explains why in its Centennial year the Society's Journal is Vol 97!

The remaining papers are grouped under the major disciplines they represent.

Green's Maritime archaeology in Western Australia reviews the development of the legislation to protect the State's underwater cultural heritage, with Western Australia enacting the world's first underwater cultural heritage legislation in 1963. The author discusses the work of the Western Australian Museum on shipwrecks on the Western Australian coast from the early shipwreck of the Trial in 1622 to the more recent wrecks of HMAS Sydney and HSK Kormoran in 1941.

Under Biological Sciences there are three botanical and two zoological papers.

The three botanical papers cover a diversity of topics. In Vegetation survey in Western Australia, Gibson documents the work of Ludwig Diels, Charles Gardner and John Beard in producing increasingly more detailed biogeographical classifications and vegetation maps for Western Australia. The author examines what might be needed to continue this work at higher resolutions. Thiele & Prober's Progress and prospects for understanding evolution and diversity in the Southwest Australian flora reviews the remarkable flora of southwest Australia with its high species richness and endemism and compares it with the flora of southeast Australia, confirming that southwestern Australia has higher species richness but lower generic and family richness than southeastern Australia. Dieback disease is reviewed in Phytophthora cinnamomi in Western Australia by O'Brien & Hardy. The pathogen Phytophthora cinnamomi has a wide host range; many Western Australian species of native plants are susceptible, and a large number are threatened with extinction. The authors look at the mechanisms by which P. cinnamomi causes disease and also at possibilities for control of the pathogen.

The two zoological papers deal with invertebrates and vertebrates. In Arachnida (Arthropoda: Chelicerata) of Western Australia: overview and prospects Harvey provides a history of the study of arachnids (spiders, scorpions, ticks, mites and their relatives) in Western Australia. The fauna consists of at least 1400 named species and it is estimated that ~6000 species exist, the majority of which are currently undescribed. Warburton's Relicts, reproduction and reintroductions—a century of marsupial research in Western Australia reviews the quintessential Australian animals, that have attracted considerable interest from the scientific community, both at home and abroad under the headings: taxonomy and natural history ('relicts'); reproductive biology and physiology ('reproduction') and conservation ecology ('reintroductions').

The sole chemistry paper, Watling, Scadding & May's Chemical fingerprinting of gold using laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS), documents the development of a gold fingerprinting protocol, using laser ablation–inductively coupled plasma–mass spectrometry and overviews the application of the technology and highlights its use in specific cases of gold theft.

There are eight Earth Science contributions, again emphasising the diversity of research in this area of science. In Geochronology of the Archean of Western Australia: a historical perspective Pidgeon & Wingate present a brief overview of the role of isotopic dating in providing numerical measurements of the geological age of igneous and metamorphic events and resolving key questions on the evolution of the Pilbara and Yilgarn Cratons. They also highlight major achievements, including the identification of the oldest fragments of the Earth's crust in metasedimentary rocks of the Yilgarn Craton and the determination of the age of the world's oldest fossils in the Pilbara Craton.

Turning to younger rocks McNamara, in Early Paleozoic colonisation of the land: evidence from the Tumblagooda Sandstone, Southern Carnarvon Basin, Western Australia documents the great variety of trace fossils in the Tumblagooda Sandstonde, which he argues is of early to mid-Silurian in age. This nascent terrestrial fauna was dominated by arthropods. The presence of extensive dwelling burrows and terrestrial trackways in the Scoyenia ichnofacies may represents the earliest known freshwater/terrestrial ecosystem and supports the view that one of the major steps in evolution, the colonisation of land by animals, may have been from rivers, rather than directly from the sea.

Devonian rocks receive attention in two papers. In Devonian vertebrates from the Canning and Carnarvon Basins with an overview of Palaeozoic vertebrates of Western Australia, Trinajstic, Roelofs, Burrow, Long & Turner review recent work on the exceptionally well preserved Late Devonian fauna of the Gogo Formation that has revealed new information on bone growth, muscle attachments, the evolution of teeth and reproductive structures, and live birth in early vertebrates. This and work on Early Carboniferous faunas from the Canning, Carnarvon and Bonaparte Basins are providing information on faunal patterns and exchange of vertebrates through the Paleozoic, which is at odds with paleogeographic reconstructions based on paleomagnetic evidence. Playford, Hocking & Cockbain's Devonian Great Barrier Reef of the Canning Basin, Western Australia: the evolution of our understanding reviews the historical development of our understanding of the world famous Devonian reef complexes that are spectacularly exposed along the northern margin of the Canning Basin in Western Australia, and have become renowned as 'The Devonian Great Barrier Reef'. The geological literature on these rocks dates back to 1884; the first studies of the biostratigraphy were conducted during the 1940s and systematic mapping the reefs started in the late 1940s and early 1950s, and since then studies by many individuals and organisations have progressively increased knowledge of the stratigraphy and paleontology of these reef complexes culminating in 2009 with the publication of the Geological Survey of Western Australia's comprehensive bulletin on the geology of the reef complexes.

The Shark Bay region is discussed in two papers. Playford's Recent mega-tsunamis in the Shark Bay, Pilbara, and Kimberley areas of Western Australia describes the very large blocks of calcrete, some weighing more than 700 t, thought to have been the products of mega-tsunamis, that lie on flat karstified calcrete surfaces behind coastal cliffs in the Shark Bay area and on Barrow and Legendre Islands. Other mega-tsunami deposits are known from the Kimberley, where they include large blocks of Proterozoic siliceous sandstone and mafic igneous rocks. Oysters encrusting the boulders have been dated: two samples of oyster shells from Legendre Island, and seven from Barrow Island, have been radiocarbon dated as 2895 and 3777 years BP (Legendre Island) and 3498 to 5444 years BP (Barrow Island). The tsunamis that struck the Kimberley coast have not been dated but may be associated with seismic activity along the Sunda and Banda Arcs of Indonesia. The origins of mega-tsunamis that impacted on the coast from Shark Bay to the Pilbara are uncertain but it seems likely that they originated from large-scale slumping of sediment on the continental slope (possibly initiated by earthquakes) or local faulting. The world famous stromatolites are described by Collins & Jahnert in Stromatolite research in the Shark Bay World Heritage Area. Detailed mapping has revealed extensive subtidal microbial deposits occupying ~300 km^2 of the total Holocene 1400 km^2 area of Hamelin Pool. The microbial pavement covers 227 km^2 of the subtidal substrate, which together with columnar structures reveals a subtidal microbial habitat that occupies an area several times larger than the area of the intertidal deposits. Oldest dated stromatolite heads are 1915 ^{14}C years BP, and the overall system was deposited in two stages: the first between 2000 and 1200 and the last from 900 years BP to the present. Slow accretion rates vary from less than 0.1 to 0.5 mm/year. Evidence of shallowing-upward fabric sequences of microbial origin reflects relative falling sea levels during the late Holocene and is likely useful in ancient environmental interpretation.

Commander reviews the water resources of the State in Drought and flooding rains: Western Australian water resources at the start of the 21st Century. The drying climate of southwestern Western Australia has led to much reduced runoff and groundwater recharge, with consequent decline in groundwater levels affecting wetlands and groundwater-dependent ecosystems while desalination has replaced the failing surface water supplies from hills catchments. At the same time, the north and northwest of the State have an increasingly wet climate in the last decade. The challenge for the State is to optimise use of the existing water resources and make best use of the undeveloped surface and groundwater. With groundwater and surface water resources increasingly fully developed, the emphasis for the future will be on recycling and water-use efficiency.

The eighth paper in this section, Some Australian contributions to meteoritics from the 19th to the 21st Centuries by Bevan, documents some of the significant achievements that have been made in the study of meteorites in Australia. Meteorites are fundamental to our understanding of the origin and early evolution of the Solar System. Many have remained virtually unaltered for 4.56 Ga and represent some of the original materials from which the planets were constructed. From the 19th Century onwards contributions to the understanding of planetary materials have been made by Australian scientists in the fields of meteorite recovery, mineralogy, petrology and metallurgy of meteorites, meteorite classification, isotopic studies, geochronology, impact cratering and Solar System formation.

The final paper is in a discipline that has featured all too rarely in the Society's Journal. In Advances in mathematics and statistics in Western Australia since 1960 Bassom, Hopwood, Noakes, Pakes & Praeger, review some of the key developments in mathematics and statistics over the last half-century concerning researchers either based in, or originating from, Western Australia. The authors describe the whole range of mathematical sciences from the work in the most abstract and theoretical aspects of pure mathematics through to the most applied area of statistics and provide an insight into the work of the mathematical community in Western Australia.

It remains for me to thank the authors, and reviewers, for the time and effort they have put into bringing this Centennial Issue to fruition. Nevertheless, it has not been possible to cover the whole spectrum of scientific endeavour in Western Australia, and some readers may feel that there are glaring omissions. We therefore invite those who think their field of science has been neglected to prepare and submit a review to the new Journal so that it can indeed continue to 'promote and assist' WA Science in all its aspects.

A E Cockbain
Hon Editor: Centennial Issue
June 2014