Dear Colleagues, Alumni and Friends,

Many of you will have heard of the recent Australian Human Rights Commission report on high levels of sexual harassment and sexual assault on Australian university campuses, including the ANU. The statistics indicate we are likely to have colleagues, classmates and friends at RSES, as well as past students and staff, who have suffered sexual harassment or assault in our workplace and classrooms, at our social events, and on our field trips.

Given this I want to express my deep and sincere apology to any past or current students or staff members, who have experienced sexual harassment or sexual assault during their time at RSES or the former Department of Geology.

What can and should we do?

• We need to support our colleagues, classmates, friends and students affected by sexual harassment or sexual assault, and assist them to reach out to professional support on offer; for example at the ANU, the University Counselling Services (61252442), or in the community: Canberra Rape Crisis Centre (6247 2525) or Lifeline (131114). Further advice on support can be found at http://www.anu.edu.au/news/all-news/respectful-relationships-at-anu.

• We should all be upstanders, prepared to intervene when we see unacceptable behaviour, and not be bystanders when we witness sexual harassment or assault.

The School, through the efforts of its Equity and Diversity Committee, has worked hard to improve our workplace culture, diversity, equality and inclusivity over the past two years. Our goal is make the School a safe and supportive and thereby more productive environment for everyone to study and work.

Steve Eggins

21st Century Resources Symposium

The 21st century is likely to be a challenging one. The growing population and increasing demand for technology are going to require the discovery of new resources (water, energy, minerals) and efficient and environmentally-friendly ways of utilising them.

RSES hosted a ‘Resources for the 21st Century’ symposium to examine how Earth scientists can contribute their expertise to this endeavour. The meeting brought together scientists from academia, industry and government to discuss the latest scientific advances and to forge new collaborations between the three sectors. The topics covered were wide-ranging and included the technologies that can help reduce the level of CO2 in the atmosphere, the complex dynamics of the energy market, the prospects for discovering new ore bodies underneath cover, and the remarkable role that microbes might play in extracting metals from ores.
In August 2017, Dr David Heslop, RSES’s Associate Director for Education, and Associate Professor Penny King ran the inaugural RSES Teaching Workshop. There were 13 talks from across the RSES with more than 50 participants, including lecturers from outside the school. The content of the workshop included ‘Flipped Classrooms and MOOCs,’ ‘Approaches to Teaching – Training, Laboratories and Practicals,’ ‘Field Work’ and ‘Approaches for Engaging Students’. We hope that this is the first of many such events where we can share our new approaches for improving our undergraduate program.

Celebrating Rig 1’s 50th Birthday

On 16 November 2017, RSES celebrated the 50th Birthday of Rig 1, our oldest operating high-temperature high-pressure rock deformation apparatus. This machine was developed in-house by Professor Mervyn Paterson and marked a major global advance in the ability to measure and understand the behaviour of materials at high pressure and temperature conditions. See page X for a profile of Professor Paterson and his work in rock deformation.

A number of distinguished guests from around Australia and the world visited RSES to mark the anniversary. The day started with tours of the High Pressure Rock Physics Lab, and a symposium was presented by the lab’s alumni and current users. The range of topics presented on the day was remarkable, highlighting some of Rig 1’s greatest triumphs; the broad diversity of fields it can be used to study, and the rigorous scientific training of all those who worked on it. The celebrations concluded with a dinner held at University House.

Rig 1 still achieves world-class mechanical accuracy at pressures of 3000 atmospheres and temperatures of up to 1000°C – equivalent to depths of 20 km below the Earth’s crust. Rig 1 has recently been upgraded with precision high-speed measurement technology, developed in partnership with Professor Dan Shaddock, Dr Bram Slagmolen, and PhD candidate Perry Forsyth from the Department of Quantum Physics. Our current research, led by Professor Stephen Cox and PhD candidate Kathryn Hayward, aims to unravel the secrets of earthquake initiation at realistic mid-crustal conditions. The RSES High Pressure Rock Physics Lab is the only laboratory in the Southern Hemisphere that can currently explore these high-pressure, high-temperature, fluid-saturated conditions.
RSES-Led Study Solves Mystery of How First Animals Appeared on Earth

A collaboration between the RSES and the Max Planck Institute for Biogeochemistry in Jena, Germany has examined sedimentary rocks from Central Australia to discover the secrets of the earliest animal life. ‘We crushed these rocks to powder and extracted molecules of ancient organisms from them’, said lead researcher Associate Professor Jochen Brocks. ‘These molecules tell us that it really became interesting 650 million years ago. It was a revolution of ecosystems, it was the rise of algae.’

Mark Kendrick

Dr Kendrick and his team analysed samples of volcanic glass from mid-ocean ridges and oceanic islands in the Atlantic, Pacific and Indian oceans, and showed they contained traces of seawater that had been deeply cycled through the Earth’s interior. This transfer of seawater into the deeper mantle is made possible by cold serpentinised rock in the base of subducting slabs, which bypasses volcanic arcs before complete dehydration. ‘The involvement of serpentinites is revealed by the high water and halogen contents of parts of the mantle with trace element signatures otherwise characteristic of dehydrated ocean crust,’ said Dr Kendrick. The study has been published in Nature Geoscience.

Monitoring North Korean Nuclear Tests from an Outback Shed

Some 2,200 km from Canberra and 6,600 km from Pyongyang, an ANU RSES team from the Seismology and Mathematical Geophysics Group is monitoring North Korean nuclear tests. Joel Tatapudi and Rajesh Erigela work at the Warramunga Seismic and Infrasound Station, near Tennant Creek in the central Northern Territory, under the supervision of Canberra-based Associate Professor Hrvoje Tkalcic. Tatapudi and Erigela monitor a network of seismometers and infrasound sensors, arranged in two lines each more than twenty kilometres long. In addition to their use in measuring earthquakes, the Warramunga seismometers can detect nuclear explosions from almost anywhere on the planet. This information is sent to United Nations data analysts in Vienna and helps to fulfil Australia’s obligations to the UN Comprehensive Test Ban Treaty Organisation.

Warramunga Station has detected a total of six North Korean nuclear tests. The most recent detonation, detected on 3 September 2017, had a moment magnitude of 6.3 at its impact site, equivalent to about 200 kilotons of TNT. This is approximately ten times stronger than the ‘Fat Man’ bomb dropped on Nagasaki, but much smaller than more modern US- and Russian-developed thermonuclear weapons.

Why India and China are Going to the Moon

Emeritus Fellow Dr Marc Norman and Associate Professor Penelope King of the RSES have published an article in The Conversation entitled “Five Reasons India, China and Other Nations Plan to Travel to the Moon”. This was the most-read Conversation article written by ANU academics for the month of November. It can be read here.
RSES Scientists Discover How World’s Biggest Volcanoes Formed

A study led by RSES researchers has solved the 168-year-old mystery of how the world’s largest and most active volcanoes, the islands of Hawaii, were originally formed. The study found that the volcanoes formed along twin tracks due to a shift in the Pacific Plate’s direction three million years ago. Scientists have known about the tracks since 1849, but their cause had remained a mystery until now.

‘The analysis we did on past Pacific Plate motions is the first to reveal that there was a substantial change in motion 3 million years ago,’ said lead researcher RSES PhD candidate Tim Jones. Twin volcanic tracks exist in other parts of the Pacific, including Samoa, and the study found that these also emerged three million years ago.

Co-researcher Dr Rhodri Davies said the twin volcanic tracks emerged because the mantle plume was out of alignment with the direction of the plate motion. ‘Our hypothesis predicts that the plate and the plume will realign again at some stage in the future, and the two tracks will merge to form a single track once again,’ Dr Davies said. ‘Plate shifts have been occurring constantly, but irregularly, throughout Earth’s history. Looking further back in time we find that double tracks are not unique to young Hawaiian volcanism — indeed, they coincide with other past changes in plate motion.’

The researchers used the National Computational Infrastructure at ANU to model the Pacific plate’s change in direction and formation of the twin volcanic tracks through Hawaii. Other contributing agencies included the University of Copenhagen, the Imperial College in London, and the Lamont-Doherty Earth Observatory at Columbia University in New York. The study’s results have been published in Nature.

Winds in the Eastern Antarctic Warm Up the Antarctic

Researchers from the RSES, the ARC Centre of Excellence for Climate System Science at UNSW, and the Geophysical Fluid Dynamics Laboratory in the USA have revealed that the unusually high rate of ice melt along the West Antarctic Peninsula is caused by strengthening winds on the opposite side of the continent, up to 6000 km away. Winds in East Antarctica can generate sea-level disturbances that propagate around the continent at almost 700 kilometres per hour, via a type of ocean wave known as a Kelvin wave. When these waves encounter the steep underwater topography off the West Antarctic Peninsula, they push warm water from the Antarctic Circumpolar Current towards the ice shelves along the Peninsula’s shoreline.

‘It is this combination of available warm water offshore, and a transport of this warm water onto the shelf, that has seen rapid ice shelf melt along the West Antarctic sector over the past several decades,’ said lead researcher Dr Paul Spence, from the ARC Centre. ‘We always knew warm water was finding its way into this area, but the precise mechanism has remained unclear. That remote winds on the opposite side of Antarctica can cause such a substantial subsurface warming is a worrying aspect of the circulation at the Antarctic margin.’

The changes in the East Antarctic coastal winds might also be related to climate change. As the Earth warms, the strong westerly winds associated with storms over the Southern Ocean contract toward the poles, in turn changing the winds near the Antarctic continent. The researchers used the National Computational Infrastructure at the ANU to model the impacts of these altered winds on Antarctica. They found that the winds could warm the waters at the Western Antarctic Peninsula’s ice shelves by up to 1°C. This could have significant implications for Antarctica’s ice shelves and ice sheets, with previous research showing that even small increases in ocean temperatures can substantially increase melt rates around the Peninsula. Co-author Associate Professor Andy Hogg of RSES said, ‘This research shows that we are still discovering the different mechanisms that control the rate of melting of Antarctic glaciers’. The research has been published in Nature Climate Change.

2017 Jaeger-Hales Lecture

In July 2017, we were treated to an inspiring lecture by Dr Valérie Masson-Delmotte, who was the 2017 Jaeger-Hales Lecturer. This prestigious biennial event honours the foundational contributions of Professors Jaeger and Hales.

Dr Masson-Delmotte is a senior scientist from Laboratoire des Sciences du Climat et de l’Environnement, Institut Pierre Simon Laplace. Dr Masson-Delmotte examined how ice cores provide insights into past climatic and environmental changes. Although water stable isotope ratios in ice core records have commonly been used as qualitative proxies for past changes in polar temperature and moisture source characteristics, she showed that it is a major challenge to extract quantitative signals from these records. She presented recent findings based on new capability to monitor water vapour isotopic composition in the North Atlantic / Greenland and several Antarctic regions. These new datasets challenge the classical interpretation of ice core records as just precipitation-weighted signals. Moreover, they challenge the ability of atmospheric models equipped with water stable isotopes to fully resolve the initial marine boundary layer isotopic composition spatial patterns. These are key limitations to our quantitative understanding of ice core signals.
Earth was Barren, Mountainless and Almost Entirely Under Water 4.4 Billion Years Ago

Scientists from RSES say the early Earth was likely to be barren, mountainless and almost entirely underwater with a few small islands, following their analysis of tiny 4.4 billion-year-old mineral grains.

Lead researcher Dr Antony Burnham said the team studied zircon mineral grains that were preserved in sandstone rocks in the Jack Hills of Western Australia, the oldest fragments of the Earth ever found. ‘We’ve used trace elements of zircon to build a profile of the world at that time’, said Dr Burnham. He found that the zircon was formed by the melting of older igneous rocks rather than sediments. ‘Our findings showed that it took the Earth a long time to evolve into the planet that we know today’. The study, ‘Formation of Hadean Granites by Melting of Igneous Crust’, has been published in Nature Geoscience.

We Need to Get Rid of Carbon from the Atmosphere, Not Just Reduce Emissions

Eelco Rohling, Professor of Ocean and Climate Change, recently wrote an article for The Conversation on this topic. The following text is a short extract from a complete article at this link.

Getting climate change under control is a formidable, multifaceted challenge. Staying within safe warming levels now requires removing carbon dioxide from the atmosphere, as well as reducing greenhouse gas emissions.

Humans have emitted 1,540 billion tonnes of carbon dioxide gas since the industrial revolution. To put it another way, that’s equivalent to burning enough coal to form a square tower 22 metres wide that reaches from Earth to the Moon. Half of these emissions have remained in the atmosphere, causing a rise of CO₂ levels that is at least 10 times faster than any known natural increase during Earth’s long history. Most of the other half has dissolved into the ocean, causing acidification with its own detrimental impacts. Although nature does remove CO₂, for example through growth and burial of plants and algae, we emit it at least 100 times faster than it’s eliminated. We can’t rely on natural mechanisms to handle this problem: people will need to help as well.

The technology to remove CO₂ from the atmosphere is in its infancy and will take years, more likely decades, to develop, but our analysis suggests that this must be a priority. If pushed, operational large-scale systems should be available by 2050.

Right now is the time to decide as without action, we’ll be locked into a pessimistic scenario where we need to remove almost 700 gigatonnes of carbon from the atmosphere and ocean within a decade. Nothing can justify burdening future generations with this enormous cost. For success, we need to do more than develop new technology. We also need new international legal, policy, and ethical frameworks to deal with its widespread use, including the inevitable environmental impacts. Without new legal, policy, and ethical frameworks, no significant advances will be possible, no matter how great the technological developments. Progressive nations may forge ahead toward delivering the combined package. The costs of this are high. But countries that take the lead stand to gain.

A foraminifera catching and beginning to eat a copepod - Dr. Oscar Branson

This photograph captures a life-or-death struggle between two ferocious sea-beasts, both are less than a millimetre long.
Trip to Sifnos, Greece by Jack Muston

Earlier in the year, a group of students travelled to Sifnos with Dr Marnie Forster and Professor Gordon Lister to map parts of the island and explore its formation and tectonic history.

Sifnos is a mountainous island with fertile valleys, beautiful beaches and several towns, and home to the metamorphic eclogite-blueschist terranes. Essentially, it’s a geologist’s idea of paradise!

The course gave us many valuable experiences including the responsibilities of extended fieldwork without direct supervision, and the dynamics of working in a small team. To find out more, read the full article.

Students Study Bungendore’s Groundwater

Students measure iron oxidation state in Bungendore groundwater.

In September and October, undergraduate students travelled to the town of Bungendore, south of Lake George, to study the local water table. The students measured the water table’s profile and flow direction, and chemical properties including pH, salinity, dissolved oxygen and iron oxidation state. Bungendore is a rapidly growing town which relies exclusively on groundwater from the Bungendore Alluvium for its everyday water supply. This trip helped our students appreciate the work that goes into real-world scientific data collection, the journey from research to policy, and the importance of sustainable water supplies.

The students made this trip as part of the EMSC3025 Groundwater course. It is the second time that the course has travelled to Bungendore. This course has attracted students from the Research School of Earth Sciences, the Research School of Chemistry, the Fenner School of Environment & Society, and the Research School of Engineering. The students’ final assessment asked them to compare their collected data to Bungendore’s historical record.

A Surreal Visit to the Sites of the Japanese Tsunami

This is a short extract from an article by Matthew Teh. For the full article, click here. [http://science.anu.edu.au/news-events/student-blog/surreal-visit-sites-japanese-tsunami]

On a recent trip to Japan, a group of 15 students, myself included, had the opportunity to study these geological hazards and their impacts in the very places they occur, visiting sites devastated by the 2011 earthquake and tsunami. This New Colombo Plan short course, called Understanding Geological Hazards, was organised in a partnership between the ANU Research School of Earth Sciences and the Atmosphere and Ocean Research Institute at the University of Tokyo.
Student Activities

Tracking the OSIRIS-Rex Spacecraft

On 22 September 2017, RSES students contributed to an Australia-wide effort to monitor the robotic spacecraft OSIRIS-REx. The spacecraft was directly over Australia between midnight and sunrise, using the Earth’s gravity to boost its acceleration towards the Near-Earth Asteroid (NEA) 101955 Bennu. Throughout this gravitational assist, OSIRIS-REx’s trajectory was tracked as part a campaign led by Curtin University. A team of PhD students from the Research Schools of Earth Sciences, Physics & Engineering, and Astronomy & Astrophysics observed the satellite from a dark sky site near Nimmitabel, to the southeast of Cooma.

OSIRIS-REx is a joint project of NASA, the University of Arizona, and Lockheed Martin. Its target, Bennu, is a carbonaceous and volatile-rich asteroid, which may host pristine samples of the oldest objects in the Solar System. Bennu also has an estimated 1-in-2700 chance of collision with the Earth between the years 2175 and 2196. An understanding of the asteroid’s structural integrity will be essential for developing impact mitigation strategies.

OSIRIS-REx will arrive at Bennu in August 2018, and return a sample to Earth in 2023.

Video of the night can be seen here, courtesy of Bryce Henson, a PhD candidate at the Research School of Physics & Engineering.

Professional Staff Activities

Professional Staff Development Fund

The Professional Development Fund is a newly developed RSES fund that is open for annual applications from staff for professional development.

2017 awardees:

The Electronics workshop were awarded funds to attend Xilinx FPGA Academy 1 Training in Brisbane;

Ulrike Troitzsch was awarded funds to attend the Australian X-ray analysis specialist meeting in Melbourne;

Xiaodong Zhang was awarded funds to attend the 4th Congress on Mass Spectrometry in London and to visit the noble gas laboratory at the University of Oxford; and

Xiang Zhao was awarded funds to complete training in three LabVIEW courses, both on-line and in Sydney.

2018 awardees

Brent Butler received funds towards completing a Certificate III in Electronics and Communications Engineering UEE30911.

Xiang Zhao received funds towards visiting labs at the Institute for Rock Magnetism (IRM), University of Minnesota, USA, and the Fort Hoofddijk Paleomagnetic Laboratory, Utrecht University, The Netherlands.

Work-Life Balance workshop

A staff workshop was held last August on the topic of work/life balance, where staff heard from the College HR team and their own colleagues about the options available to aid them in achieving a healthy work/life balance. The workshop was a mix of information presentation and Q&A discussion on topics such as working hours, flexible working arrangements, overtime and timekeeping.

Dr. Ulrike Troitzsch

Milky Way + Tent – Dr. Jonathan Pownall
SciScouts and Footyquakes: The Human Side of Seismology

Over the 19th and 20th of August, the weekend of National Science Week, more than twenty staff and students from RSES took part in two separate Science Week events to engage the public in the measurement of anthropogenic earthquakes.

At the SciScouts event on the Cotter River, Michelle Salmon, Sima Mousavi, Yuwei Li and Armando Arcidiaco took on the challenge of turning 1,300 6-to-18-year-old school children into earthquake ‘jumpers’. The young children displayed ample enthusiasm to create their own seismic energy, which was duly recorded by the seismologists.

In a separate event, Michelle Salmon, Herbert McQueen Julian Byrne and Malcolm Sambridge installed a seismometer under the main stand at the GIO Stadium in an effort to record the ‘footyquake’ during the Raiders v Panthers NRL game.

A marquee was set up in the west forecourt before the match, where RSES staff and students engaged with the Raiders fan base, explaining seismic waves, earthquakes and how we measure vibrations from human-induced micro seisms. Caroline Eakin was on hand to provide expert advice during Science at ANU’s Facebook Live event and see that the day was communicated more broadly through social media.

Results show that the Viking clap was clearly recorded, and the RSES team were able to watch the game from the stand while monitoring in real-time the first ever footyquakes created by the crowd when the Raiders and the Panthers crossed the line. The Raiders may have lost on points but they won the footyquake contest with more energetic signals recorded by the home team supporters. Several news and print media outlets, including the ABC and the Canberra Times, picked up on the story and featured the event over the weekend.

Art Donation Explores Connections between Geology and weaving

Internationally renowned woven textile specialist, Jennifer Robertson, collaborated with Emeritus Professor Ian Jackson at RSES to produce Crystal Imperfections as Agents of Deformation.

The work focused upon RSES pivotal research into ‘defects’ or ‘flaws’ – vacant sites and dislocation lines – running through atomic and molecular crystal lattice structures of minerals such as olivine. The weaving uses a disrupted pattern and structure to form dislocation faults, highlighted in red copper over an olivine grid structure. The art work contains key mineral fibres such as basalt, glass, stainless steel, copper and silver.

Jennifer Robertson very generously donated Crystal Imperfections as Agents of Deformation to RSES for the earth sciences community to enjoy.
Brief News

New Books

In Exploring the Earth Under the Sea, Neville Exon has brought together tall tales and true in this wonderful history of Australia and New Zealand in the Integrated Ocean Drilling Program. Visit ANU Press to obtain this book.

Deep Crustal Seismic Reflection Profiling by Brian Kennett presents the full suite of reflection profiles carried out in Australia by Geoscience Australia and various partners. Visit ANU Press for a copy of this book.

In Eelco Rohling’s book, The Oceans: A Deep History, he traces the 4.4 billion-year history of Earth’s oceans while also shedding light on the critical role they play in our planet’s climate system. The book will be available in early 2018 at Princeton University Press.

High School Student and RSES Staff Search for Micrometeorites on the Jaeger 8 Roof

Larissa Liow, a Year 10 student at Daramalan College, has earned a Gold award in the CSIRO CREST program and a Highly Commended grade in the Earth and Space section of the Science Educators’ Association of the ACT (SEA*ACT) Science and Engineering Fair, mentored by RSES staff Professor Trevor Ireland, Dr Penelope King, Dr Janaina Avila and Mr Shane Paxton. Ms Liow’s project involved looking for micrometeorites in the stormwater run-off from the RSES roof. It likely represented the first search of its kind in the Southern Hemisphere.

Ms Liow filtered sand-sized insoluble particles from the run-off of Jaeger 8’s roof, separated the particles by density and magnetism, and examined the particles under a scanning electron microscope with energy-dispersive X-ray spectroscopy capabilities. While none of the particles that Ms Liow found had the nickel-rich composition which indicates a meteoric origin, the European Space Agency’s Stardust project only found 500 micrometeorites from 300kg of sediment, a ratio of about 100 parts per billion; the sample size of Ms Liow’s project was substantially smaller.

Colin Price, a science teacher at Daramalan College, has used CSIRO CREST to develop his school’s science program. Last year, RSES’s Dr Paul Tregoning mentored two of Mr. Price’s students, Terence Johnson and Lachlan Wilson, whose project examining polar ice loss and sea level rise won 3rd place in the Engineering division of the BHP Billiton Science and Engineering Awards.

Data Science Events: Data Surgery Sessions

RSES Data Surgery sessions are discussion groups/tutorials aimed at helping higher degree research students and staff to solve Earth science problems with data science tools. The group meets every two weeks, and aims to encourage the open discussion of the theory and practice of data processing and analysis. More information is available on the RSES Data Science website and the notebooks of the sessions are available on the RSES Data Science Github repository.
Warramunga Station Fire

Fires ravaged the area near RSES’s Warramunga research facility in the Northern Territory earlier this year. However, all critical fixed infrastructure and people were safe, thanks to the efforts of staff members Rajesh Erigela and Joel Tatapudi in maintaining fire breaks and thinking quickly during the fires.

Staff Focus

Professor Mervyn Paterson: Father of Rock Deformation Research

Many of us have seen Professor Mervyn Paterson, now aged 92, at tea or around the School – but who was he, and what did he do that was so significant? Mervyn Paterson was born into a farming family in South Australia in 1925 and attended Adelaide Technical High School. In 1943 he completed his undergraduate studies in metallurgy at the University of Adelaide. Mervyn began his career at the CSIR Division of Aeronautics working on the physics of metal fatigue, a position that would today be called a ‘materials scientist’. He received a PhD from the University of Cambridge in the UK on the x-ray diffraction effects of deformation in metals, and pursued postdoctoral studies in Chicago in the USA.

In 1951, Mervyn returned to Australia to work at the CSIRO. He was soon approached by Professor John Jaeger, and was appointed to the Department of Geophysics at the ANU in 1953 to pursue research in the field of rock deformation. Mervyn remained as a researcher at the Department of Geophysics, and its successor the Research School of Earth Sciences, until his retirement in 1990. During this time, he developed the instruments that we have today in the High Pressure Rock Physics Lab and undertook seminal research into the strength and behaviour of many crustal and upper mantle materials, including work on quartz, calcite and olivine.

Following his ‘retirement’, Mervyn proceeded to have a second career as the chairman of Paterson Instruments Pty Ltd, a company which oversaw the development of all the ‘commercial’ Paterson apparatuses that are the pride of many rock deformation labs around the world. Not one to take retirement too easily, Mervyn published his latest book at the age of 88, titled Materials Science for Structural Geology.

While the design of Paterson’s rock deformation machines is seemingly simple, the devil is in the details, and Paterson Instruments machines remain the only gas-medium apparatuses that can operate in such a high temperature and pressure range. Paterson’s oldest apparatus, Rig 1, is located in the RSES High Pressure Rock Physics Lab, and has recently celebrated its 50th year of almost-continuous operation.

RSES Social Media, Twitter and OnCirculation

Twitter: https://twitter.com/anuearthscience
Instagram: https://www.instagram.com/anuearthsciences/
Facebook: https://www.facebook.com/anuearthsciences/
Blog: https://oncirculation.com
Welcome to Associate Professors Leanne Armand & Meghan Miller

A/Prof Leanne Armand was recently hired as the ANZIC (Australian and New Zealand International Ocean Discovery Program Consortium) Program Scientist and an ANU RSES researcher. She has a strong interest in the distribution of diatom species related to the physical oceanic environment, and the subsequent preservation of this environmental relationship in the fossil record. She uses the records of fossil diatoms in deep sea cores between Australia and Antarctica to estimate past climatic conditions, such as sea ice extent and sea surface temperatures over the last glacial cycles. She leads the Collaborative Australian Postgraduate Sea Training Alliance Network (CAPSTAN) voyage that involves students and early career researchers from around Australia in two weeks of intensive at sea training on board the Marine National Facility, RV Investigator.

Meghan S Miller is a structural seismologist with research focus involving the interactions between upper mantle convection and tectonics, in particular the role of subduction and continental dynamics. She studies mantle dynamics using field-based broadband seismological data in a range of locations, including plate boundary systems of the Caribbean, Mediterranean, North America, and the western Pacific. Most recently she is focusing on imaging the structure of the crust and upper mantle in the Banda Arc funded by the National Science Foundation in Southeast Asia and is aiding in establishing earthquake monitoring in Timor-Leste through the Geoscientists Without Borders program.

RSES Postdoc Dr Bishakhdatta Gayen Awarded RJL Hawke Fellowship

RSES post-doctoral student Dr Bishakhdatta Gayen has been awarded the Australian Antarctic Science Program’s RJL Hawke post-doctoral fellowship. This prestigious role will support Dr Gayen over the next two years. His research will study subsurface melting of ice shelves around Antarctic, and its implications for future global sea level rise.

The Antarctic Ice Sheet is losing ice at an increasing rate, predominantly due to ocean-driven melting beneath ice shelves. Field data from underneath ice shelves is limited, measurements under relevant conditions are difficult in the laboratory, and computer models rely on uncertain coefficients and assumptions about the dominant mechanisms. Dr Gayen will use the Hawke Fellowship to undertake cutting-edge numerical simulations to examine the complex dynamics of melting of ice-shelves in the presence of convection and turbulence. The project will improve the representation of these processes in future global ocean models.
Fond Farewells (Departing Staff and Students)

Academic Staff Departures

Harri Kokkonen, Maree Coldrick, Linda McMorrow, Les Kinsley, Robyn Petch and Heather Scott-Gagan. Also, Hongtao Gao, Mary Hapel, Joan Cowley, Qi Li, Abhinav Purelli (not pictured).

Postdoctoral Fellow or Teaching Professional Departure

Mike Gagan.

Achraf Koulali, Sebastien Allgeyer, Brendan Hanger, Seongryong Kim and Pengxiang Hu.

Taken up Honorary Positions

Richard Armstrong, Mark Fanning, Ross Kerr and Robert Rapp (not pictured).

New Emeritus Professors

Neville Exon, Masahiko Honda, and Ian Williams.

Professional Staff Departures

Professional Staff who have Moved Elsewhere on Campus

Mary Anne King, Joy McDermid.

D C ‘Bear’ McPhail passed away from a heart attack while travelling with his wife Maria in Canada in March 2017. His sudden death was a shock to many. At the time, Bear was an Emeritus Fellow at the RSES, having retired in July 2015 from his position as Reader (Associate Professor) in Geology.

Bear grew up in Canada and attended Vernon Senior Secondary school in British Columbia from 1971-1972. He was not fond of his first name and preferred to be called Bear, also having many ‘bear-like’ attributes of which he was shyly proud. Bear graduated with a BSc(Hons) in Geology from the University of British Columbia (UBC) in 1980, followed by an MSc in Metamorphic Petrology from UBC in 1985 and PhD from Princeton University in 1991. His PhD thesis was on hydrothermal geochemistry.

In 1991 Bear moved to Australia to take up a post-doctoral position at Monash University and in 1994 he was appointed Lecturer and later Senior Lecturer, specialising in hydrothermal ore deposits and environmental geochemistry. Bear moved to Canberra in 2002 joining the Geology Department (later Department of Earth and Marine Sciences) at the ANU as a Reader, teaching and researching in hydrogeochemistry, regolith science and environmental chemistry. For a period he was Head of Department. From 2002 until 2008, Bear was also a Key Researcher in the Cooperative Research Centre for Landscape, Environments and Mineral Exploration (CRC-LEME2), specialising in low temperature hydrogeochemistry. He worked on a number of projects with both environmental and minerals industry application, including early studies on the use of groundwater geochemistry for mineral exploration. During this period he also served on the Executive of the CRC.

Bear was an engaging and effective undergraduate teacher and supervised numerous honours and postgraduate students throughout his career. He worked on a wide range of research topics with his students, increasing their understanding of mineral stability fields, low temperature ore deposit formation, hydrogeochemistry of the regolith, and microbiological processes including gold-fixing bacteria. From 2003 to 2014 Bear helped develop and deliver the Regolith Geoscience and Mineral Exploration course for national honours students within the Minerals Technology Education Council (MTEC, a division of the Minerals Council of Australia). This course was instrumental in passing on new knowledge of regolith science to the next generation of geologists and mineral explorers.

Bear was passionate about ice hockey and helped raise the profile of his favourite sport in the ACT and Australia. From 2004 he was a volunteer coach and supporter for the junior hockey team in the ACT and in 2012 coached the Canberra Knights, league team. During 2011-2012 he served as president of Ice Hockey ACT and he also helped establish the national Ice Hockey Australia organisation. Most recently he was head coach of the ACT women’s team, the Canberra Pirates.

Bear had a cheerful, affable disposition, was always helpful and a great mentor to his students, colleagues and friends. He will be sadly missed, but fondly remembered. He is survived by his wife, Maria, three sons Shaun, Chris and Joey and daughter Christina.

Ken McQueen
Professor Kenton S W Campbell

It is with great sadness the School remembers Professor Kenton S W Campbell (Ken) who died on 17 June 2017 following a stroke.

Although Ken retired from the ANU some 25 years ago he remained active as an ANU Emeritus Professor, initially in the Geology Department and then the Research School of Earth Sciences, where he continued his research on Palaeozoic fishes.

Ken had been a student of Professor Dorothy Hill at the University of Queensland prior to commencing his academic career at the University of New England. He was appointed to the ANU by Professor David Brown, the Foundation Professor of Geology. Ken was one of the Department of Geology’s first members of staff, along with the late Professor Bruce Chappell. Ken rose through the ranks to become Head of Department, and was also Dean of the Faculty of Science for a period.

Ken was also a foundation member of the Australasian Palaeontological Association and a founding member of the journal Alcheringa, the Australasian Journal of Palaeontology.

Ken was elected to the Academy of Science in 1983 for his distinguished research in the fields of vertebrate palaeontology, early evolution and Palaeozoic stratigraphy. While his research interests were broad, his particular passion was for Palaeozoic fossil fishes, several of which were named in his honour, including Kenichthys campbelli from China. He received many prestigious awards and prizes for his work including the Academy’s Mawson Medal and Lecture in 1986, the Geological Society of Australia WR Browne Medal in 2006 and the Royal Society of NSW Clarke Medal in 2010. In 2013 he was the first Australian working in Australia to receive the prestigious RC Moore medal for Excellence in Palaeontology from the US Society for Sedimentary Geology.

Ken gained a reputation for being a dedicated teacher. Many alumni have acknowledged Ken’s influence on their careers, particularly through geological mapping, which he insisted was fundamental to becoming a ‘well rounded’ geologist. Ken had a long-term productive collaboration with zoologist Dr Dick Barwick, who joined Ken at the Geology Department in retirement. They formed a perfect match in their studies of fossil lungfish and produced numerous papers on material from the Gogo Formation in Western Australia, and closer to home from near Burrinjuck. This work placed both two locations on the international stage for fish evolution and morphology. Their more recent association with Professor Tim Sendon from the Research School of Physics & Engineering has provided new insights into cranial morphologies of lungfish through the use of 3D X-ray imaging produced in Tim’s laboratory.

Throughout his career, Ken insisted on the vital importance of knowing the biology of organisms in order to understand the form and function of fossils, and the use of sediments in which the fossils were found to provide clues as to the palaeoecology of the organisms. More recently, Ken became interested in the role of gene regulation and the evolution of organisms in response to Palaeozoic environmental changes. He was never short of ideas.

Ken will be remembered for being a dedicated teacher and outstanding researcher. Each year the Research School of Earth Sciences, adopting the tradition commenced in the Geology Department, awards the ‘Ken Campbell Teaching Award’ to the person who has made the outstanding contribution to teaching.

Our deepest condolences go to Professor Campbell’s family and friends.
DA Brown Award to Tony Kemp

The DA Brown Medal was awarded to Dr Tony Kemp, UWA, in recognition for being an ANU graduate who has made a distinguished contribution to geological research, teaching, administration or exploration. Tony gave a lecture on ‘Crumbs! … of the Earth’s Oldest Crust’.

Dr Kemp seeks to unravel the generation of the continental crust and the evolution of the crust-mantle system through a combination of detailed field studies, trace element geochemistry, and stable and radiogenic isotope tracing.

The medal and lecture are named in honour of Professor David Brown, who was appointed the Foundation Professor of Geology at ANU in 1958. Professor Brown is known for his work on Polyzoa (Bryozoa) and for his significant research on the biogeographic distribution of Late Palaeozoic and Triassic Labyrinthodonts (Amphibia). He co-authored the textbook Australian and New Zealand Geology and developed an English-Russian geological dictionary.

Professor Brown’s motto was ‘lead from the front’ and he designed undergraduate courses focussed on fieldwork, which he felt was integral to undergraduate study. He attended many field camps himself, often accompanied by his wife and children.

RSES Alumni
Suzy Urbaniak

Suzy Urbaniak, BSc Geol (Hons) ’87, won awards for geology as an undergraduate, worked as a geologist for Newcrest Mining for almost a decade, and won the 2016 Prime Minister’s Prize for Excellence in Science Teaching in Secondary Schools.

Suzy is passionate about taking her students out of the classroom and is surprised how little teaching styles have changed over the years. Her philosophy of teaching is all about having young scientists in the classroom, doing hands-on investigations, in a real context,

in a real world application, so students in high school can actually learn the science to explain the phenomena that is around them.

Suzy has taken students on about 50 field trips, from Shark Bay to Esperance and other places in Western Australia, and then interstate and internationally, to Hawaii and Norway and Iceland. She says that students need to understand how they can transfer their skills and understanding across boundaries and that hands-on exercises provide that opportunity.
RSES Alumni – Jenna Roberts

Jenna Roberts completed an honours year at the Research School of Earth Sciences (RSES) in planetary geochemistry in 2007. One of her favourite memories is walking across the lush green ANU campus on a sunny day from the research school to her lab on Daley Road, marvelling at the fact that she had a piece of the Moon in her handbag.

After obtaining first-class honours, she worked as a graduate scientist at Geoscience Australia, before receiving the inaugural Aspi Baria PhD Scholarship from ICON Water.

Jenna returned to the ANU, and to RSES, to commence a joint PhD project with CSIRO Land and Water in environmental chemistry and ecotoxicology. Her field-based research focussed on the presence and behaviour of endocrine disrupting chemicals, pharmaceuticals and personal care products in Australia’s largest inland sewage treatment plant and its effluent-receiving environment in Canberra, and impacts on fish and invertebrates.

Jenna split her time between RSES and the CSIRO labs in Adelaide and was awarded her PhD in 2015. She was the recipient of the RSES Robert Hill Memorial Award for excellence in doctoral research and the ability to communicate science research to the community.

She is now a senior policy officer in the Department of Agriculture and Water Resources, working in an area that deals with policy and regulation of agricultural chemicals and veterinary medicines. She specialises in providing scientific advice to inform policies that have tangible impacts on agricultural productivity, particularly the relationship between international chemical regulation and Australian trade.

Outside of work and studies, Jenna is also keen on performing arts, having appeared in a number of theatre, film and art projects including renditions of Chicago and A Midsummer Night’s Dream (where she won Canberra Area Theatre awards for her roles), as well as Legally Blonde - the Musical.
Dr Rhodri Davies was awarded the Anton Hales Medal of the Australian Academy of Science for outstanding contributions to understanding solid Earth structure and evolution through the development and implementation of powerful computational tools for simulating geodynamical processes.

Emeritus Professor Ross Griffiths FAA was awarded the 2017 Jaeger Medal by the Australian Academy of Science. This prestigious award recognises Emeritus Professor Griffiths’ life-long achievement and the outstanding contribution he has made to the advancement of science. In particular his influential research in fluid dynamics in geophysics.

Emeritus Brian Kennett was awarded the AGU Inge Lehmann Medal for 2017. This medal is given out annually in recognition of “outstanding contributions to the understanding of the structure, composition, and dynamics of the Earth’s mantle and core.” Brian is only the second recipient outside the US to receive this prestigious medal, and the first who has not held a US Faculty position. Brian’s award follows Shun Karato, an RSES alumni, receiving the medal last year!

Professor Eelco Rohling was made a fellow of the AGU for original contributions to sea level reconstruction and for fundamental insights into understanding anoxic sediment formation.

Professor Joerg Hermann, now at the University of Bern, has been awarded the Dana Medal for 2018 by the Mineralogical Society of America which recognises sustained, outstanding scientific achievements through original research in the mineralogical sciences by an individual in the midst of his or her career.