

VOLUME
36
NUMBER
1

explore

culture

MESSAGE STICKS IN
THE DIGITAL AGE

nature

ASTEROIDS AND MASS EXTINCTIONS

discover

WHO WAS WILLIAM HOLMES?



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over MY SHOULDER



This is my last *Explore* editorial. What do I say after 10 years working with an amazing team at this wonderful museum?

The ten years have had many highlights, large and small. At the monumental end is the construction of the Collections and Research Building, opened in 2008, with much credit to former Trust President Brian Sherman and former Arts Minister Bob Debus for securing and retaining the funds to make the building happen.

And while we are on research facilities, the 30th Anniversary Development of the Museum's Lizard Island Research Station has resulted in one of the world's foremost tropical marine research facilities. Special credit here must go to Ken Coles and Charlie Shuetrim of the Lizard Island Reef Research Foundation for raising the funds for this expansion and for their continuing support.

Establishing both the Australian Museum Research Institute and Australian Centre for Wildlife Genomics last year will further focus Museum research and boost our research profile. The increasing application of genomics to the biological work of the Museum has greatly increased our ability to understand Australia's biodiversity.

FOUNDATION

Other personal highlights result from the generosity of donors to the Australian Museum Foundation, enabling many of the Museum's recent acquisitions such as the *Menagerie* contemporary Indigenous art collection, the wonderful Dauma and Garom 'ghost net' sculptures and the Timor-Leste expeditions, among many others.

A particular highlight for me continues to be the Pacific Youth Cultural Reconnection Program (also supported by the Foundation, with community and government partners), where we have used the Pacific cultural collections to help at-risk youth from Pacific communities build identity and pride and avoid the cycle of crime. The use of the Museum's cultural collections by creator communities is extremely important and marks a move towards a greater dialogue with diverse communities.

ENGAGEMENT

There have been many wonderful exhibitions during my time here. Close to home, we've had the *Scott Sisters* exhibition drawn from the Museum's Archives – still touring regional New South Wales and now available as an app. At the other end of the spectrum was last year's magnificent *Alexander the Great* exhibition from the State Hermitage of St Petersburg, which set a new benchmark for the Museum in major exhibitions.

But overall it's the people who make up the Australian Museum family that I am most proud to have worked with, be they staff, volunteers, Members or supporters. I am happy to be leaving the Museum in their capable hands and in those of our new Director, Kim McKay, whom I like and admire very much. Please give Kim the same wonderful level of support that you have given me.

FRANK HOWARTH PSM

Director of the Australian Museum

meet

KIM MCKAY

IF YOU'VE HEARD OF CLEAN UP AUSTRALIA AND THE GENOGRAPHIC PROJECT, THEN YOU ALREADY KNOW SOMETHING ABOUT **KIM MCKAY** AO, THE AUSTRALIAN MUSEUM'S NEW DIRECTOR.



Kim McKay AO has been appointed Director of the Australian Museum from April 2014. Photo © Ross Coffey.

Kim, you were made an Officer of the Order of Australia in 2008 for distinguished service to the environment and the community. When did you first become interested in the marine environment?

I grew up going to the beach with my family, and my earliest memories are of going to swim in the surf with my parents at Dee Why Beach. We moved to England when I was six for my dad's job, and in those days you went by ship. And I remember as a little girl sitting at our cabin window and staring at the ocean for hours on end on the lookout for whales ... so I fell in love with the ocean very early on.

It's those early things you experience as a child that get seeded into your memory. We moved back to Australia at the end of primary school and for me, back living on the northern beaches, surfing ... it was just in my veins!

Can you tell us a little more about your family and background?

Well I went to a State high school, Mackellar Girls High in Manly Vale. My dad was a toolmaker before he moved into management in the manufacturing firm he worked for. My mum eventually worked as a teacher's aide. So we were a typical middle-class family really.

I'm single, but that's only because George Clooney hasn't met me yet! I don't have children of my own, but I do have two nephews and a niece in my extended family. They're all grown up now.

How did you come to establish Clean Up Australia with Ian Kiernan?

After studying Communications at UTS, I worked on many projects and major events and eventually ended up working on the BOC Challenge [a solo around the-world yacht race] doing public relations and event management. It was a very interesting event with a strong environmental and educational component. And that's when Ian, after doing that 1986/87 race, walked into my office and said he was worried about the rubbish in and around Sydney Harbour and could we do something about cleaning it up. And I said yes, let's do that! And that was the start of Clean Up Sydney Harbour in 1989. It evolved into Clean Up Australia the following year and then later Clean Up the World.

Do you have any plans for the Museum to do large-scale citizen science projects like the Genographic Project?

Dr Spencer Wells and I came up with the concept for the Genographic Project when I was working with *National Geographic* in the USA in 2004 and it continues to grow and engage the public as it traces the migratory history of humans across the globe. Close to a million people have been engaged directly by participating in the research or purchasing a cheek swab kit. The money raised from kit sales helps fund the science as well as the

continued page 29



carrying THE MESSAGE STICK

THE DIGITAL REVOLUTION IS HELPING THE MUSEUM SHARE KNOWLEDGE AND INFORMATION FROM THE COLLECTION WITH INDIGENOUS COMMUNITIES, SAYS THE MUSEUM'S **MARIKO SMITH**.

For many thousands of years, Aboriginal people have used message sticks – small pieces of wood, carved or painted with symbols – to convey important information between neighbouring groups.

Messengers were generally granted safe passage as they passed through often-fiercely defended territories. Upon arrival at their destination, the messenger would be received by the Elders who would read and interpret the message and respond in accordance with protocols.

The messages they conveyed covered wide-ranging topics from invitations or notices about upcoming ceremonies and celebrations, details about the messenger's credentials and privilege of safe passage (like a visa) to a call for warriors to come together for battle.



Previous page

Message sticks needed to be small and portable. They could be cylindrical or flat, carved or painted, plain or elaborate. These two message sticks appear to be simple wooden cylinders with carved patterns. (top) Ironwood message stick, Top End Emu clan. *E083100* (below) Softwood message stick, Yir Yoront Grass clan. *E083101*

Opposite from left

Broad softwood shield with red and white ochred bands. 71 x 16.5 cm. *E083088*

Narrow softwood shield with red and white ochred bands. 63.5 x 9.5 cm. *E083089*

Necklet made from swamp grass, strung on double-looped fine nylon line. 30 cm circumference. *E083073*

Pandanus-strip basket bound with cabbage-palm string, made by Jessie Josiah in 1985. 22 x 33 cm. *E082989*.

All photos by Stuart Humphreys.

MUSEUM AS MESSENGER

The message stick is still used today but is more often digital, with the online realm providing a platform for Aboriginal and Torres Strait Islander communities to present and share knowledge, stories, histories and cultures with each other and with the wider world.

I sometimes think of the Australian Museum as a messenger that carries an important message about Indigenous cultural identity, goodwill and ‘both ways’ learning. Our ‘message stick’ is the large, diverse collection of cultural objects in both physical form (in our exhibition displays and storage facilities) and digital form (through the Museum’s electronic records).

By digitising its Aboriginal and Torres Strait Islander collections, the Museum is providing new ways for people to connect with Indigenous objects and build meaningful relationships. Websites, web portals and online databases operate as an intermediary space, a meeting place, in which the Indigenous and non-Indigenous worlds can intersect.

Combining these digital media with Indigenous input and participation can create a means to express and preserve Indigenous languages, knowledge and material culture in collaborative, respectful and sustainable ways.

RETURNING KNOWLEDGE

Since the 1980s, the Australian Museum has played a pivotal role in fostering positive relations with Indigenous communities through consultation, collaboration and repatriation. My role as Indigenous Collections Repatriation

Officer at the Museum often involves the return of ancestral remains and secret/sacred objects from museum collections to Aboriginal and Torres Strait Islander communities.

But we also have a number of ‘digital repatriation’ projects that aim to return knowledge and information associated with objects in the collections to the communities that created the objects in the first place – often long ago and perhaps forgotten. Archives, records, labels and descriptions are a rich source of this intangible heritage that often includes notes about Indigenous names, creators and the uses and cultural significance of the objects.

This process not only gives Indigenous communities greater opportunities to access their cultural material than purely physical visits would, but also allows broader audiences to engage with Australia’s Indigenous first peoples through their material culture.

SHARING THE SPACE

This may seem like an obvious thing for a museum like ours to be doing, but it hasn’t always been so. In the past, Indigenous objects were often considered only in terms of their artistic and anthropological value, rather than as representations of dynamic living cultures.

Things began to change in the late twentieth and early twenty-first century as political movements across the world brought attention to indigenous rights – in particular the primary moral rights of indigenous peoples over their material culture and traditions.



These developments challenge the roles played by museums in the centuries-old practice of collecting Indigenous objects (mainly for the benefit of non-Indigenous audiences).

Museums are becoming shared spaces where Indigenous communities can learn about their heritage from collections, contribute to that knowledge and preserve it for future generations. Take for instance the Museum's purchase of 158 contemporary objects in the mid-1980s from Kowanyama Handicrafts, an Indigenous arts and crafts collective in Cape York.

This acquisition added to the Museum's array of ceremonial ornaments, weapons, spiritual items such as casting points and,

incidentally, message sticks from Far North Queensland.

We are working on consolidating and sharing the information we hold about these objects with Indigenous audiences to yield new insights that are not apparent from physical inspection of the objects alone.

Taking this further, some online research about central Cape York Aboriginal languages in the Kowanyama area reveals that message sticks were known by a number of names: *ug ilpa* and *ilp elan* in the Uw Olkola language, and *yuku maakan* and *mo'a yakan* in the Pakanh language.

We are now able to bundle up this knowledge and send it back to the

Aboriginal community to be shared, added to and preserved. This simple example shows how digital repatriation goes beyond the physical objects to form a more detailed picture of the cultures that created them.

This trend is set to continue and grow as we realise the full potential of digital technologies in preserving the material and intangible cultures of Aboriginal and Torres Strait Islander peoples.

MARIKO SMITH, INDIGENOUS COLLECTIONS REPATRIATION OFFICER

WEBLINK >

Search the Museum's collections at australianmuseum.net.au/Australian-Museum-Collection-Search



Australian Museum Directors
1829 –



WILLIAM HOLMES.

enigma

AN EMPTY PICTURE FRAME SPARKED
A PERSONAL QUEST FOR AMATEUR
SLEUTH **COLIN JOHNSTON**.

There have been just 16 directors in the Australian Museum's 187-year history (with another, Kim McKay, due to take up the reins in April). Their photographs hang in two neat rows on the wall just inside the Museum's William Street entrance.

Walking past them each day, I was intrigued that two of the frames – those of William Holmes and William Galvin, the Museum's first two custodians – were blank. Curiosity got the better of me, and I began to search for a portrait of Holmes or at least something about his life and times.

SOURCES

My hopes of finding a portrait soon faded, as photography (invented in 1827) would have been in its infancy, and oil paintings were for the rich and powerful, not minor public servants. Turning to Ronald Strahan's comprehensive history of the Museum, *Rare and Curious Specimens*, I was surprised to find only basic information about Holmes and a



William Holmes

few pages about his appointment (16 June 1829) and death (23 August 1831, 'shot by accidental discharge of his gun while at Moreton Bay collecting Birds and other Curiosities'). The Museum seems to have no record of specimens collected by Holmes, and even the Museum's Archives hold only one or two documents from his tenure.

Undeterred, I searched online. As anyone who's researched their family tree knows, the web has some amazing resources, such as Trove (the National Library of Australia's online search engine); digitised newspapers such as the *Sydney Gazette*, *Sydney Herald* and *Monitor*; shipping records; and registers of births, deaths and marriages.

You can also take the hands-on approach of going through old manifests and documents held in archives. There is nothing more exhilarating than finally locating something you have been searching long and hard for, and quite a few times my fellow researcher, Beverly Malone, after visiting NSW State Records, would contact me to say, 'Guess what I have just found?'. Your heart skips and you know something good is coming, and we have had quite a few of these moments while doing this research.

When we began, we knew little about William Holmes – not even his age, spouse, children or siblings – but these details slowly came to light as we delved deeper.

BROTHERS

William Holmes was baptised William Hulme in Ormskirk, Lancashire in the UK on 7 July 1797, the fourth of ten children. In 1818, his older brother James was convicted of larceny and transported to the penal colony of New South Wales for seven years.

Returning to England in 1825, James may have inspired William to emigrate in search of a better life. With their younger brother Thomas and James' son Luke, they left London aboard the *Elizabeth* on 25 November 1826, leaving William's wife of just six weeks (also called Elizabeth) behind.

The brothers arrived in Sydney in April 1827 and took up residence at 61 Castlereagh Street to work as carpenters and joiners. William returned to England the following year to bring back his wife, sisters-in-law, their children, his youngest brother and his nephew. The extended family arrived in May 1829 (again on the *Elizabeth*), just a few weeks before William was to begin his new job at the Colonial Museum, as it was called.

We still don't know how or why he was appointed as Zoologist (as his role was known). William lacked formal qualifications, so was it his cabinet-making skills as a carpenter that got him the job, as Ronald Strahan suggests? Or was it the letter of introduction from RW Hays, Under-Secretary of the Colonial Office, to Governor Darling? Or maybe William was something of a lay veterinary, as descendants of Thomas Holmes wrote in a letter to the Museum in 1991.

DUTIES

Holmes presumably set about collecting specimens for the new museum in the Sydney region initially. In November 1829 he travelled to the fledgling penal settlement of Brisbane (settled in 1824) on the brig *Amity*, carrying a letter from Colonial Secretary Alexander Macleay (himself a keen insect collector) instructing Commandant Patrick Logan to provide Holmes with whatever rations he needed.

Above left

Col Johnston plays Sherlock on the trail of Holmes.

Above right

Very little correspondence from Holmes survives. This is a rare example of his signature taken from his marriage certificate.

Next page

Colonial Secretary Alexander Macleay. Oil painting by Margaret Carpenter, 1838.

Col Johnston in the Museum's Research Library.

Photos by Stuart Humphreys.

We found that letter in NSW State Records, which holds Macleay's correspondence, but there are many blanks in the story of the Museum's early days. We know that by 1830 the Museum was housed in the old Post Office in Bent Street where Holmes would politely show the collection 'to any respectable individuals who may see fit to call', as an article in the *Gazette* from August 1830 reported.

Another snippet, from the *Herald* in July 1831, recommended that newcomers should '... take a look into the Sydney Museum in Bligh-street [sic], which consists entirely of the production of the Colony, scientifically arranged'. Although not mentioning Holmes by name, it reported that 'the person in charge very politely renders to the visitors every information in his power'.

It's also clear that Holmes had access to skilled convict labour to assist in cabinet-making, as a request to Macleay found in NSW State Records, shows.

DESTINY

While details of Holmes' life are sketchy, his demise is well documented. In June 1831, the convict ship *Eleanor* arrived in Sydney carrying more prisoners destined for Brisbane. Here was an opportunity for a second collecting trip to this relatively unexplored region, which must have been an attractive proposition for any collector.

Ominously, the ship's departure was delayed in Port Jackson due to a disturbance on board. Soldiers had opened fire on prisoners thought to be mutineering (but who were actually clamouring for rations). Two prisoners died and two were wounded, and the *Eleanor* remained berthed until an inquiry was held. Finally, on 10 August, she set sail for Moreton Bay with Holmes on board.

He arrived on North Stradbroke Island on 23 August 1831 accompanied by a convict helper, Samuel Saunders, and the pilot of Moreton Bay, James Nelson. The three men breakfasted and headed off to collect



specimens at Amity Point. Nelson soon turned back, while Holmes and Saunders continued on their collecting quest.

Holmes sighted a cockatoo in a gum tree, took out his double-barrelled fowling gun and felled the bird with one shot. As he was retrieving the specimen, he rested the gun against his right side, but it discharged, shooting him at point blank range.

An inquiry into the shooting took place the following day under the supervision of Commandant James Oliphant Clunie, with statements taken from Saunders and Nelson. Saunders told the inquiry that on hearing the shot, he rushed to Holmes' side to hear him utter his last words, 'Oh my God, I am dead'. He quickly alerted Nelson, who arrived to find Holmes' lifeless body. They lifted it into the boat and, after a brief stop at Dunwhich, transported it to Brisbane. Assistant Surgeon James Murray concluded that the death was accidental, as the inquiry documents in NSW State Records reveal.

MISSING

So where is William Holmes' final resting place? We don't know for sure, but it's probably the old Skew Street cemetery in Brisbane (now covered by a park); unfortunately, the earliest burial records in the Queensland State Archives don't begin until July 1832.



The body is unlikely to have been returned to Sydney, as the next ship to Moreton Bay was the *Governor Phillip*, which docked in Brisbane on 9 September 1831, 17 days after the shooting, and arrived in Sydney on 15 October 1831 with two crates of Holmes' belongings. NSW State Records has the inventory that accompanied them, but there is no mention of his remains. Nor were there any bird skins or other specimens, as he died on the first day of his ill-fated trip.

So the empty photo frames remain empty. Our knowledge of William Galvin, Holmes' replacement, is similarly sketchy, though *Rare and Curious Specimens* provides a few juicy biographical nuggets. Our research has at least helped flesh out the (missing) bones of our first custodian. Who knows what further details remain to be uncovered?

COL JOHNSTON, EXHIBITION PRODUCTION COORDINATOR

WEBLINK >

Meet all of the Museum's curators and directors at australianmuseum.net.au/Museum-Curators-and-Directors

Further reading

Ronald Strahan, 1979. *Rare and curious specimens. An illustrated history of the Australian Museum 1827-1979*. The Australian Museum, Sydney.

on the RECORD >

Ctenophorus mirrityana, a new species of dragon from Western NSW. Photo © Steve Sass of Envirokey.



REVIEW

The Best Australian Science Writing 2013
New South Publishing 2013

In curating this anthology the editors have included many writing styles and perspectives. The story of medical researcher Michael Alpers and his search for the cause of the disease *kuru*; the frustration felt by Tim Flannery as he tried, in vain, to save the Christmas Island Pipistrelle from extinction; the poetic ruminations of Tollund Man as he is exhumed 2000 years after death – there is no quick way to summarise the diversity of the 33 stories and poems in the book. The themes are as diverse as science itself, but the writing is sure to enlighten and entertain.

NEW LIZARD SPECIES FROM NSW

It's not every day that scientists find a new species of lizard, let alone one as spectacular as this dragon lizard, *Ctenophorus mirrityana*. Previously thought to be an outlying population of *C. decresii*, the new species was published recently in the *Records of the Australian Museum* in an article by PhD student Claire McLean (University of Melbourne) and colleagues. In a cross-cultural twist, the new lizard is from an area rich in Aboriginal rock art and engravings depicting lizards. 'The Museum published a paper about the rock art by anthropologists Fred McCarthy and Neil McIntosh in 1962', said *Records* editor Shane McEvey. 'So it's taken more than 200 years for us to find a lizard that may well have been first illustrated by the Aboriginal people of Mootwingee in the State's Far West!'

Find links to the original articles about the 'new' lizard and rock art at australianmuseum.net.au/Explore-magazine

FELLOWSHIPS OPEN

A new round of fellowships provides financial support for researchers to visit the Australian Museum and work with its research staff and collections.

Offered by the Australian Museum Research Institute, the fellowships include the Chadwick Biodiversity Fellowship, which supports a recent PhD graduate in establishing their career in biodiversity research. The postgraduate awards, visiting research fellowships and collections fellowships on offer will encourage greater collaboration between researchers and improve knowledge of the Museum's collections.

Applications for the fellowships close at 5 pm, Friday 24 May.

Find out more about the Australian Museum Research Institute Fellowships at australianmuseum.net.au/Visiting-Fellowships

THE K-T BOUNDARY AND THE *mass extinction* OF SPECIES

THE ASTEROID STRIKE THAT CAUSED THE EXTINCTION OF DINOSAURS AND MANY OTHER SPECIES WAS ONE OF THE MOST DRAMATIC EVENTS IN EARTH'S HISTORY, WRITES EARTH AND PALEO-CLIMATE SCIENTIST **DR ANDREW GLIKSON**.

Many readers would have heard that 'an asteroid wiped out the dinosaurs', but it is only recently that scientists finally concluded that the evidence for an asteroid as the cause of mass extinctions some 65 million years ago is convincing.

EVIDENCE

The asteroid hypothesis was first proposed by the Nobel laureate physicist Luis Alvarez, his son Walter and colleagues Frank Asaro and Helen Michel, all from the University of California. Their paper, titled 'Extraterrestrial cause for the Cretaceous-Tertiary extinction', was based on the analysis of an unusual geological layer of marine sedimentary rock just one centimetre thick from a site in Gubbio, Italy, found to be correlated with similarly aged sites in Denmark and New Zealand.

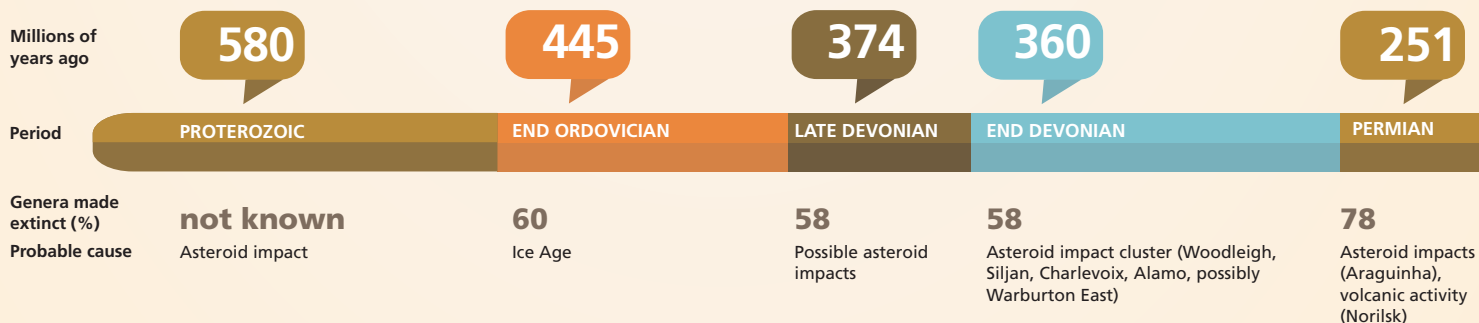
These layers were dated to 65 million years (precise age: 64.98 ± 0.05 million years), and they contained unusually high levels of the platinum group element iridium, which is normally rare in the earth's crust

but more abundant in meteorites. Its age corresponded to the end of the Cretaceous and beginning of the Tertiary periods and was named the K-T boundary (K being the traditional abbreviation for the Cretaceous period).

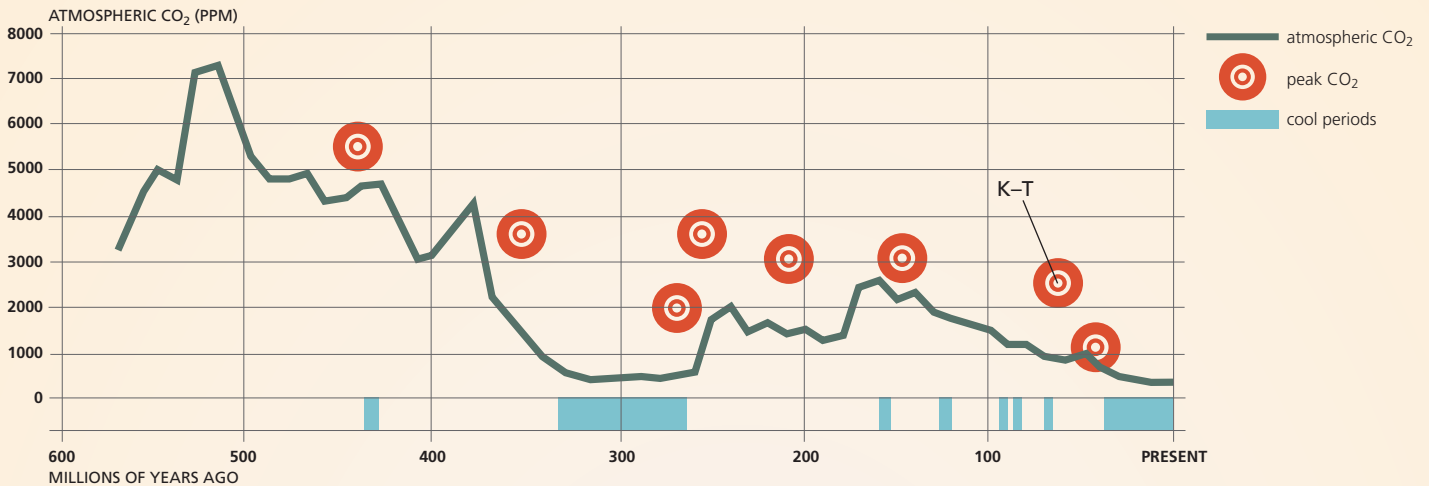
In further evidence, the Italian layer showed two distinct zones: a lower, 5-mm-thick grey clay zone, containing ejected grains of pulverised rock, and an overlying 5-mm-thick red clay zone containing a high concentration of iridium, termed the 'fire layer' (see photo page 12). The underlying limestone was rich with relatively large microfossils (forams, tiny single-celled animals that secrete a distinctive calcite shell), but the overlying layers were found to contain micron-sized coccoliths (calcite fragments secreted by a type of floating algae) and fewer, smaller forams.

The 'sudden' disappearance of the larger foram species from one layer to another and the changes in species composition

Mass extinction events in earth's history



Atmospheric carbon dioxide and mass extinction events



indicated a major change in the marine environment. Results from similarly aged sediments have been reported from more than 100 sites around the globe.

HYPOTHESIS

Initially, scientists had been unable to agree on the reasons for the sudden loss of dinosaurs and other species from the fossil record. Various theories had been proposed, ranging from cyclical changes in the ocean or atmosphere, to nearby exploding stars (supernovae). Alvarez *et al.* explained their novel theory as:

In brief, our hypothesis suggests that an asteroid struck the earth, formed an impact crater, and some of the dust-sized material ejected from the crater reached the stratosphere and was spread around the globe. This dust effectively prevented sunlight from reaching the surface for a period of several years, until the dust settled to earth.

The authors described how the lack of sunlight would have affected life, and

they estimated the size of the asteroid at between 6 and 14 kilometres in diameter. But it was to be a further 10 years before a crater matching that age and size was identified – at Chicxulub, Yucatan Peninsula, Mexico, which is 170 kilometres across. A smaller crater at Boltysh, Ukraine also dated at 65 million years is 25 kilometres across.

The Alvarez hypothesis, as it came to be known, had its critics, but in the following 30 years scientists found much further supporting evidence for the theory. Finally, in 2010, a panel of 41 international experts from 33 institutions concluded that the evidence for a cause-and-effect relation between asteroid impact and mass extinction at the K–T boundary was overwhelming.

GREENHOUSE

The immediate effects of the K–T asteroid impact ranged from the incineration of large land surfaces to major changes to earth's atmosphere, with the ejection of

Above

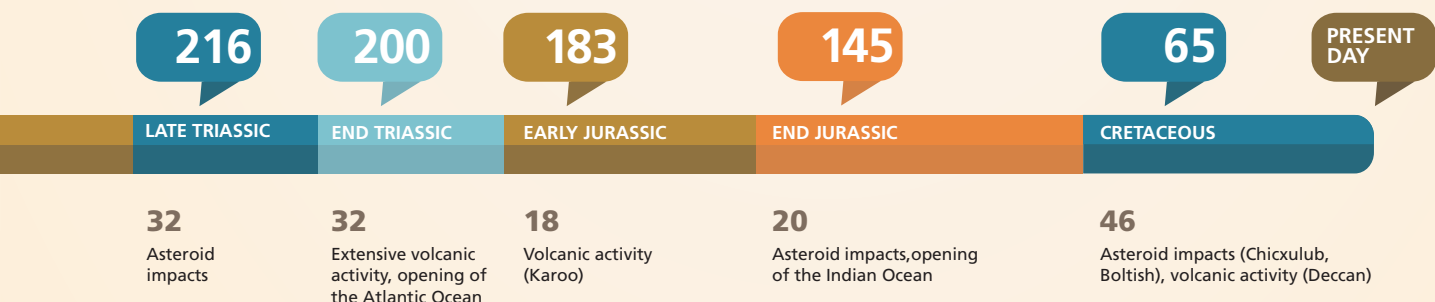
Atmospheric carbon dioxide and mass extinction events.

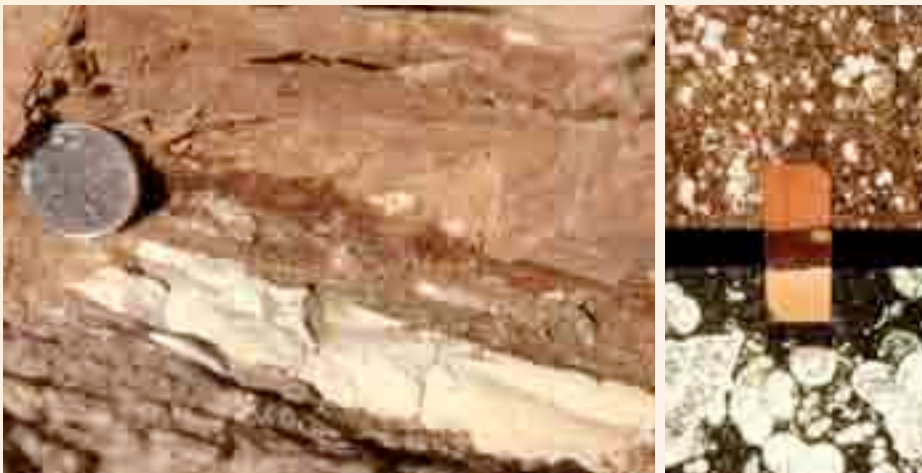
The evolution of carbon dioxide (green line) and occurrence of ice ages and cold phases (blue bars) from the Cambrian (542 million year ago) to the present. The red circles are peak carbon dioxide levels related to asteroid impacts, volcanic activity and mass extinction events. Redrawn from DL Royer, RA Berner, IP Montañez, NJ Tabor & DJ Beerling, 2005. CO₂ as a primary driver of Phanerozoic climate. *GSA Today* 14(3): 4–10.

Below

Major mass extinction events in earth's history.

The asteroid impact that extinguished the non-avian dinosaurs was the most recent of an estimated 10 mass extinctions from asteroid impacts, volcanism and ice ages.





Left

The KT impact boundary at Gubbio, Italy. Left: a plankton-rich limestone bed is overlain by green-brown fragmental ejecta layer, overlain by a red 'fire layer' which contains microkrystite spherules (glassy beads produced by meteorite impacts), overlain by *Scaglia rossa* – red limestone containing only small foraminifera. Right: a thin section showing the contrast between the white limestone (lower zone) containing large forams, *Globotruncana contusa*, and the red *Scaglia rossa* (upper zone) containing smaller forams, *Globigerina eugubina*. Photo courtesy Alessandro Montanari.

dust and water vapour, oxidation of atmospheric nitrogen and consequent ozone depletion. Longer term consequences arose from the release of carbon dioxide and other greenhouse gases which induced global warming and acidified the oceans. A depletion of atmospheric oxygen resulted from oxidation of nitrogen and carbon and a decrease in oxygen-releasing vegetation. The impact also triggered large tsunamis.

The extinction coincided with a spike in volcano activity, possibly due to seismic enhancement of volcanic activity underway in the Deccan Plateau, India. Atmospheric carbon dioxide rose abruptly from between 350–500 parts per million (ppm) to at least 2300 ppm within about 10,000 years. Compare this with the current rate of carbon dioxide increase, which is about 2 to 3 ppm per year, and now exceeds 400 ppm.

The K–T rise in carbon dioxide is consistent with the instantaneous transfer of around 4600 gigatonnes of carbon to the atmospheric reservoir. Climate models suggest consequent forcing of 12 watts per square metre, sufficient to warm the earth's surface by around 7.5 degrees Celsius.

EXTINCTION

The effect of these physical changes to life on earth was indeed catastrophic, with an estimated 46% of genera disappearing. In the oceans, the loss of sunlight caused

phytoplankton (microscopic floating plants) to disappear, along with the animals that depended on them. Forams, many diatoms, most marine invertebrates (corals, echinoderms and molluscs), jawed fishes and cartilaginous fishes became extinct, yet approximately 80% of the shark, ray and skate families survived.

On land, over half of all North American plant species became extinct. All archaic birds and non-avian dinosaurs became extinct, while smaller mammals, including egg-laying mammals and marsupials, survived (though these mostly disappeared from North America).

Historically, geologists believed that the processes modifying the earth proceeded gradually and evenly, but advanced geological and paleontological studies in the twentieth century showed periods of gradual evolution were often interrupted by abrupt events, including global volcanic eruptions and asteroid impacts, leading to the mass extinction of species.

The geological record betrays a close relationship between such events and changes in the concentration of atmospheric greenhouse gases and paleo-temperature trends, with periods of low carbon dioxide concentration coinciding with ice ages (see graphic, page 11).

There have been at least 10 major mass extinction events in earth's history (see

graphic, page 10), the K–T event being the most recent and second largest, with several lesser events affecting the evolution of marine and terrestrial life forms.

The discovery of the K–T boundary heralded a new blueprint for theories of terrestrial evolution because it indicated the extreme sensitivity of the atmosphere to geological changes and the crucial role of the carbon and oxygen cycle – the lungs of the earth. Critically, it emphasises the dependence of life on the composition of the atmosphere and oceans – a poignant lesson for the species *Homo sapiens*.

DR ANDREW GLIKSON, VISITING FELLOW, ANU SCHOOL OF ARCHAEOLOGY AND ANTHROPOLOGY

Further reading

LW Alvarez, W Alvarez, F Asaro & HV Michel, 1980. Extraterrestrial cause for the Cretaceous-Tertiary extinction: experimental results and theoretical interpretation. *Science* 208 (4448): 1095–1108.

tadpoles

IN THE SNOW

WHAT INSPIRED **RONN ALTIG** TO DEVOTE HIS CAREER TO THE STUDY OF TADPOLES?

I'm here at the Australian Museum with Dr Jodi Rowley, primarily working on tadpoles she's collected in Vietnam. Jodi sent me tadpoles of the Vampire Flying Frog, *Rhacophorus vampyrus*, and I had never seen a tadpole like that. It wasn't just the fangs – there are other things we still don't understand. It's likely that *vampyrus* is a living lineage within the genus whose ancestors are not available any more.

So I applied for a Geddes Fellowship to travel from the USA and that's why I'm here. I think by the time I go home, after four weeks, I'll have eight manuscripts in various states of completion, so it's been a productive trip.

EPIPHANIES

Why did I get into frogs and tadpoles? I went from a little farm in central Illinois to the University of Illinois – from a country town of 600 to a university of 42,000. I mean, I was pretty amazed! Well, I met a fellow there who was a famous herpetologist [Hobart Smith, who died in 2013, aged 100] and he took me under his wing. He introduced me to one of his graduate students, Ron Brandon. When Ron went to Southern Illinois University, I went down as his Masters student.

But previous to that, in 1962, I rode one of the first Honda motorcycles that came into central Illinois to the World's Fair at Seattle [over 3200 kilometres] and was totally



blown away. I found out there are areas of the US that are not covered by corn and soya beans! And I said I've got to get back here. So I got my Masters, then I went to Oregon State University.

On the way out there [to Oregon], well I went up over Tioga Pass and Yellowstone National Park at 9000 feet in August and it was snowing. I walked out there because I could hear frogs calling and there, at 9000 feet in the snow, I saw tadpoles in the water . . . and that's the story I tell that got me into tadpoles. Also, I don't like doing the same thing as everybody else, and almost nobody else is interested in tadpoles!

A BLEAK FUTURE

I did eventually find out what those tadpoles were. One of them's now extinct, and the other's almost extinct because they've stocked the streams with trout [for fishing]. And a trout can live in a pretty small area of water; so anything a trout



can live in, a tadpole's not going to make it. The future's not looking great for frogs. I don't keep up with it that much, but there's some new diseases coming along behind the chytrid fungus, which has affected so many species, so there's likely to be another whole wave of extinctions.

EMERITUS PROFESSOR RONN ALTIG OF MISSISSIPPI STATE UNIVERSITY SPOKE TO **BRENDAN ATKINS**

WEBLINK >

Read a longer interview with Ronn Altig at australianmuseum.net.au/explore-magazine

Martyn Robinson reviews *Tadpoles and frogs of Australia* on page 18.

Above left

Head of a Vampire Flying Frog, *Rhacophorus vampyrus*, tadpole which lives in tree holes in the rainforests of Vietnam. Its hard, black fangs are likely used for feeding on unfertilised eggs deposited by the mother as a food source for the developing young.

Above right

Ronn Altig visited the Australian Museum on a Geddes Fellowship in November 2013. Photos by Jodi Rowley.



NEW DISCOVERIES AWAIT BIODIVERSITY SCIENTISTS IN THE REMOTE, INHOSPITABLE NORTH OF AUSTRALIA, WRITES MALACOLOGIST **ANDERS HALLAN**.

The vast, remote expanses of Australia's tropical north have conjured up images of the unknown and unexplored for me ever since I arrived here from Norway in 2002. Some might argue that hardly anywhere is unexplored in this day and age, but there is indeed a lot to be discovered still, particularly at the microscopic level – and especially about the numerous, tiny and inconspicuous snails that dwell in the mangroves lining the northern coasts.

SNAIL HUNT

My postdoctoral fellowship at the Australian Museum (funded by ABRS, the Australian Biological Resources Study) answered this 'call of the north' with two field trips during the dry season in 2013 – one to the Top End and Kimberley, and the other to Cape York.

Equipped with a four-wheel-drive, swags, satellite phone, maps and of course plenty of collecting gear, my colleagues (Ashley Miskelly, Francesco Criscione and Frank Köhler)



Above
Anders Hallan and Frank Köhler at work in Seisia, northern Cape York, Queensland, in July 2013. Photo © Ashley Miskelly.

Left
One of the diverse shells of truncatelloidean gastropods from tropical northern Australia as seen with the Museum's scanning electron microscope. Photo by Rosemary Golding.

and I traversed the continent in search of diminutive gastropods of the superfamily Truncatelloidea. This large group contains several hundred described species, and more than a hundred yet to be described in Australia alone. The high number of undescribed species is partly due to their miniscule size which makes them difficult to study.

In fact, some of the smallest known molluscs are truncatelloideans (we are currently working on species just one millimetre in length). A combination of features sets them apart from other micro-molluscs, such as a simple, often rounded aperture (the opening to the shell) and the configuration of their radula (teeth).

My project focuses primarily on families that are poorly known but abundantly represented in northern Australian mangroves.

ADAPTABILITY

The small sacrifice one must make in order to find these little critters is the significant discomfort of temporarily sharing their habitat; mangroves are interesting places but quite inhospitable to humans.

However, our reward for enduring the mosquitoes, sandflies, sunburn, deep mud, tedium of migrating tides and ever-present threat of saltwater crocodiles is the valuable new insights we've gained into a complex group of snails, such as their diversity, richness of habitats, distribution patterns, biology and behaviour.

A lot of this complexity has been uncovered at the Australian Museum, where truncatelloideans have been studied by malacologists (scientists who study molluscs) for several decades.

My project, in collaboration with the Museum's Winston Ponder and Rosemary Golding, builds on this long-standing research effort in which hundreds of new species, dozens of genera and even new families have been described. These studies have gradually built a new understanding of a highly diverse group, whose habitats include caves in Tasmania, mound springs in the arid interior, seagrass and shallow reefs, and of course, said mangroves.

And it is partly because of this diversity, as well as their microscopic size, that you can lift a rock at the edge of a creek in Chatswood in suburban Sydney, or inspect the muddy underside of a log near Bobbin Head on the Hawkesbury River, and still stumble upon undescribed species.

DWINDLING

The more remote swathes of the continent, from tropical mangroves to desert springs, are home to a plethora of species. Even where these have been described, we know little about their biology and behaviour, or their roles in food webs, evolutionary relationships and geographic ranges.

As new information is pieced together, a sobering picture also emerges – one of dwindling habitats and even habitat extinction, particularly so for freshwater truncatelloideans (which are the subject of intensive study by my Museum colleagues, led by Winston).

So next time you go for a weekend hike on the boardwalks among the Hawkesbury mangroves, cast your eyes to the mud below your feet. Those little punctuation marks crawling on a piece of bark or clinging to life in the crevice of a rock are part of a rich and complex group, the secrets of which continue to unfold and surprise.

DR ANDERS HALLAN, ABRs RESEARCH FELLOW

LOST, *found* AND LOST AGAIN?

... A NEW MAMMAL SPECIES FOR AUSTRALIA

HAS AUSTRALIA ALREADY LOST ITS NEWEST MAMMAL SPECIES, THE CHRISTMAS ISLAND SHREW? DR MARK ELDRIDGE REPORTS.

Christmas Island, situated in the Indian Ocean just 380 kilometres south of Java, Indonesia, is home to some fascinating wildlife found nowhere else.

One such species is the Christmas Island Shrew, *Crocidura trichura*, a small, long-nosed, insectivorous mammal weighing just 5 grams. Shrews are found throughout Europe, Asia and Africa, but are absent from the Australian mainland, which makes the Christmas Island Shrew Australia's only shrew species.

SHRIEKS

When first collected by British naturalist Joseph Lister in 1888, the Christmas Island Shrew was highly abundant. It was still abundant in 1898 when another British scientist, Charles Andrews, described its characteristic high-pitched shrieks in the night-time forests and collected specimens of the shrew for the Natural History Museum in London.

Yet Andrews neither saw nor heard a single shrew when he returned to the

island a decade later. Around this time, two other endemic species became extinct: the Bulldog Rat, *Rattus nativitatis*, and Maclear's Rat, *Rattus macleari*, probably because of the accidental introduction to the island of the Black (or Ship) Rat, *Rattus rattus*.

As the decades passed, no more shrews were located and it was thought to be extinct until, surprisingly, a live specimen was captured in December 1984, and another three months later. Then just as suddenly, the Christmas Island Shrew disappeared again and has not been found since.

IDENTITY

The strange appearance and disappearance of the shrews, together with the difficulty of distinguishing one shrew species from another, led to some speculation about the identity of the 1980s specimens. Were these really the species long thought to be extinct? Or were they a different Asian shrew that had recently hitched a ride to Christmas Island?

Christmas Island Shrew, *Crocidura trichura*.
Illustration by Kevin Stead © Australian Postal Corporation (from the Christmas Island World Wide Fund for Nature: 50 Years stamps).



With colleagues Dr Rebecca Johnson from the Museum's Australian Centre for Wildlife Genomics and Dr Paul Meek from the NSW Department of Primary Industries, we began a study to find out.

Fortunately, Andrews' specimens of the Christmas Island Shrew collected in 1898 were still in the safe keeping of the Natural History Museum, while the two specimens from the 1980s had been donated to the Western Australian Museum after they had died in captivity.

Using tiny tissue samples taken from these museum specimens, we were able to extract and sequence several short fragments of DNA and compare them.

Sure enough, the DNA sequences from the 1985 specimens were identical to the 1898 specimens, confirming that the two latest individuals were genuine Christmas Island shrews.

In another twist to this tale, the Christmas Island Shrew was originally considered to be only a subspecies of a widespread

Asian Gray Shrew, *Crocidura attenuata*. We were able to show that not only is it a genetically distinct species – making the Christmas Island Shrew Australia's newest mammal species – but its closest relative is the Oriental Shrew, *Crocidura orientalis*, from Java.

SURVIVAL

The Christmas Island Shrew was able to survive for more than 80 years, not only in the presence of the introduced Black Rat, but also without being detected. This finding has raised hopes that Australia's only shrew species may yet survive on the island.

But locating additional specimens will be a formidable challenge. The unique biodiversity of Christmas Island is facing ecological collapse brought about by multiple introduced species, especially the Yellow Crazy Ant, *Anoplolepis gracilipes*.

Many of the island's endemic species are declining. The Christmas Island Shrew is listed as 'endangered'. Three of the five

mammal species originally known from Christmas Island are already extinct: the two rats mentioned earlier and now the Christmas Island Pipistrelle, *Pipistrellus murrayi*, a small insectivorous bat last seen in 2009.

In addition, numbers of the once-abundant Christmas Island Flying-fox, *Pteropus melanotus natalis*, have declined to the extent that it is now listed as 'critically endangered'.

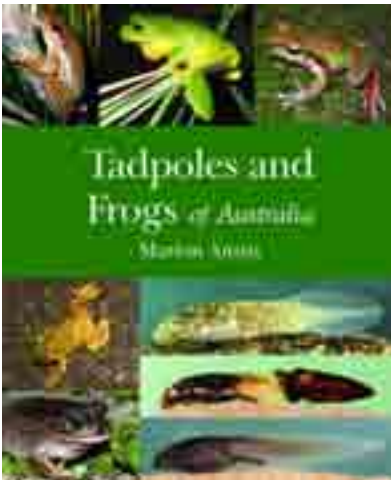
Has a small population of the Christmas Island Shrew once again been able to hide away and survive against the odds? If so we need to find it – urgently – and then take action to conserve our newest Australian mammal.

DR MARK ELDRIDGE, SENIOR RESEARCH SCIENTIST

Further reading

MDB Eldridge, PD Meek, & RN Johnson, 2013. Taxonomic uncertainty and the loss of biodiversity on Christmas Island, Indian Ocean. *Conservation Biology*, published online 27 November 2013 <http://dx.doi.org/10.1111/cobi.12177>

reVIEW



TADPOLES AND FROGS OF AUSTRALIA

by Marion Anstis
New Holland Publishers, 2013

It was in 1980 that scientists first began to notice that amphibians were disappearing. Various species of frogs, toads, salamanders and newts would retire from view in the winter, never to be seen again.

Unfortunately, the fall of amphibian diversity has continued ever since with no single reason responsible and not all species affected.

Nevertheless the problem is a worrying one, because amphibians, like the canary in the coal mine, are very sensitive to their environment at both the aquatic larva/tadpole and air-breathing adult stages of their lives.

What is affecting them could be the early signs of something which may ultimately affect us all, or at the very least, that something is amiss in the environment.

To understand what is going on with frogs, and what stages of their life cycle are affected (or even what species live in an area), we need to be able to identify them at all stages of their lives.

Australia's only free-living amphibians are native frogs (of which there are some 200 species) and the feral Cane Toad, *Rhinella marina*. The only salamander species in Australia is the Axolotl, *Ambystoma mexicanum*, which resides only in pet shops and home aquariums.

You might think this would make the process of identifying frogs or tadpoles easy. Sadly this is not the case. Not only can adult frogs of one species vary greatly in colour, the juveniles are often different again. And the tadpole stages of most

species are so poorly known that they are often ignored in wildlife surveys, ecological reports and behavioural studies.

But now we have this book, *Tadpoles and Frogs of Australia*, which in full colour covers the life stages of nearly all Australian frogs, including their eggs and metamorphs (when the young frog has just absorbed its tadpole tail and often has a very different colour pattern to the adult).

The result of 10 years' work by Marion Anstis, the book is quite a feat – even if several of the species in the book are already thought to be extinct (Australia has one of the worst records of global frog extinctions).

Marion has long been the 'tadpole guru' of Australia and this isn't her only book on the subject, but it is certainly the biggest and best.

This is a book for everyone interested in natural history, frogs and identifying wildlife (though at over 800 pages it's probably too large to use as a field guide). Its value to the amateur and professional alike should make it a popular reference book and a classic in times to come.

My only criticism is that whenever I look through it, I find another fascinating item and end up spending much longer than I intended!

MARTYN ROBINSON, NATURALIST





Autumn/Winter April to July 2014

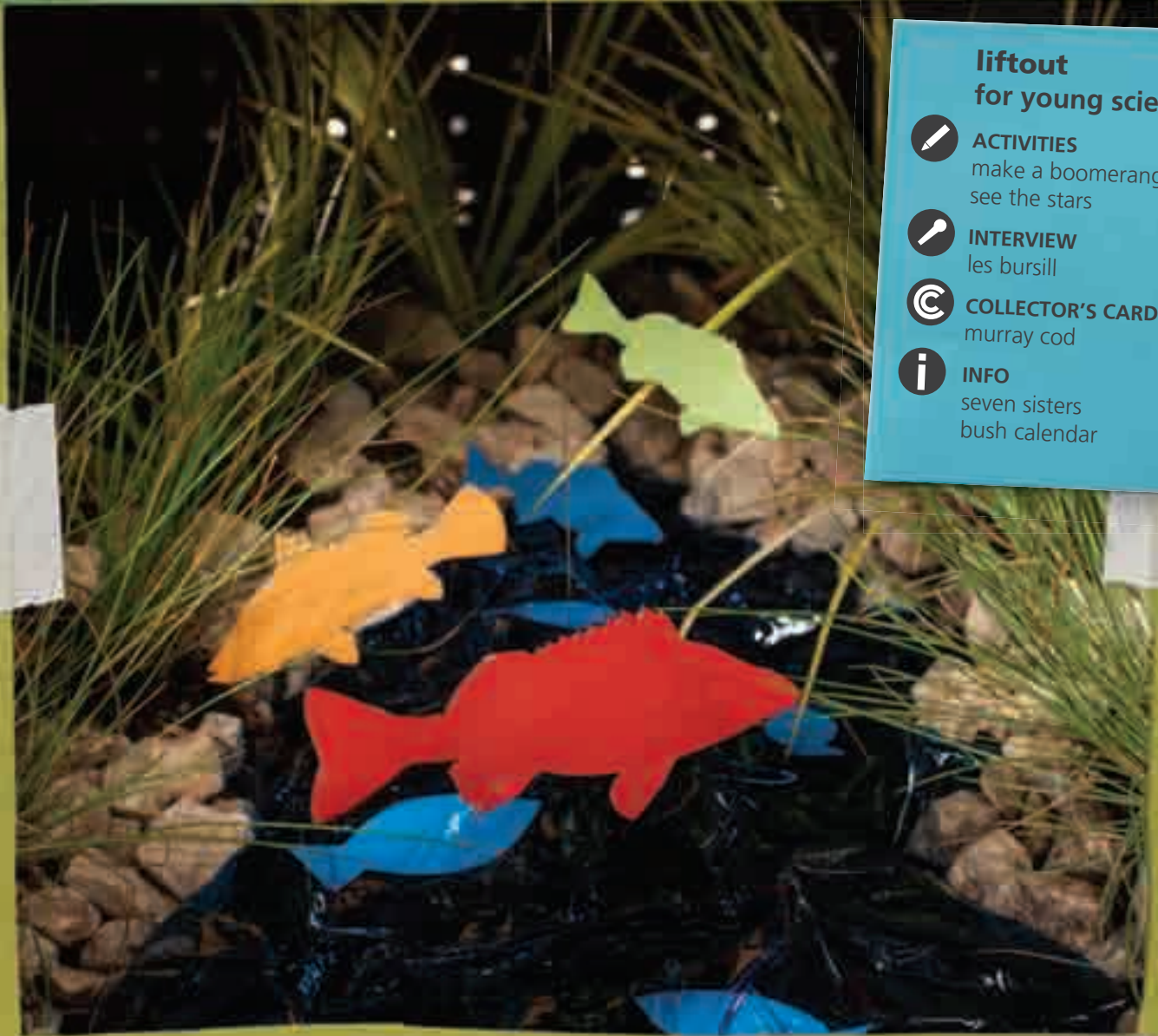


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liftout for young scientists

-  **ACTIVITIES**
make a boomerang
see the stars
-  **INTERVIEW**
les bursill
-  **COLLECTOR'S CARD**
murray cod
-  **INFO**
seven sisters
bush calendar



INDIGENOUS SCIENCE



CARLA'S BLOG

Hi, I'm Carla the Echidna!

When I'm not working in the Museum, I love to spend time in the Australian bush. It's so peaceful after being in the big city. At night, you can see millions of stars, even when the moon is out. It's much harder to see stars in the city because the street lights are too bright.

My favourite stars are the Southern Cross because the 'tail' of the cross always points towards the south, so I can always find my way home. Can you find the Southern Cross in the night sky?

I hope you enjoy my page!

On the cover Indigenous science is based on 60,000 years of observation and sustainable living. Styling by Trudi Fletcher. Photo by Stuart Humphreys.



MAKE YOUR OWN BOOMERANG



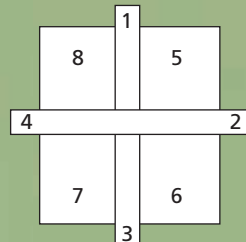
The boomerang is a very effective hunting weapon used by Aboriginal people. It comes in many shapes and sizes. In this activity, you can make your own cross boomerang.

You will need: a blank sheet of paper, two pieces of thin cardboard, each about 20 cm long and 1 cm wide, a pencil and coloured pencils.

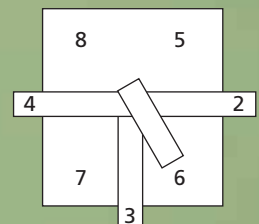
- 1 Place the cardboard strips on the paper to form a cross, with the horizontal strip on in front of the vertical strip (step 1). Number each end of the cardboard strips as shown from 1 to 4. Start from the top and go clockwise, then number the corners of the sheet from 5 to 8.
- 2 Diagonally fold the strip so that number 1 meets 6.
- 3 Diagonally fold the other strips so that number 2 meets 7, and 3 meets 8.
- 4 Add the numbers 9 and 10 as shown.
- 5 Fold number 4 over number 9 and under number 10.
- 6 Pull all the strips tight to form its shape and decorate your boomerang.

Now practise throwing your boomerang. Can you make it hover or return to your hand?

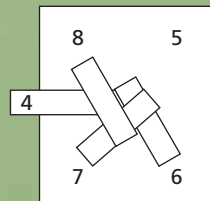
Discover more about boomerangs at australianmuseum.net.au/Boomerang



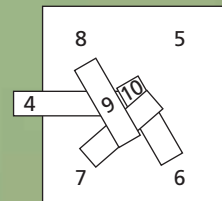
step 1



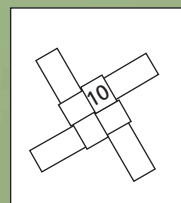
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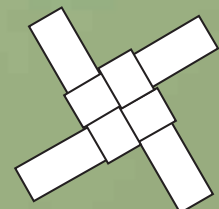
step 3



step 4



step 5



step 6

◀ LIFT STAPLES TO REMOVE XPLORER ▶

SEVEN SISTERS



The Pleiades (pronounced 'ply-ard-ees'), or Seven Sisters, is a cluster of more than 1000 stars of which we can see only six or seven with the unaided eye.

This distinctive cluster has captured the imagination of peoples from ancient cultures the world over, and it features in many traditional Aboriginal cultures and stories.

In some cultures, the stars represent a group of young women fleeing from a man or group of men (often Orion, another constellation that follows the path of Pleiades across the night sky). In others, they represent a group of kangaroos fleeing from dingos. For Aboriginal people, the arrival of these stars in the night sky marked the change of seasons, signifying that certain foods were now available.

SEE THE STARS



In New South Wales, Pleiades can be seen in the evening sky in early April. 'Look for it low in the northwest, just above the horizon', advises Geoff Wyatt, Education Officer at the Sydney Observatory. 'Otherwise, you can always find it on the badge of a certain brand of Japanese car!'

Find out what's happening in the night sky this month at sydneyobservatory.com.au



JULY HOLIDAYS SAVE THE DATE!



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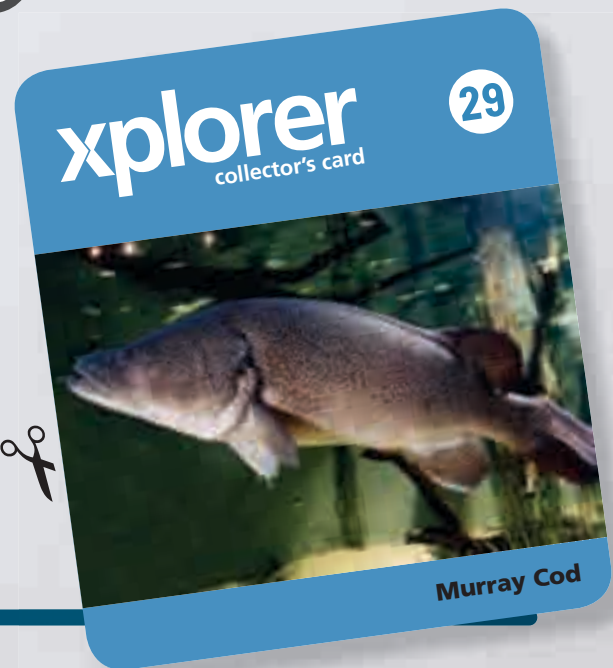
15 & 16 April **Dangerous Australian Animals**

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Each issue of Xplorer includes a collector's card for you to cut out and keep!



Murray Cod



ANCIENT TIMES

Les Bursill OAM is a Dharawal (Aboriginal Australian) historian, archaeologist, anthropologist and author. He was interviewed by Catherine (Cat) Beehag, Manager of Science Communication and the Australian Museum Science Festival.

CAT: You've discovered over 300 archaeological sites in the Sutherland Shire in Sydney. What is your favourite site and why?

LES: I guess the discovery of the Wagilag Sisters Dreaming is my favourite engraving site, followed by the Hooked Boomer and Kangaroo Dreaming. I also truly love the Red Fish cave site with its Fish Dreaming and the child's hand stencils.



Photo courtesy
Les Bursill.

THIS EDITION OF XPLORER COMPILED BY DEREK WALKER,
CHARLOTTE GALLEGUILLOS, SHENALI BOANGE & TIM MALL

Murray Cod

Australia's largest freshwater fish, the Murray Cod, *Maccullochella peelii*, is known as *ponde* or *mewuruk* to Aboriginal peoples. It lives in the Murray-Darling River system where it preys on fishes, molluscs, turtles and other animals. The largest specimen recorded was 1.8 metres long and weighed over 110 kilograms, but they are usually less than 70 centimetres and under 10 kilograms.

Its deep body is patterned olive, grey and green above with a creamy white belly. It has a large mouth, small eyes and curved head shape. Once common, the Murray Cod is now threatened because of overfishing and environmental changes to our rivers.



Photo by Mark McGruther

I like them because these sites are part of my dream line. I am Dharawal, as were all my forebears. These sites are my people's history.

CAT: Where did you study hunter-gatherer and Dharawal culture and language?

LES: I only work on Dharawal sites in southern Sydney. I did a degree majoring in Prehistory at the University of New England. My second major was Ancient History. Then I completed a Masters degree on Dharawal living sites – it was original research.

CAT: You have had many careers in your life so what advice would you give to a young student just leaving school?

LES: Set up a good portable superannuation scheme, keep up to date with technology, and don't let yourself become too narrow in any one field. Don't ever work at a job you don't enjoy. Don't sit around – get out and find an active hobby that you can turn into a career if the need arises.

FUN FACT

Aboriginal people used the bark of the paperbark tree, *Melaleuca*, to cook fish and keep it moist. They would prepare and soften the bark by soaking it in water for 2 or 3 days, then wrap the fish in the wet paperbark, place it in a ground oven and cover it with earth. When the paperbark was dry, the fish was ready for eating.

BUSH CALENDAR

For Aboriginal people, the Sydney Golden Wattle, *Acacia longifolia*, was both a bush calendar and a fishing aid. It is said that when the wattle blooms (June to October), it's time to go fishing for mullet. The fisher would drop flowers onto the water surface and the fish would swim up and eat them. The flowers would bloat the fish, causing them to float so they could be readily scooped up.



Photo © Royal
Botanic Gardens
& Domain Trust.

Send your query to the *Search & Discover* team, email sand@austmus.gov.au

search > DISCOVER



Left

Juvenile female Thicklip Wrasse. Photo © Andy Lewis.

Right

Adult male Thicklip Wrasse. Photo © Mick Richters.

FREQUENTLY WE ARE ASKED TO IDENTIFY ANIMALS FROM PHOTOGRAPHS; HOWEVER, THIS CAN GET TRICKY WHEN THE ANIMAL'S APPEARANCE CHANGES OVER ITS LIFETIME. TAKE FISHES FOR EXAMPLE.

Search & Discover is the Museum's hands-on mini-museum packed with real specimens and resources, from computers and microscopes to books and magazines. Bring in your questions or email them to us at sand@austmus.gov.au.

There are many fish species where the juvenile stage looks very different to the adult stage, causing some confusion among the fishers and divers who come into contact with them.

THICKLIPS

A keen fisherman, Mick Richters of Gladstone (Qld), sent us this stunning photo of a fish (above right) for identification. The fish is vivid green in colour and each scale is highlighted with a dark green edge. It also has thick lips – a vital clue which, with the location (Hummocky Island, Queensland), suggested to Fish Collection Manager Mark McGrouther that it was none other than the Thicklip Wrasse, *Hemigymnus melapterus*.

'The adult male is a pretty distinctive-looking fish', Mark said. 'What might surprise people, however, is that the fish adopts a number of different guises as it grows. Juveniles are light-coloured on the front half, dark at the back and have yellow tails. Very young specimens look different again, having a greenish black body with dark bars and a white band around the middle.'

HALF-AND-HALF

'Unfortunately, many fish identification guides use images of the juveniles which are known as the half-and-half wrasse. Not only are they a different colour, they lack the obvious thick lip', Mark said.

'The male's final colour change is associated with sexual maturity. It's not clear why the juvenile "wears" its half-and-half colouration.

'The colour changes with growth shown by the Thicklip Wrasse (indeed, by many species of wrasse) increase the challenges for underwater photographers who try to take representative photos of the species!'

DAVID BOCK, COORDINATOR, SEARCH & DISCOVER

WEBLINK >

Explore the wrasse family, Labridae, online at australianmuseum.net.au/Labridae-Wrasses-list

MOTHS TO A FLAME



Left

Scientists use simple light traps like this one to capture a diversity of insects. Photo by Dave Britton.

Right

Quail or Brush Turkey chick? Photo © Dr Paul Stewart.

Mention 'pollution' and you might think of poisoned water, rubbish-strewn streets or toxic brown fumes, but there are other types, including some we don't often consider, like light pollution. Yet light pollution is quite a problem and has been growing for a number of years.

Astronomers are already aware that bright lights from the towns and cities at night are so strong that detecting the comparatively faint light from distant celestial bodies can be difficult, even with powerful telescopes. As a result, modern observatories are usually built well away from suburban/urban areas, often in remote inland sites.

Clearly light pollution affects astronomers, but it must be pretty harmless to the rest of the natural world as it's only light, right? Light can't hurt you, can it?

Well perhaps not humans, but many animals which migrate over long distances often use the distant light of the sun, moon and stars to keep them on track.

They can do this because the faraway distant light is virtually perpendicular to the earth's surface. Some scientists believe that the navigating animal keeps this distant light striking its eyes at the same angle so it can travel in a straight line.

Unfortunately, animals will instinctively try to use bright artificial lights in the same way. These emit light rays at right angles to the source, with the effect that the light beams radiate out like the spokes on a bicycle wheel.

To keep the light at a constant angle to their eyes, the migrating animals must continuously change course as they try to pass the lights, which results in the familiar spiral path that moths and beetles follow as they fly into a light bulb or candle flame.

Whenever the unfortunate insect tries to leave, it automatically corrects its flight path and ends up at the light again. Like guests in the *Hotel California*, they can check out but never leave.

When morning comes, their burnt, exhausted or dead bodies are easy pickings for the birds. Any survivors will hide away until nightfall, only to repeat the exercise and suffer the same fate.

Nor are these the only animals affected by light pollution. Larger animals, like fishes and cephalopods in the oceans, and birds, bats, frogs and nocturnal reptiles on land, have all been known to change their behaviours to feast on the smaller prey attracted to lights.

A quick check of your garden will usually reveal a higher concentration of spider webs around the outdoor lights or windows for the same reason.

So is there a solution? Well, responsible homeowners, businesses and councils can simply replace white outdoor lighting with yellow-coloured bulbs, as it is the ultraviolet component of white light that seems to attract flying insects.

THE FEARLESS QUAIL



We often get enquiries to help people identify a strange bird they have seen in their garden but cannot seem to find in any of their Australian bird field guides.

Sometimes the mystery bird is an escaped exotic cage bird; others can be unusual colour variations of a more common species (the all-black Galah is my pick of these). And sometimes it's because the bird is a juvenile.

Over summer, we've had many enquiries about 'quails', wandering about in suburbia and seemingly quite tame.

A few hints about their true identity are already present in this brief description! The first is that the 'quail' is by itself; most quail travel in small flocks (called coveys). The second is that the bird seems tame, whereas most quail – even pet ones – are far from 'tame' and generally run or crouch when approached, or suddenly explode in a flurry of beating wings when disturbed. Hardly 'tame' behaviour.

A quick question or two about the colour, and lack of a tail, and the true identity is revealed as the chick of a Brush Turkey, *Alectura lathami*.

'Oh no', they say. 'It can't be that! This one could fly *and* there were no parents nearby looking after it!'

Well one of the strange things about megapodes (the mound-building birds of Australasia like the Brush Turkey) is that the chicks hatch ready equipped with flight feathers ready to fly.

Stranger still, despite months of mound-building and careful attention to the nest and its eggs, the parent birds don't care for the hatchlings at all, which are on their own from day one; indeed the parents don't even seem to recognise the chicks as their own species.

Fortunately, the chicks are remarkably good at raising themselves and can find food and keep out of danger – which is

why there are so many Brush Turkeys around Sydney's northern suburbs in recent summers I'd guess. They also seem to keep an eye on one another and learn from each other's successes and mistakes.

Certainly many of Australia's megapode chicks (Australia has the Brush Turkey, Jungle Fowl and Mallee Fowl) fall prey to predators, but those that survive will fly straight up into the trees or dive deep into dense cover if alarmed.

So if the 'quail' looks like the image shown here and they're walking about like they own the place – they ain't quail!

MARTYN ROBINSON
IS THE MUSEUM'S
RESIDENT NATURALIST

MUSEUM NATURAL HISTORY COLLECTIONS CAN HELP ANSWER MANY QUESTIONS, BUT HOW DO WE ENSURE THEY CONTINUE TO BE RELEVANT, ASKS THE MUSEUM'S **DR BRIAN LASSIG**.

Opposite
Dr Brian Lassig with Peregrine Falcon, *Falco peregrinus*. Photo by Stuart Humphreys.

collections MATTER!

In answering questions about the natural world, scientists often turn to the collections held in natural history museums like ours. Indeed, that's why we collect specimens in the first place.

One well-known example is the study of the bird egg collection at the Field Museum in Chicago in the 1960s which determined that shells of Peregrine Falcon, *Falco peregrinus*, eggs had become thinner and more fragile since the introduction of DDT for agricultural use.

Subsequent work showed that DDT interferes with calcium production in female birds causing them to lay thin-shelled eggs which were more likely to be crushed during incubation. With levels of DDT bioaccumulating in the food chain, it was top predators like the peregrine that were being most affected.

The study helped us understand why populations of this magnificent bird had declined so drastically, and it resulted in the US government banning the use of DDT for agricultural purposes in 1972.

It is crucial to note though that the Field Museum's collections were made over many

decades without this specific question in mind; yet without such a long time-series of collected specimens the reason for the peregrine's decline might not have been discovered in time.

QUESTIONS

There are many such uses of collections and collection data. To give some idea of the scope and depth of these applications, we can analyse downloads of nearly 750 million records from the Atlas of Living Australia (the shared repository of collection data from many Australian natural history museums).

The broad categories of these uses include not only scientific research and education, but many applied uses such as conservation management and planning, environmental impact assessment and biosecurity management.

It is reassuring that some decision-making appears to be based on the available scientific information, but the analysis is not all that helpful in understanding exactly what users are trying to discover.

Perhaps the most pressing question we've been asked recently is: what can our

collections tell us about the impact of climate change?

The question coincided with the release of the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report into the physical science behind climate change. The IPCC report identifies a number of significant and disturbing environmental changes over the last 100 years or so (see panel, opposite).

Surely the magnitude of these changes should be forcing radical changes to our biodiversity – but is there any evidence?

ANSWERS

To answer that question, the Australian Museum Research Institute (AMRI) recently hosted a seminar to find out what museum collections can reveal about climate change.

We now know, from a study of over 300 species, that the ranges of marine and intertidal molluscs (essentially snails) have been shifting south along the east coast of Australia on average by about 10 kilometres each decade as water temperatures have increased. Some species have shifted at 10 times that rate.

One mussel species studied now has a much narrower range and is likely to be lost from New South Wales if trends continue. Also, the body size of marine snails has decreased over time, probably as a result of increasing acidification of the ocean. Species that have only ever been recorded around mainland Australia have started appearing in Tasmania – even the Blue Groper, the NSW fish emblem, whose southern-most distribution was previously recorded as at Wilson’s Promontory in Victoria. On land, species living in the cooler montane areas are at grave risk as temperatures rise and the available area of suitable habitat shrinks.

A guest speaker at the AMRI seminar, Professor Craig Moritz from the Australian National University, presented a fascinating case study that highlighted the value of planning for future needs. In the early twentieth century, Joseph Grinnell, founding Director of the Museum of Vertebrate Zoology at the University of California, documented and collected vertebrates from more than 700 locations across California and adjoining states.

Scientists re-surveyed Grinnell’s sites just a couple of years ago and found a range of climate change impacts among mammals. For example, formerly low-elevation species had expanded their ranges and high-elevation species had contracted theirs, leading to changes in the composition of ecological communities at mid- and high elevations.

Such is the power of systematic and strategic collecting.

COLLECTING FOR THE FUTURE

The Australian Museum’s collections date back to 1828 and include many different animal groups, from worms to wallabies. But, like the Field Museum, our collections were not accumulated to answer questions about climate change. There are often big gaps in the time series of collected specimens; collections from single localities are generally not repeated over time; species absent from particular places



are usually not recorded; and those species that are collected may not be strongly influenced by the local climate.

It is clear that museums should be developing long-term collection programs so that we can more confidently respond to these sorts of questions in the future.

So now we have a new challenge: while continuing to document the breadth of Australian biodiversity we need to review how we go about collecting. We need to ensure that we have adequate baseline information so we can be prepared to answer different questions about biodiversity, some of which we know about and others that we can’t even begin to guess!

DR BRIAN LASSIG, ASSISTANT DIRECTOR, SCIENCE AND LEARNING DIVISION, AND HEAD, AUSTRALIAN MUSEUM RESEARCH INSTITUTE

WEBLINK >

Find out more about this topic at australianmuseum.net.au/blogpost/collections-climate

Further reading

IPCC, 2013. *Climate change 2013: the physical science basis. 5th Assessment Report. World Meteorological Organization, Geneva, Switzerland.* ipcc.ch/report/ar5/wg1/

THE WARMING PLANET

- Each of the last three decades has been successively warmer at the Earth’s surface than in any preceding decade since 1850.
- Average global land and ocean surface temperatures have warmed by around 0.85 degrees Celsius since 1880.
- Global average sea levels have risen by 0.19 metres over the twentieth century.
- Atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years.
- The oceans have absorbed about 30 per cent of the emitted anthropogenic carbon dioxide, causing them to become more acidic.

Source: IPCC 5th Assessment Report



stealth INVADERS

DETECTING A BIOLOGICAL INVASION IS MADE ALL THE HARDER IF THE INVADER LOOKS EXACTLY LIKE ONE OF THE LOCALS, REPORTS **DON COLGAN**.

Above

Looking west across Koono Bay, Lake Illawarra, towards Albion Park. Photo by Don Colgan.

Inset

An overturned log reveals *Xenostrobus* mussels in their habitat.

Every organism is constrained to live within the ecological limits of its environment and biology. Temperature, food sources, predators and other habitat characteristics all help to determine what survives and what does not.

But the balance is easily upset. As constraints change, so does the distribution of species. Generally, as the climate warms, many species' ranges will tend to move pole-wards. Warm-loving animals creep into areas previously too cold for them. 'Cool' species seek out cooler climes, with many montane species facing extinction as their cool mountain-top habitat disappears, leaving them with nowhere to go.

In contrast to such gradual changes, species introduced to new areas, accidentally or deliberately, can result in biological invasions on a large scale. Freed from the ecological controls of their native habitat, the population can increase rapidly, often at the expense of the new environment and its inhabitants.

MUSSELLING IN

One such invader is the Zebra Mussel, *Dreissena polymorpha*, which causes more than US\$200 million damage annually by biofouling (growing on boat hulls and other submerged structures) in the Great Lakes region of North America.

Right

These *Xenostrobus securis* shells (valves) show little or no difference between the non-invasive group (upper two photos) and invasive group (lower two). The scale bars are 5 mm in each photo. Photos by Sue Lindsay.

Another troublesome mussel is the little Black Horse Mussel, *Xenostrobus securis*, which has invaded Japan, the Atlantic coasts of southern Europe and the Mediterranean. In New South Wales, it is one of the most common shellfish living on solid substrates in estuaries and coastal lagoons.

Detecting invasive species before they become established is difficult, however, and even more so when the invader has a similar appearance to local species.

The original population of *X. securis* discovered in Japan was thought to be a subspecies of a local mussel and could only be identified as *securis* by genetic studies. In Australia *X. securis* has a very broad, supposedly native, distribution, ranging from southern Western Australia to northern Queensland along the southern coasts; the populations in New Zealand are also thought to be native to that country.

IT'S COMPLICATED

Studies of this mussel's DNA by Australian Museum researchers have found that *X. securis* may include multiple species that all look much the same. It could actually be a species complex, with the invader effectively slipping into the local populations by stealth.

The genetic variants discovered in central NSW populations can be divided into two distinct groups according to how closely they are related. Variants from only one of these groups have been recorded from Japan or Europe. The other group has not yet been discovered outside New South Wales.

Both groups are found in most localities in the state, but the first variant is more frequent in the upper reaches of estuaries, while the second (non-invading) group is more frequent nearer the ocean.

IMPERATIVES

We're collaborating with interstate and international colleagues in the search for answers to questions like: is the first group truly a separate species? Is it a native or an invader? If an invader, what is its source?

One of the imperatives of this research is that certain European populations of *X. securis* are known to host a species related to the single-celled parasite that causes QX disease, which can devastate populations of the widely cultivated Sydney Rock Oyster, *Saccostrea glomerata*.

Does the introduced *X. securis* act as an alternative host of QX disease here? The answer is crucial for understanding this disease and developing solutions for the future management of an industry valued at over \$35 million annually.

DR DON COLGAN, PRINCIPAL RESEARCH SCIENTIST





ON THE
ROAD
TO

yuendumu

THE MUSEUM IS SET TO REVISIT AND RENEW ITS LINKS WITH THE YUENDUMU COMMUNITY IN THE NORTHERN TERRITORY.

Visit one of the world's most famous landmarks, the Eiffel Tower in Paris, and you can enjoy views across to the roof of the nearby Quai Branly Museum, which features a 700-square-metre painting by Aboriginal artist Lena Nyadbi.

In Australia, look to the skies and you might see the latest 'flying art' – a Qantas 737-800 decorated with a painting by Kimberley artist Paddy Bedford. Aboriginal art, described by critic Robert Hughes as 'the last great art movement of the twentieth century', is hard to miss. What is not so apparent however is just how recent Aboriginal art's place on the world stage is, and how fast the industry has developed.

Thirty years ago, the Aboriginal art 'industry' barely existed, and even the dot-painting artists from Papunya were struggling to be recognised. Aboriginal art was largely seen as a subject for anthropologists and museums, an ethnographic curiosity with limited aesthetic appeal. In 1981 Johnny Bulunbulun became only the second Aboriginal artist to hold a solo exhibition, a reflection of the tiny commercial market. Throughout all Australian cultural institutions there was only one curator of Aboriginal art and, hardest of all to imagine, the National Gallery of Australia opened in 1981 with no contemporary Aboriginal art either on display or in its collections.



Above

View of bush track at Yuendumu from inside a burnt-out, abandoned car. Photo by Scott Mitchell.

Left

Ceremonial carved emu egg (ngipiri) painted by Judy Nampijinpa. Made of softwood from the Yinirnti tree, it was used in rituals about the Dreamtime Emu. E078376

All Photos by Stuart Humphreys.



Left
Carved ceremonial turkey foot (Wirliya), used by women in Turkey Dreaming dances. Painted by Judy Nampijinpa. Made of softwood from the Yinirnti tree. E077970

Below
Women's ceremonial club (kuturu). E078484

With support from the Australian Museum Foundation, we are exploring the evolution of contemporary art practice over the last thirty years in the Aboriginal community of Yuendumu, 300 kilometres northwest of Alice Springs. Working in collaboration with Warlukurlangu Artists, the community's art centre, we will commission a series of paintings and collect a range of other works that reflect the contemporary visual arts produced in the community. This new material will build upon and reference a unique collection of art drawn from the community a generation earlier when the women first began to experiment with commercial art.

WOMEN ARTISTS

In October 1982 the Australian Museum held a world first: an exhibition by female Aboriginal artists. Nine Warlpiri women from Yuendumu travelled to Sydney (two paying their own way) to show their work and demonstrate traditional body painting, songs and dances. The women had only just begun to experiment with painting for a wider audience and this exhibition, called *Women Artists*, was their first public venture.

The Museum is lucky to have within its collections the several hundred painted objects from this groundbreaking exhibition, along with other Yuendumu artworks collected around this time. They represent a critical period in the life of the community – as women began to experiment with the use of acrylic paints and the production of art for the commercial market. Just a handful of the works are painted on canvas; most are on carved wooden objects such as dance boards, bowls, carved eggs, clap sticks and digging sticks. Unlike today, many of the works were painted with fingers rather than brushes. They are made on bones and grinding stones as well as wood and canvas, and traditional ochre is often used alongside modern acrylic paint.

There is an experimental quality to these works – hardly surprising given that the artists were grappling with how to render designs traditionally painted onto bodies or sand into a form suitable for sale. However, it is striking that all the elements that have made Yuendumu artists such an enormous critical and commercial success are present: the vibrant colours, the recurring use of dots as a graphic motif and, perhaps most importantly, the strong association between the artworks and the *Jukurrpa* (loosely translated as the Dreaming, or the time when the ancestral beings made epic journeys, shaping the landscape as they went and laying down the rules of behaviour for future generations to follow).

The continuities are all the more striking because the objects represent not only artistic innovation, but a radical social experiment. Women old enough to remember nomadic life in the desert were experimenting with how to engage a modern market economy. Elders were exploring how to allow secret and sacred *Jukurrpa* stories to be appreciated by a wider public. Gender roles in the community were actively being contested and renegotiated as women began to paint and share their stories in a way only men had done previously. The continuities reflect how quickly community members were able to resolve these issues and move on to carve out a successful place in the contemporary art world.



*“the last great art movement
of the twentieth century”*



RECOGNITION

At the time, *Women Artists* passed with little attention from the critics or the public, but over the next few years recognition came quickly for the Aboriginal art world. For example, at least 50 major Aboriginal art exhibitions were staged during the Australian Bicentenary in 1988, including three in the USA. Suddenly private galleries specialising in Aboriginal art were springing up in Australia’s major capital cities and around the world. In Alice Springs alone there were 30 outlets – including the local Kmart – selling Aboriginal art. By 1988 all the major national and state galleries had acquired curatorial staff specialising in Aboriginal art and were actively competing against each other to acquire new work.

Recognition came fast to Yuendumu too. Soon after *Women Artists*, the men began painting the famous Yuendumu Doors (a series of stories painted onto the doors of the Yuendumu School) in 1983. Warlukurlangu Artists was established in 1985, and the cooperative has now taken part in more than 1000 exhibitions around the world, with a financial turnover that puts them among the five most commercially successful Indigenous art centres in Australia.

When I visited Yuendumu recently a party of artists from Shanghai was there on a study trip, while local artists spoke of their upcoming projects in China, Singapore and Germany. Like the art on the Quai Branly and Qantas jet, Yuendumu artists and their works are on the world stage. Our collections give us a unique opportunity to understand and appreciate how they got there so quickly.

DR SCOTT MITCHELL, HEAD, CULTURE, CONSERVATION & COLLECTING

By making a donation to the Australian Museum Foundation, you can help support more projects like Yuendumu Stories. For further information, please see the back cover or contact the Development Branch, telephone 02 9320 6216.



Top

Women’s ceremonial wooden dish (parraja). Painted by Biddy Napanangka. Made of softwood from the Yinirnti tree. E078306

Left

Women’s ceremonial digging sticks (karrparnu) held during dances, painted by Bessie Nakamarra (E078404, left) and Mona Napurrurla (E078423, right).

meet KIM McKAY

continued from page 2

Genographic Legacy Fund benefitting indigenous communities around the world. But I'm not coming in to the Museum to put my own personal passions on display. The team at the Museum has some great plans for engaging the public into the future and we have some ambitious targets for building attendance, and how we do that will be top of mind.

Will you be continuing Frank's strong stand on biodiversity conservation and climate change?

Climate change is not a belief system; it's about science, and there is an overwhelming body of scientific opinion that says there is a very real and rapid change happening to our planet. I'm not interested in personal belief systems; I'm interested in science and in communicating that science to people.

I have been on the record for a long time as an advocate of generating awareness of the impacts of climate change and will continue to do that. The Museum is uniquely placed to continue to do climate change research linked to biodiversity and conservation, and we have a responsibility to show that this is an issue that needs more understanding, continued research and greater engagement. It is one of the key pillars of the Australian Museum Research Institute.

As a Museum Trustee over the last two years you've helped establish the New Museum project. Can you tell us a little about that?

I can only touch on it at this point, but it's a large, complex project that will basically allow us to create much-needed floor space for exhibitions by developing the under-used eastern end of the College Street site. We have one of the best Pacific collections in the world and I believe this needs to be front and centre because of our role as a country in the Pacific region. I also think our Indigenous collection is extraordinary and needs to be showcased more too.

And I see opportunities for taking some of the larger travelling exhibits that are out there, but we simply don't have the floor space to show them. Plans are still being developed, so all I can say is, stay tuned for those announcements.

What personal challenges do you anticipate in running the Museum?

Well, one is I've never worked in the public service previously. Bureaucracy is always an interesting thing to come up against, but I always seem to find ways to get around it [laughs]. That aside, I want more Museum science to be showcased on the floor of the Museum, to bring the science out, because people find it amazing. And bringing in more families and kids is critical.

Being the first female director of the Museum is an incredible honour, but there are big shoes to fill and I'd like to acknowledge all the work that Frank and his predecessors have been doing. Of course a new director will always want to put their stamp on things, but I need to get in there and understand it first. The Australian Museum has been doing great work on many fronts and that needs to continue. We've got an important role to play in the whole fabric of this city and state as a major cultural and science institution.

DIRECTOR-IN-WAITING KIM McKAY SPOKE TO BRENDAN ATKINS

WEBLINK >

Find out more about Kim McKay at www.australianmuseum.net.au/Explore-magazine

musings



FREE MUSEUM APP – SCOTT SISTERS

Step back in time and admire the simple beauty of nature through the eyes of the Scott sisters, Harriet and Helena. Colonial Sydney's most famous natural history artists produced brilliant illustrations of butterflies, moths and native plants that are still fresh and vital today. Now you can explore their stunning works at the touch of a screen with a new app for both iPhone and Android smartphones which puts the sisters' illustrations and the latest scientific data in the palm of your hand. It's a must for art and nature lovers everywhere.

Called *The Art of Science: butterfly and moth paintings by the Scott sisters*, the app is available free from australianmuseum.net.au/Art-of-Science or from the iTunes store and, from mid-April, the Android app store.



WEBLINK >

Find out more about the Scott Sisters at australianmuseum.net.au/Beauty-from-Nature-art-of-the-Scott-Sisters



GONG FOR LIZARD ISLAND STAFF

Co-directors of the Australian Museum Lizard Island Research Station, Drs Anne Hoggett and Lyle Vail, were made Members of the Order of Australia in the Australia Day 2014 Honours list 'for significant service to environmental research and conservation'. Anne and Lyle have been running the Lizard Island station, recognised as one of best coral reef research stations in the world, since 1990. Each year, the station offers up to 8000 visitor nights for scientists and students, with a research output of more than 80 scientific papers – crucial for understanding and protecting the fragile ecology of these precious habitats.



UNVEILING THE MUSEUM'S TREASURES

Come and enjoy a very special evening of entertainment, intrigue and wonder at the Australian Museum Foundation Fundraising Dinner. With sophisticated company, fine wine and a gourmet meal, *Unveiling the Museum's Treasures* is a rare opportunity to delve into the past and inspect some of the Museum's most valued treasures. To be held on Thursday 8 May, tickets are on sale now and places are strictly limited. For further information about how to book please contact Juliet Gauchat at development@australianmuseum.gov.au or phone 02 9320 6216.



PARENTAL *care*



Left
Fatherhood. Photograph
by Richard Wylie © Richard
Wylie.

THE SUPERBLY CAMOUFLAGED COMMON SEADRAGON IS ONE OF ONLY TWO SPECIES OF SEADRAGON IN AUSTRALIAN COASTAL WATERS.

The Common Seadragon, *Phyllopteryx taeniolatus*, is found from the central New South Wales coast to south-western Western Australia. It favours kelp-covered rocky reefs at depths from 3 to 50 metres.

In the breeding season (summer), the male carries the fertilised eggs under his tail until the fully formed young hatch eight weeks later, with up to 250 from a single brood.

This stunning specimen was photographed beneath Flinders Pier on Mornington Peninsula, Victoria. The photo earned Richard Wylie first place in the 2013 New Scientist Eureka Prize for Science Photography.

2014 AUSTRALIAN MUSEUM EUREKA PRIZES



What does science mean to you?

Capture your answer in a single photograph and you could win a share of \$10,000 in the New Scientist Eureka Prize for Science Photography. It's one of 15 prizes on offer in the 2014 Eureka Prizes program.

To see the complete line-up and conditions of entry go to australianmuseum.net.au/eureka

Entries close 7 pm AEST Friday 2 May 2014

Follow us on Facebook and Twitter

Hook, line and sinking.
Photo © Justin Gilligan,
commended in the *World
in our hands* award,
Wildlife Photographer
of the Year 2013.



HOOK, LINE

AND

sinking



THE *WILDLIFE PHOTOGRAPHER OF THE YEAR* EXHIBITION FEATURES ONE HUNDRED POWERFUL NEW IMAGES OF WILDLIFE AND NATURE, INCLUDING THIS ONE FROM AUSTRALIAN PHOTOGRAPHER **JUSTIN GILLIGAN**.

Anything three metres long with teeth like that has to be dangerous, right? Well, no: the Grey Nurse Shark, *Carcharias taurus*, is a placid species that prefers to avoid people.

Its worst crime is stealing bait from fishing hooks, for which it often pays with injuries like these or, worse, a slow death from swallowed hooks. State regulations now ban fishing in the few special places where the Grey Nurse Shark, listed as critically endangered, congregates – but that hasn't stopped the injuries and deaths.

Photographer Justin Gilligan tried several times to photograph the Grey Nurse Shark at Seal Rocks, one of their known hang-outs on the NSW central coast, before capturing this telling image. 'Venturing underwater with a camera allows me to provide a voice for the animals that I see', said Justin.

Justin's photo highlights the cruel fate of many sharks globally, with millions butchered each year for the shark-fin soup trade and beach nets drowning thousands more. 'The growing number of people in the world is placing pressure on the coastal and ocean environments – it's more important now than ever to provide images that tell the truth about environmental concerns and our interaction with the environment', he said.

'It's time we accepted that this planet is ours to share; we need to learn to live with and respect these creatures before we lose them completely.'

BRENDAN ATKINS, EDITOR

See the *Wildlife Photographer of the Year 2013* exhibition at the Australian Museum from 29 March to 1 June. Free with general Museum entry. *Wildlife Photographer of the Year* is co-owned by the Natural History Museum and BBC Worldwide



A special welcome to all our new Members! Did you know that the Members lounge is available for use whenever you visit the Museum? It's open from 9.30 am to 4.30 pm, so drop by to have a peaceful respite from a busy day, eat your lunch or enjoy a complimentary tea or coffee. Find us just inside the William Street entrance.

MEXICO ANYONE?

With *Tyrannosaurs* wrapping up in July, our next blockbuster exhibition will be *Aztecs*, opening in September along with a rich program of events, including a tour to Mexico departing May 2015. Especially designed for Members, the tour will take in all the best that Mexico has to offer. Find further details on these pages.

TALKS

The last of our *Tyrannosaurs* talks is the grand finale that answers the question: what happened to the dinosaurs? We all want to know! Then we have two historically themed talks, the first of which marks the centenary of a major science festival held in Australia on the eve of World War 1. The second talk looks at the life of a controversial Museum curator of old, fish scientist James Ogilby. By popular demand, our Night Talks start at 6.30 pm.

Come and visit the Museum again soon – we look forward to welcoming you!

SERENA TODD

Events Coordinator
Australian Museum Members

Serena Todd's photo by Carl Bento.

ALL NIGHT TALKS

TIME 6.30–7.45 pm

COST Members \$20, non-Members \$30

BOOKING Book online at australianmuseum.net.au/whatson or phone 02 9320 6225

Fate of the dinosaurs: a perfect storm

Dr Andrew Glikson, Australian National University

WHEN Wednesday 2 April

The discovery of the K-T boundary (a thin, distinctive layer found in geological sediments worldwide), and the realisation that it coincided with mass extinctions 65 million years ago, heralded a major shift in the long-running debate about the demise of the dinosaurs. Join Andrew Glikson as he presents the evidence for our theories of the events that wiped out so many, yet allowed others to survive (see story, page 10).

**History flashback
Science on the eve of war**

Dr Geoffrey Fishburn, UNSW

WHEN Tuesday 1 July

Surprisingly, it was a major science festival in Australia that placed the Commonwealth on the world stage in 1914. The 84th annual meeting of the British Association for the Advancement of Science (BAAS) was four years in the planning and attended by over 300 British scientists. The conference began just days after war had been declared, generating excitement, debate and more than a few controversies in every capital city. The BAAS was formed in 1831 to promote science, and its annual meetings were famous for their startling scientific announcements. Behind the 1914 tour of Australia were two great personalities: British geneticist William Bateson and Australian chemist David Rivett, at opposite ends of their respective illustrious careers. Relive this crucial period in the development of science in Australia with Geoffrey Fishburn.

James Ogilby: a man with a taste for fish

Joy Ware, historian and author

WHEN Tuesday 15 July

James Ogilby researched fishes and birds in Ireland and the USA before coming to Australia and joining the Australian Museum in 1885. A prolific scientist, he published 21 papers in his first two years at the Museum and a total of 181 papers in a 40-year career, describing 154 new species of fishes (by himself and in collaboration) and registering over 5000 lots of fishes with the Museum collection. Departing the Museum under a cloud in 1901, Ogilby moved to the Queensland Museum and further work with the Amateur Fishermen's Association of Queensland.

Join historian and author Joy Ware as she shares her research into the life and times of her great-uncle, James Ogilby.

Bonus: Following Joy's talk, we'll have the chance to examine some of Ogilby's type specimens from the Museum collection and view his notes and diaries from the archives. Note that this special evening will conclude at 8.30 pm.



Above Zoologist James Ogilby. Photo by H Hacker.



The many cultures of Mexico: from Aztec to Maya

WHEN May 2015

Join archaeologist Chris Carter as we explore the cultures of Mexico, rich with history, cuisine, music and dance. We will walk the cities of this fabulous country, visit historic sites, shop in local markets and meet local people. Mexico has a rich tradition filled with music and dance. The tour includes visits to venues for you to experience these firsthand, with free time to explore areas at your own pace. The tour also takes us to the shores of the Caribbean for your relaxation and enjoyment.

The tour will highlight Mexico City itself, one of world's great metropolises. Experience the art of Diego Rivera and Frida Kahlo and stand among the imposing ruins of Teotihuacan. We'll take in the colonial cities of Puebla, Oaxaca and Merida, the Mayan cities of the Yucatan (Palenque, Uxmal and Chichen Itza), and relax on the shores of the Caribbean, on the 'Mayan Riviera'. And, if you think you'd like a little more adventure, you can opt to extend your trip to Belize, a renowned biodiversity hotspot, and Guatemala.

To register your interest or find out more, please phone Serena Todd on 02 9320 6225.

Madagascar: a world apart

WHEN Departs October/November 2014

Experience a biodiversity wonderland, Madagascar. Formerly a landlocked plateau in Gondwanaland, it became marooned when that ancient and huge landmass separated into the island continents of Australia, Antarctica, South America and Africa. The natural history of Madagascar is unique: isolated from the African coast by the Mozambique Channel, it has evolved in isolation. Travellers are rewarded with glimpses of outlandish wilderness inhabitants like the chameleon, 90 per cent of the world's lemur species, rare and gorgeous birds, and more than a thousand species of orchids – including the Earth's rarest specimen and the mysterious other-worldly black orchid.

We plan to have a comprehensive Malagasy experience including Berenty Reserve, the crocodile caves of Ankarana, Périnet Reserve, Antananarivo and much more.

To register your interest or for further information, phone Ray Boniface at Heritage Destinations on 02 4228 3887.

Orange, New South Wales: FOOD, Wine, Stars

WHEN 4–6 April 2014

Join us on this three-day autumnal tour of the beautiful Orange Region to partake in the annual FOOD (Food of Orange District) festival. We'll begin with a special lecture by Nobel Laureate Brian Schmidt about his quest to find the meaning of life, then we're off to the Age of Fishes Museum in Canowindra, the famous 'Dish' in Parkes and meanders through the historic towns of Forbes and Molong. Sip on fabulous cold-climate wines from our partner CSU Winery and gaze at the stars with our special astronomy guest hosts.

For more information, please contact Marnie on 1300 729 183 or request further information at info@fredwatson.com.au



Scan this code to your mobile device to find all **Members travel**, or visit our website, australianmuseum.net.au.

Top Discover the archaeological site of Palenque, a former Mayan city, on our Mexican tour in 2015. Photo courtesy Chris Carter.

Above Orange's cooler climate produces award-winning wines. Photo courtesy Justin Byrne, CSU Winery.

adventurouswalks

TIME 9.30 am – 3.30 pm approx.

COST Members \$15, non-Members \$20

BOOKING Visit www.australianmuseum.net.au/whatson or phone 02 9320 6225

The Mittagong Colliery Walk

WHEN Sunday 18 May

Explore the old Mittagong Colliery Walk in Box Vale with popular walk leader Ross Pearson OAM. Meander through caves, cuttings and old railway lines.

Middle Head History Walk

WHEN Friday 18 July

Join Ross Pearson OAM on this shorter morning walk exploring the old ramparts, nooks and crannies and overall history of Middle Head. There's much to see and explore as Ross reveals some little-known spots of historical interest. We'll finish off with tea and nibbles in a nearby café.



Scan this code to your mobile device to find all **Members events**, or visit our website, australianmuseum.net.au.

specialevents

Gold and the Incas: the lost worlds of Peru

WHEN Sunday 13 April, 7 am – 7 pm

COST Members \$135, non-Members \$150

BOOKINGS Book online at australianmuseum.net.au/whatson or phone 02 9320 6225

Get in the mood for the upcoming *Aztecs* exhibition at the Australian Museum! Come with us on a day tour to see the *Gold and the Incas: lost worlds of Peru* exhibition at the National Gallery of Australia in Canberra.

Revealing the splendour, drama and beauty of Ancient Peru and the famous empire of the Incas, this remarkable exhibition features more than 220 works of art including spectacular gold pieces and scintillating jewellery created thousands of years ago to decorate the nobility in life and in death.

Ten private and public museums from Peru, including the National Museum of Archaeology, Anthropology and History, have generously lent some of their greatest treasures for this spectacular exhibition.

Our luxury coach departs the Australian Museum at 7 am, returning at around 7 pm. In between, the day includes morning tea en route at Berrima, a picnic lunch on the shores of Lake Burley Griffin with sandwiches, slices, wine and fruit juice, transport and admission to the exhibition.

Join like-minded Members on this great day out.



Above Moche culture, North coast 100–800 AD, Bead in the form of an owl's head, gold and turquoise; 3.7 x 3.3 cm. Ministerio de Cultura del Perú: Museo Tumbas Reales de Sipán, Lambayeque. Photograph: Museo Tumbas Reales de Sipán. Courtesy National Gallery of Australia.

School holiday fun!

DETAILS Visit australianmuseum.net.au/event/School-Holiday-Program

Enjoy a range of activities here at the Museum every school holidays.



TYRANNOSNORE

WHEN Friday 11 April

TIME 6.30 pm – 7.30 am

COST Members: adults \$120, children \$150
non-Members: \$140, children \$180

AGES 5–12 years

BOOKING Book online at australianmuseum.net.au/whatson or phone 02 9320 6225

How would you like to spend the night sleeping in the *Tyrannosaurus* exhibition at the Australian Museum?

Come to the Museum at night for a special pizza dinner, join in a fun *T. rex* craft activity, tour the Museum by torchlight, watch some DVDs with friends and then catch some ZZZs in the *Tyrannosaurus* exhibition, surrounded by the dinosaurs!

Make sure you bring your camera to capture every moment of this larger-than-life experience.

AUSTRALIAN MUSEUM MEMBERS SINCE 1972, SUPPORTING AUSTRALIA'S FIRST MUSEUM



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Available only from the Museum Shop,
phone 02 9320 6150, email shop@austmus.gov.au

RRP \$50, Members price \$45.

Above
Dr Frank Talbot AM with
specimen of Red Bass,
Lutjanus bohar, from
Feathers of the Gods.
Photo by Stuart Humphreys.



Mariko Smith is returning knowledge from the Indigenous collection to traditional owners. Story, page 3. Photo by Stuart Humphreys.

EXPLORE

Volume 36, Number 1, ISSN 1833-752X
Autumn/Winter 2014

Explore, the news and events magazine of the Australian Museum and Australian Museum Members, is now published three times per year.

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Design management Louise Cornwall

Design and layout Trudi Fletcher

Original design template Stephen Goddard

Production Jenny Hooker

Advertising Brendan Atkins 02 9320 6249

Prepress Spitting Image

Printing Peachy Print

We welcome your feedback, comments and enquiries.

Email the Editor at explore@austmus.gov.au

Frank Howarth's photo by Carl Bento

Australian Museum

6 College Street Sydney NSW 2010
Open daily 9.30 am – 5 pm (closed 25 Dec)
t 02 9320 6000 (switch)
t 02 9320 6225 (Members)
australianmuseum.net.au

President Catherine Livingstone AO

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Explore is produced using carbon-neutral processes under an ISO 14001 environmental management system. It is printed on ecoStar, a carbon-neutral paper made from 100% post-consumer recycled waste, using alcohol-free, vegetable-based inks made from renewable sources.

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We would like to acknowledge the generous support of our many benefactors, corporate partners and research partners in realising this vision.



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