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This newsletter is published twice a year and is archived at rses.anu.edu.au/newsletter
Editing: Mary Anne King
Design: Bethany Ellis
Contact Mary Anne King to submit content.

Science Meets Street Art: PhD Student Tanja Pejic had her seismology research interpreted by street artist PAW during National Science Week. Can you see the wave going into the Earth, interacting with the inner core?
From the Director

I would like to take this opportunity to thank my predecessor Professor Ian Jackson for his leadership and considerable legacy that has consolidated the School's financial position and laid the foundations for the future. On behalf of the students and staff I also extend a heartfelt thanks to Ian for his very generous donation to the Earth Sciences Future Fund.

It is an exciting time for the School as we explore new opportunities to shape research directions and continue to create and deliver a world-class education program. The School seeks to grow our engagement with business, industry and government so that together we can address major geoscience challenges.

A comprehensive review of the Research School of Earth Sciences is underway and I invite you to consider making a submission before Monday, 7th November 2016. For more details please go to our website.

Professor Stephen Eggins, October 2016

Brief News

Reaching new heights to study oldest life on Earth

RSES post-doctoral researcher Aditya Chopra recently undertook field-trips to the world heritage listed Shark Bay Nature Reserve and the Pilbara in Western Australia with technology that is offering a new perspective to scientists. His trip was enabled by a travel grant from the Australian Geoscience Council and the Australian Academy of Science.

Drones offer higher resolution maps than those available from satellites or aircrafts. “The drone-based aerial surveys of the complex microbial communities that build the stromatolites will enable researchers to study how these communities respond to extreme weather events, rising sea-levels and ocean acidification,” said Dr Chopra.

Advancements in technology have made it possible for us to readily construct 3D maps of sites of geological interest and fly around them virtually. “The big picture context from our vantage point up in the air helps guide our research efforts and it is also a valuable teaching tool,” said Dr Chopra.

Image: Rohan Thomson
Science Meets Street Art

During National Science Week street artists worked with young scientists from ANU as part of Co-Lab: Science meets Street Art. Two RSES PhD candidates, Tanja Pejic and Alena Kimbrough were selected to take part in this collaborative project that involved scientists and artists being paired up. For Tanja Pejic explaining her project about the earth’s inner core in lay terms was not easy but she admits that “collaborating with PAW, a talented artist, was refreshing, and seeing the artwork emerge through various sketches was nothing short of amazing. It captured the complexity of the research brilliantly yet simply.”

Read More

3 Minute Thesis Competition

Congratulations to Kate Holland and Jennifer Wurtzel who swept the pool at the College of Sciences final for the 3 Minute Thesis competition.

Kate took out first place for the College of Physical and Mathematical Sciences, while Jennifer won second place and the people’s choice award. If there was a third place award it probably would have gone to our other RSES competitor, Eleanor Mare. Well done to all three of our 3MT representatives on their outstanding achievements.

The Three Minute Thesis is an international competition for higher degree research students to showcase their research. Students have to talk about what their research is and why it is important in plain language for three minutes, with only a single PowerPoint slide.

WikiBomb Women in Antarctica

The Women in Antarctica WikiBomb was launched at the Scientific Committee on Antarctic Research (SCAR) meeting in Kuala Lumpur. This was designed to raise the profile of female scientists in Antarctica. Over 100 Wikipedia profiles provide a focus on female scientists and their contributions to Antarctic science.

Dr Jan Strugnell, a marine biologist, and Thomas Schaffee, a Wikipedia specialist from LaTrobe University coordinated a team of 27 volunteers from around the world to research, write, and upload the biographies.

Dr Strugnell said it was important that senior women scientists were visible to younger female scientists, so that they understood that careers in science were possible. She said some 60% of early career Antarctic researchers are women, with strong reputations in the scientific community, but only about 10% of awards, prizes and papers at scientific conferences were presented to, or given by, women.

“A greater online presence of female Antarctic science role models is important and long overdue,” Dr Strugnell said.

Some 18 women from Australia have now been profiled through the WikiBomb. These include Nerilie Abram and Liz Truswell from RSES.

You can read more about it at Nature, from the ABC, and from the Australian Antarctic Division.

There is a rumour that following the WikiBomb there are now more Antarctic women than men on Wikipedia!
Brief News

John and Kerry Lovering support new Master of Earth Sciences Scholarship

“We want the student to add to the sum of knowledge and understanding of this precious planet of ours.”

We are delighted to announce the establishment of the John and Kerry Lovering Scholarship for the Master of Earth Sciences (Advanced).

John and Kerry Lovering hope to inspire a student to follow their passion for Earth sciences.

“We live on this planet we call Earth and it is very important for us to understand the sensitivities of our use of resources, our need for food supply and making sure we look after the climate,” says John.

“We are very keen to have women and men study the Earth Sciences because it is basic to the development of the Solar System and the development of the Earth within the Solar System,” says Kerry.

Professor John Lovering AO, FAA, FTSE began his academic career at the ANU. He returned from USA to Australia in 1956 as a research fellow (1956-60), then fellow (1960-64), and finally senior fellow (1964-69) in Geophysics and Geochemistry at the ANU. This was the start of a distinguished career including the study of meteorites, moon rock and Antarctic research. From 1975 -1987 Professor Lovering was head of the School of Earth Sciences at the University of Melbourne, before becoming Dean of Science and Deputy Vice-Chancellor (Research). In 1987 the Loverings moved to Adelaide where Professor Lovering became Vice-Chancellor of Flinders University (1987 -1995) and later President of the Murray- Darling Basin Commission (1994-1999).

After graduating with a BSc(Hons) from University of Sydney, Ms Kerry Lovering OAM began her career as a geologist in what was a very male dominated industry. Ms Lovering has been a lifelong activist for women’s rights including convening the Women’s Electoral Lobby. She has held many positions in an active career including public service, academia and serving on local councils. Ms Lovering is a graduate of Sydney University, University of California, Los Angeles, Monash University, and the University of Melbourne.

John and Kerry look back on these experiences with gratitude and hope that their scholarship will spark a student’s own rewarding journey in Earth sciences.

Andychristyite

Congratulations to Dr Andy Christy who has had a new mineral named after him, ‘for his contributions to mineralogy.’ Andychristyite is a tellurate of lead and copper, PbCu2+Te6+O5-H2O, and it is a very rare mineral.

Read more

Patrick De Deckker recently led a group of students, postdocs and staff on a field trip around SE Australia, exploring key Quaternary sites. Group photo taken at the Gibson Steps at the eastern side of the Great Ocean Road. Marine Tertiary formations are visible in the background.
Oldest fossils point to thriving life on young Earth

Australian researchers have found the world’s oldest fossils, revealing that diverse life forms thrived on Earth 3.7 billion years ago.

Co-lead investigator Associate Professor Vickie Bennett from The Australian National University (ANU) said the research on stromatolite fossils found in Greenland provided a greater understanding of early habitats of life on Earth and could have implications for searching for life on Mars.

“This discovery turns the study of planetary habitability on its head,” said Dr Bennett from ANU Research School of Earth Sciences.

“For the first time we have rocks that we know record the conditions and environments that sustained early life. Our research will provide new insights into chemical cycles and rock-water-microbe interactions on a young planet.”

The research, published in Nature, involved the University of Wollongong (UOW), ANU and the University of New South Wales (UNSW).

Co-lead investigator Professor Allen Nutman from UOW said the stromatolite fossils, found in the Isua Greenstone Belt along the edge of Greenland’s icecap, predated the world’s previous oldest stromatolite fossils from Western Australia by 220 million years.

For much of Earth’s history life was just single cells, and stromatolite fossils are mounds of carbonate constructed by these communities of microbes.

“The significance of stromatolites is that not only do they provide obvious evidence of ancient life that is visible with the naked eye, but that they are complex ecosystems,” Professor Nutman said.

“This indicates that as long as 3.7 billion years ago microbial life was already diverse. This diversity shows that life emerged within the first few hundred million years of Earth’s existence, which is in keeping with biologists’ calculations showing the great antiquity of life’s genetic code.”

The discovery pushes back the fossil record to near the start of the Earth’s geological record and points to evidence of life on Earth very early in its history.

IODP Expedition 363

Two scientists from the ANU Research School of Earth Sciences, Bradley Opdyke and Jennifer Wurtzel embarked on Expedition 363 to the Western Pacific Warm Pool (WPWP).

The WPWP Expedition leaves from Singapore and aims to improve our understanding of the interaction between climate and the WPWP from the middle Miocene to Holocene. A series of sites will be drilled in the western equatorial Pacific and eastern Indian Ocean to investigate (1) the role and response of the WPWP to millennial climate variability during the late Quaternary, (2) changes in the WPWP and relation to monsoon activity on orbital timescales during the Pliocene-Pleistocene, (3) changes in the Indonesian Throughflow during the Pliocene-Pleistocene, and (4) the long-term evolution of WPWP sea surface (SST) and intermediate water temperatures (IWT) and water chemistry since the middle Miocene.

Dr. Opdyke will be hoping to recover material from off the north western margin of Australia (just south of Timor) to extend detailed climate records from the area from half a million years to a million years.

PhD candidate, Ms. Wurtzel will be hoping to recover a very detailed climate record from a location north of Papua New Guinea where sedimentation rates climb to more than a meter per thousand years to pursue a detail climate record from the late Holocene.
Humans have caused climate change for 180 years

An international research project has found human activity has been causing global warming for almost two centuries, proving human-induced climate change is not just a 20th century phenomenon.

Lead researcher Associate Professor Nerilie Abram from the ANU Research School of Earth Sciences and ARC Centre of Excellence for Climate System Science, said the study found warming began during the early stages of the Industrial Revolution and is first detectable in the Arctic and tropical oceans around the 1830s, much earlier than scientists had expected.

"It was an extraordinary finding," said Associate Professor Abram.

"It was one of those moments where science really surprised us. But the results were clear. The climate warming we are witnessing today started about 180 years ago.

The new findings have important implications for assessing the extent that humans have caused the climate to move away from its pre-industrial state, and will help scientists understand the future impact of greenhouse gas emissions on the climate.

"In the tropical oceans and the Arctic in particular, 180 years of warming has already caused the average climate to emerge above the range of variability that was normal in the centuries prior to the Industrial Revolution," Associate Professor Abram said.

The research, published in *Nature*, involved 25 scientists from across Australia, the United States, Europe and Asia, working together as part of the international Past Global Changes 2000 year (PAGES 2K) Consortium.

How ice age carbon hid in the deep Atlantic

A huge reservoir of carbon developed in the deep Atlantic Ocean during the last ice age, research led by ANU Research School of Earth Sciences has found.

Lead researcher Dr Jimin Yu found that as ocean currents changed over 10,000 years, an extra 50 gigatonnes of carbon was stored at the bottom of the Atlantic Ocean.

"It was a major climate transition period for the Earth," said Dr Yu.

"Within 10,000 years the sea level dropped 60 metres, and the atmosphere lost 60 gigatonnes of carbon, equivalent to a drop of about 30 parts per million of carbon dioxide. This research helps us understand the fate and the impact of that carbon."

The research will help scientists better understand the complex interactions between the atmosphere and the ocean that may occur with the current rise in atmospheric carbon dioxide levels, which is causing global warming.

In the past 150 years, atmospheric carbon dioxide has risen from below 300 parts per million to 400 parts per million.

"To improve our understanding of climate change in the future we must look at what processes controlled changes in the past," said Dr Yu.

The research team from ANU, University of New South Wales, Chinese Academy of Sciences, and several other partner institutions studied the chemical makeup in fossils of tiny animals called benthic foraminifera that live in the deepest parts of the Atlantic Ocean.

During the slide into an ice age about 70,000 years ago, the ratio of boron to calcium in the fossils decreased, reflecting an increase in the amount of carbon dioxide in the ocean more than three kilometres under the surface.

The team found that this change in carbon dioxide matched closely with changes in the ocean circulation, which caused a large body of carbon-laden water in the southern Atlantic to spread northward and upward.

"The deep ocean water originating from the South Atlantic stayed at the bottom of the ocean for hundreds of years accumulating carbon from the dead plankton sinking from the surface," said Dr Yu.

The research is published in *Nature Geoscience*.
Research Highlights

ARC Centre of Excellence for Climate Extremes

The Australian Research Council has funded a new Centre of Excellence for Climate Extremes. The new centre will transform the direction of Australian climate research and help us to understand and reduce the country’s vulnerability to climate extremes.

Climate extremes cost Australia up to $4 billion a year and will intensify over coming decades.

"Climate change will continue to be a global priority and an issue that affects everyone. ANU is known for producing world-leading climate research and that will now contribute to the work of the new centre," said Professor Michael Roderick, who will be one of the ANU Chief Investigators for the Centre. Andy Hogg and Nerilie Abram from RSES are also Chief Investigators for the new Centre.

The Centre brings together world-leading researchers from five Australian universities and a range of national and international partners.

Success at 2016 AuScope Awards

Congratulations to RSES researchers who have been recognised at the 2016 AuScope awards.

Hrvoje Tkalčić recieved the Excellence in Research Achievement Award. This honours researchers, working in the Earth and Geospatial Sciences using AuScope infrastructure, who demonstrate excellence through track record or clearly demonstrated potential.

The Capricorn Orogen Project, which includes researchers from RSES, took out the Application of Science Award. This honours an individual or group that have demonstrated a significant advancement in research using Auscope infrastructure and translated the research into a substantial impact both nationally and internationally.

3D printed fish fossil may reveal origin of human teeth

Three-dimensional prints of a 400 million year old fish fossil from around Lake Burrinjuck, about 50 km northwest of Canberra, in southeast Australia reveal the possible evolutionary origins of human teeth, according to new research by The Australian National University (ANU) and Queensland Museum.

The research team digitally dissected the jaws of a fossil Buchanosteus - an armoured fish from the extinct placoderm group - and used the 3D prints to learn how the jaws moved and whether the fish had teeth.

"We are researching this question using new evidence from an exceptionally preserved fossil fish about 400 million years old," said Ms Hu, a PhD candidate.

The research team used high-resolution CT scanning facilities developed at ANU to investigate the ancient fish fossil.

Read more

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Read more
Queensland Geoscientists honour
Dr Simon Beams

Congratulations to Dr Simon Beams (BSc Hons 1975), Managing Director and Principal Geologist of Terra Search, who is the inaugural recipient of the John Campbell Miles Medal awarded by the Queensland Division of the Geological Society of Australia (GSAQ) and the Queensland branch of the Australian Institute of Geoscientists (Qld AIG). John Campbell Miles discovered the Mount Isa lead-zinc deposit in 1923.

This prestigious award recognises Dr Beams’ major contribution to economic geology in Queensland. The award citation states:

‘Simon Beams has been an integral part of the economic and mineral exploration communities in northern Queensland for more than 30 years. Through his unswerving dedication to the practice of geology with scientific integrity, and to the growth and development of the Queensland resources industry, he has been a major and positive role model for colleagues and associates…in addition, his willingness to develop new approaches and to apply new technology, and his commitment to preserving geoscience and exploration data, have resulted in significant advances in the quality and accessibility of data available to explorers in Queensland.’

“The Award was a complete surprise,” said Dr Beams.

“It is a great honour to be recognised by your peers in such a way. Over 40 years ago at ANU I began mapping the granite bodies of the Bega Batholith of Southeast NSW and Victoria with mentors and colleagues like Bruce Chappell, Tony Eggleton, Ian Smith, Allan White, Ian Williams, Richard Lesh, Ian Levy and Richard Price. It is a demonstration that many of the skills I learnt at ANU are just as relevant today, even though there have been some tremendous advances in technology in the intervening period.”

“While geologist grow old they may not grow up”

On Saturday 23rd January 2016, RSES hosted the ANU Geology 20ish year reunion. Around 40 former students and their families along with former and current staff attended a BBQ in the RSES courtyard, hosted by Steve Eggins and Mary Anne King. The reunion group comprised former students from graduating classes in 1999 and 2000, and marked “almost 20 years” since leaving ANU, and 19 years since the famous Broken Hill field trip of 2007 - a trip that left quite an impression on all touched by it! Former students travelled from around Australia for the reunion - Darwin, Melbourne, Sydney and all areas in between.

After a welcome by Steve, there was a tour of the current RSES facilities and then a BBQ and drinks. A smaller group kicked on in Civic after the BBQ proving that while geologists may grow old, they may not grow up.

The diversity of career paths chosen by these geology graduates reflects the strength and reputation of the education provided by ANU - as well as some practicing geologists, the group has investment bankers, teachers, writers, farmers and academics, all of whom are excelling in their chosen professions.

By Dave McPherson
Awards for Outstanding Alumni

Andrea Dutton
GSA Fellow

We congratulate Andrea Dutton (ANU Postdoctoral Fellow 2004 -2006, Research Fellow 2006 - 2015) on her election to Fellowship of the Geological Society of America. This honor is bestowed on the best of the geoscience profession and recognises Andrea’s enthusiasm and energy as well as an ‘encyclopedic knowledge of geology.’ Andrea is a sea level change researcher at the University of Florida.

Lesley Wyborn
GSA Fellow

Lesley Wyborn (ANU PhD 1978) is a distinguished geoscientist who has an international reputation for synthesizing and analyses of complex data sets. We congratulate Lesley on her election to Fellowship of the Geological Society of America as the Geoinformatics Division 2016 Outstanding Contributions in Geoinformatics Awardee.

Shun Kurato
AGU Inge Lehmann Medal

Dr Shun Kurato (ANU Research Fellow 1981-1985) has won the 2016 Inge Lehmann Medal given by the American Geophysical Union. The Medal has been awarded to only a handful of the world’s great geophysicists. It recognizes ‘outstanding contributions to the understanding of the structure, composition, and dynamics of the Earth’s mantle and core.'

Brad Pillans
Fellow of the Geological Society of Australia

This award recognises Professor Brad Pillans’ significant contribution to geological sciences over an academic career spanning more than 30 years in both New Zealand and Australia. From 2010 to 2012, he served as president of the Geological Society of Australia and since 2010 he has played a major role in the development of the National Rock Garden, serving as Chair of the NRG Steering Committee and as a Director of the NRG Trust Fund.

Happy 70th Birthday ANU

August 1, 1946, is the date when The Australian National University (ANU) was established by an Act of Federal Parliament. It was at the time, a unique nation building project. At the 70th anniversary Vice Chancellor Professor Brian P. Schmidt AC led the celebrations on campus. Many notable alumni shared their reflections.

Read more.

Alumni and Friends Reception in Sydney

The ANU Colleges of Science hosted a very successful alumni and friends reception in Sydney in August. Held at the Powerhouse Museum, to coincide with the international Collider exhibition, we were delighted that so many people could join us. Deans and School Directors particularly enjoyed hearing stories of, and reflections on, people’s time at the ANU. The Deans hope this will become an annual event in Sydney.

Do you have some news about our alumni?
Please let us know: rses.alumni@anu.edu.au
During the September teaching break a dozen Earth and Marine Science students took part in the industry-led “Core Skills” course at Heron Resources’ Woodlawn Project in NSW. The key objective of the six day course was to build understanding of methods used by the minerals industry in formulating large-scale economic evaluations of geological systems. The course was based on a real-world scenario, whereby students formed their own “consultancies” and were tasked to undertake a review of the Woodlawn asset on behalf of a fictitious partnership of international investors.

The student consultancies logged hundreds of metres of drill core, liaised with geologists from Heron Resources’ and spoke with industry-based experts to make an assessment of the Woodlawn Project. Back at RSES, the core logs and on-site knowledge gained by each consultancy were incorporated into a large-scale 3-dimensional computer model of the mineral resources at Woodlawn. Based on their models, reports were compiled by each consultancy presenting their findings and making final recommendations concerning potential investment in the Woodlawn Project.

“Tasks like this are challenging to experienced industry geologists and the students had a real taste of those challenges,” said Dale Sims from Dale Sims Consulting, who led the “Core Skills” course.

“Industry, the students and the University all benefit from these types of exercises and it is great to see ANU taking the lead with this approach.”

We are very grateful to Heron Resources, Dr Carol Simpson, Dale Sims and Matt Valetich for their time and support of the “Core Skills” course.

Heron Resources helping students learn

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RSES Student Blog

On Circulation is a blog and science communication platform about the diverse research, oresome field trips and lives of the students from RSES. We welcome comments, encourage discussion and hope you enjoy our stories. Read the blog

Images: Dale Sims

Goldschmidt 2016

This year the Goldschmidt geochemistry conference was held in the southern hemisphere in Yokohama, Japan. A large contingent of staff and students participated in the conference delivering key presentations, student poster sessions and the opportunity for networking.

PhD student, Michael Anenburg was fortunate to attend field trips in the Fuji-Hakone region. Read about his experiences

Image by Jen Wurtzel, currently onboard the JOIDES Resolution. Follow our students live in the field on Facebook, Instagram and Twitter
Student Activities

Travel Journal: Oman

The rugged landscape of Oman is a geologist's dream and for PhD candidate Joëlle Ducommun the desert became a reality. Oman is home to the world’s best preserved ophiolite; a piece of the crust once lying at the bottom of the ocean and now exposed in front of our eyes, ready to unravel deep mysteries about its formation. Warm and welcoming people, people who are proud of their culture, people with avid curiosity who are not afraid of the barriers imposed by language and people who are willing to share and to open their homes to two strangers walking around with hammers.

Read More

In search of fossil earthquakes

Kathryn Hayward joined a group of geologists for field work in Italy’s Adamello Massif in search of evidence of ancient earthquakes. Of interest to the group was the Gole Larghe Fault zone; a fault with more than 1km of slip that cuts a tertiary granitic batholith exposed along the Periadriatic fault system.

Read More

Congratulations Muriel Naguit

Muriel’s research into earthquake hazard, specifically the damage caused by the 2013 Mw7.1 earthquake that occurred in Bohol, Philippines, has been recognised at an international conference on Building Resilience, held in Auckland.

Read More

Stories in the Stone

If rocks could speak, they would have a lot to say. Even without a voice, they’re great story-tellers. So long as you know how to listen. I didn’t really get interested in geology until the later years of high school, when I realised that you can tell a story from rocks,” says Eleni Ravanis, an ANU student who completed a nine-day geology field trip at Wee Jasper in NSW.

Read More
We congratulate the following students on completion of their degrees. We celebrate their achievements and are immensely proud of them.

**PhD**
- Roberto Benavente
- Aditya Chopra
- Nur Gueneli
- Michael Jollands
- Claire Krause
- Yang Li
- Sarlae McAlpine
- Scott Meyerink
- Michael Moore
- Tomas O’Kane
- Marian Sapah
- Prokopiy Vasilyev
- Malte Willmes

**MPhil**
- Robert Burne
- Kathryn Hayward
- Andrew Higgins

**Grad Cert Science**
- Prudence Merriman

**Honours**
- Nicholas Badulovich
- Ellen Cliff
- Callum Macfarlane
- Aziah Williamson

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**Ms Kathryn Hayward**

2016 Australian Bicentennial Scholarship

PhD candidate, Ms Kathryn Hayward (ANU MPhil) is the recipient of a post graduate scholarship designed to promote international collaboration between Australia and the United Kingdom. Ms Hayward will travel to the UK to study with Professor Giulio Di Toro at the University of Manchester, with the aim of exploring weakening mechanisms at the onset of fault slip to gain insights in earthquake propagation. Congratulations Kathryn.

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**Professor Phil Cummins**

Ganesha Widya Jasa Adiutama Award

This prestigious Indonesian award from the Bandung Institute of Technology (ITB) recognises Professor Cummins’ outstanding achievements over more than a decade with implementing science and technology in development activities. Since the 2004 Indian Ocean Tsunami, Professor Cummins has been at the forefront of the development of Indonesia-Australia collaboration in earthquake science.

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**Ms Ellen Cliff**

2016 ANU University Medal

The University Medal recognizes an exceptional undergraduate student who has obtained first class honours supported by an outstanding academic record. Ellen completed a Bachelor of Philosophy, majoring in chemistry as well as taking an interest in maths and biology. She obtained first class honours for her dissertation: “Development and application of a high precision Ca anomaly method to trace calcium carbonate cycling in the Southern Ocean”

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**Professor Trevor Ireland**

2016 Fellow of the American Geophysical Union

Becoming an AGU Fellow is acknowledgement of the outstanding contribution made in the Earth and space sciences. Professor Ireland’s areas of expertise lies in isotopic and chemical analysis with secondary ion mass spectrometry with application to terrestrial and extraterrestrial materials. He is currently a member of two space missions to asteroids, namely JAXA’s Hayabusa II to asteroid Ryugu, and NASA’s Osiris Rex to asteroid Bennuto.