

Australia and New Zealand  
IODP Consortium

2020

ANNUAL REPORT



Australian and New Zealand  
IODP Consortium

Exploring the Earth under the Sea

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Publication stats: Ginny Lowe, *JOIDES Resolution* Science Support Office - Publication Services.

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# ANZIC LEADERSHIP

ANZIC Governing Council Chairperson - Dr Ian Poiner

ANZIC Program Scientist - Professor Leanne Armand

New Zealand Lead Representative - Dr Stuart Henrys

Lead CI - Professor Richard Arculus

Science Committee Chairperson - Dr Joanna Parr

Science Committee Co-chair - Dr Luke Nothdruff

Host Organisation Representative - Professor Steve Eggins (Jan- Nov)  
Professor Dorrit Jacobs (Nov -)

Office Administrator – Kelly Kenney

Communications Officer – Larisa Medenis

Cover photos:

The iconic Sydney Opera House provides a beautiful backdrop for the drilling vessel *JOIDES Resolution*, flagship of the IODP. (Credit: Ian Edwards)

EXP 378: Simon George, Chris Hollis and Claire Concannon (Credit: IODP)

The *JOIDES Resolution* at the dock in Lautoka, Fiji. (Credit: Simon George & IODP),

# Chairman's Overview

With about 60% of Australia's and 95% of New Zealand's territory offshore, our two nations' vast oceans are central to the heritage, heart and economic future of our countries. Despite their importance, much of our ocean territories remains unexplored and poorly understood. A challenge for the 21st century is to manage our oceans sustainably in a rapidly changing climate so we can continue to enjoy the economic, environmental, social and cultural benefits they provide for generations to come. As such, our countries share common marine science needs that recognise the value of international collaborative ocean science to both nations and participation in the International Ocean Drilling Program (IODP) is a wonderful example. The IODP is an international marine research collaboration that explores Earth's history and dynamics by examining seafloor sediments and rocks and by monitoring subseafloor environments focused on providing essential knowledge of climate change, deep life, planetary dynamics, and geohazards.

Dr. Ian Poiner was appointed as the Chair of the ANZIC Governing Council in 2013.

Following a successful research career at CSIRO (1985-2004), Dr. Poiner served as the Chief Executive Officer of the Australian Institute of Marine Science from 2004 to 2011. He was a member of the International Scientific Steering Committee of the Census of Marine Life from 2002 and its chair from 2007 to 2013. From 2012 to 2016, he was the Chair of the Gladstone Healthy Harbour Partnership Science Panel. Ian is also the Chairperson of the Great Barrier Reef Marine Park Authority, the Chair of the CSIRO Oceans and Atmosphere Advisory Committee, Patron of the Australian Marine Science Association and a member of the Board of the Australian Maritime Safety Authority. His recent roles include: Chair of Australia's Integrated Marine Observing System; Marine National Facility Steering Committee; and the Reef and Rainforest Research Centre.



Scientific ocean drilling through the IODP is a continuation of the world's longest-running and most successful international geosciences research collaboration. The IODP operates deep-sea drilling vessels to collect continuous core samples of sediments and rocks from below the sea and this is the seventh year of the current IODP Program that is guided by a decadal science plan (2013-23) – Illuminating Earth's Past, Present and Future.

The extreme events of the 2020 austral summer emphasized the impact of climate change on our world. Australia and New Zealand face significant environmental and economic impacts from climate change and other pressures across several sectors including coasts and oceans. This highlights the ongoing need for and value of marine science to Australia, New Zealand and the world. Marine science provides an understanding of how Earth systems work and essential knowledge of ocean systems and resources, essential knowledge that underpins decisions by government, industry and society generally. 2020 was a challenging year for all. The January Canberra hailstorm impacted our ANZIC office operations at ANU and shortly after, the first confirmed cases of COVID-19 were reported in Australia and New Zealand. As the pandemic developed Australia and New Zealand closed their borders in March 2020, heralding a tough year for ANZIC operations. Despite these challenges I am proud of our staff's commitment to navigating this unique period in our history while continuing to successfully deliver outcomes for ANZIC and IODP by working with members and our stakeholders. ANZIC's success is a tribute to the commitment of our 20 member universities and research organisations and their international counterparts with excellent leadership and support from the Governing Council and Program Office team led by our Program Scientist, Dr. Leanne Armand.

ANZIC is one of the IODP's 23 international partners and is a 0.5 associate member of the US/European Consortium via a MOU with the United States National Science Foundation. Australia and New Zealand's contributions to the IODP through ANZIC are significant. Despite the challenge of COVID, ANZIC scientists participated in one international

expedition, but unfortunately, the other planned expeditions for 2020 were postponed. Several new ANZIC led pre-proposals in our region were submitted during the year, and others acquired new site survey data with the aim of submitting mature proposals in the near future. Studies of legacy scientific ocean drilling material and/or data were maintained and ANZIC authors continued to be very active. They are represented in 11.8% of all the IODP publications over the life of the IODP, for a very small contribution to operational costs.

A highlight of the year was the role ANZIC played in the development of the new IODP Science Strategic Framework (2024-2050), released in October 2020. Following on from our very successful Ocean Planet Workshop in April 2019, eight ANZIC members were invited to be part of the Framework's writing team. The new Strategic Framework's mission and vision will guide the IODP and ANZIC activities beyond 2023. Of note was the inclusion in the framework of the ANZIC promoted 'ocean health through time' theme under one of the new Flagship Initiatives.

With the current IODP decadal science plan ending in 2023 and with ANZIC's current funding ending in 2020, a key focus for us for the year was on the future of ANZIC and the IODP. Our proposal to the Australian Research Council's (ARC) Linkage Infrastructure, Equipment and Facilities (LIEF) scheme in 2020 was successful and this will enable us to maintain our IODP membership for an additional two years. The proposal was led by Prof. Eelco Rohling and congratulations to all involved. Unfortunately, our submission to the Department of Education and Training for continued support beyond 2020 under the National Collaborative Research Infrastructure Strategy (NCRIS) scheme was unsuccessful.

ANZIC continues to be supported by an outstanding Program Office team. My gratitude and appreciation to Assoc. Prof. Armand, Science Committee Chair Dr. Joanna Parr, ANZIC Administrator Ms. Kelly Kenney and our Communication Officer Ms. Larisa Medenis for their significant ongoing contributions to ANZIC. Maintaining efficient and effective ANZIC operations despite the challenges

of COVID highlighted the value of our Program Office team. ANZIC continues to benefit from the strong support of our host organization, the Research School of Earth Sciences, The Australian National University. Thank you to Prof. Stephen Eggins for his support over many years as the ANU Host representative as Director of the Research School of Earth Sciences and welcomed Prof. Dorrit Jacobs as his replacement as she took up the Director role in September 2020.

Looking to the future, a key focus of the Governing Council will be to continue to work with our member universities and research organisations and the broader Australian and New Zealand earth science communities to ensure the continued support of the Australian and New Zealand governments beyond 2022. ANZIC is an essential part of Australia's and New Zealand's research portfolios as the IODP attracts the best and brightest talent and the collaboration of Australia and New Zealand in ANZIC demonstrates we can be successful in bringing this talent to Australasia. In 2021, we will engage in the National Research Infrastructure Roadmap process with the goal of participation in the 2022 Investment Plan and future support as part of NCRIS.

ANZIC is committed to being a high-performing and responsive organisation. An organisation that nurtures diversity, equity, and inclusion in the workplace and the development of early and mid-career scientists. ANZIC will continue to support programs or initiatives that will foster diversity and the development of the skills and experience of the future leaders of ANZIC.

I am inspired by the work and commitment of the Program Office team, the many scientists from our 20 member organizations who participate in ANZIC and the IODP Committees and most importantly, the many scientists who participated in the IODP research. Together, they are ensuring Australia and New Zealand's continued success in the IODP. I look forward to working with the Governing Council and the Program Office team to ensure the ongoing success of ANZIC.

**Dr Ian Poiner**  
ANZIC Governing Council Chair

# Program Scientist's Summary

The Australian and New Zealand International Ocean Discovery Program Consortium (ANZIC) is a partnership between 16 universities (13 Aust., 3 NZ) and four government agencies (2 Aust., 2 NZ). Our activities are steered by the ANZIC Governing Council and the ANZIC Science Committee, whilst the ANZIC Program Office, hosted at the Research School of Earth Sciences at the Australian National University, manages activities under the leadership of the ANZIC Program Scientist. Membership of the consortium enables participation in the International Ocean Discovery Program, which undertakes scientific ocean drilling across the Earth's oceans. Ocean drilling addresses scientific problems of global interest by taking continuous cores of rocks and sediments that address four broad themes: deep life, planetary dynamics, climate and geohazards. Two large coring vessels, *JOIDES Resolution* and *Chikyu*, and alternative mission-specific ship-based coring-platforms, are used and our participation on these two month-long expeditions provides international training and research opportunities to the Australian and New Zealand research communities.

Associate Professor Leanne Armand is a marine scientist and an expert in the identification of diatoms in the Southern Ocean. She is known for her contributions to the understanding of past Southern Ocean dynamics and sea ice as a result of her knowledge of diatom distributions and ecology.

Leanne is a researcher at the Research School of Earth Sciences, ANU and joined ANZIC as the Program Scientist in September 2017. Prior to her current appointment, Leanne was a member of the Dept of Biological Sciences at Macquarie University (2009-2017).



2020 was an unusual year for ANZIC as we pivoted our activities and efforts around bushfires, hailstorms and the pandemic, each event leaving its mark on our operations and engagement nationally and internationally. Despite the challenges, we did have ANZIC scientists participate in an IODP expedition 378 in the southwest Pacific region in 2020, while other planned expeditions, including 387, 388 and 390, in which ANZIC scientists had been selected to participate, were postponed as the pandemic took hold. Focusing on the sole successful expedition, Exp 378 South Pacific Paleogene Climate, this expedition sailed out on the 3rd of January from Lautoka, Fiji, and returned to port on the 6th of February in Papeete, Tahiti. Onboard, ANZIC had two scientists, Prof. Simon George (Macquarie University) as a member of the sedimentology team and Dr. Chris Hollis (GNS-Science) as the specialist radiolarian micropaleontologist. In addition, a New Zealand-based Outreach Officer, Ms Claire Concannon from Otago Museum, was also onboard. The preliminary report outlines the results of the expedition; "Expedition 378 recovered the first continuously cored, multiple-hole Paleogene sedimentary section from the southern Campbell Plateau at Site U1553. This high-southern latitude site builds on the legacy of Deep Sea Drilling Project (DSDP) Site 277, a single, partially spot-cored hole, providing a unique opportunity to refine and augment existing reconstructions of the past ~66 My of climate history. This also included the discovery of a new siliciclastic unit that had never been drilled before." (Thomas, Rohl, Childress & Exp 378 Scientists, Apr. 2020, doi:10.14379/iodp.pr.378.2020)

ANZIC's national activities were heavily focused on the delivery of Australian and New Zealand-focused science expertise, questions and future scientific drilling research aims encapsulated through the Ocean Planet Decadal Science Plan report. The report forms part of the future international Science Strategic Plan beyond 2023 and can be downloaded from: doi:10.25911/5e1c39629af61.

As a result of ANZIC's enthusiastic decadal report, eight ANZIC members were selected to be included on the writing team and working group for the development of the future IODP Science Strategic Framework. ANZIC's major thematic contribution to the strategic science plan was centred on the inclusion of our Ocean Health through Time theme

under one of the new Flagship Initiatives of the Framework. The ANZIC Science Committee, members of the Governing Council and the ANZIC community also provided significant feedback to the two international community input requests as the Framework was developed and finalised. The document was completed and released in October 2020. The new Strategic Framework's Mission and Vision are detailed below:

- Two large coring vessels, the *JOIDES Resolution* and the *Chikyu*, and alternative mission-specific ship-based coring platforms are used and our shipboard participation on two month-long expeditions provides international training and research opportunities to the Australian and New Zealand research community. MISSION: The 2050 Science Framework for Scientific Ocean Drilling guides multidisciplinary subseafloor research into the interconnected processes that characterize the complex Earth system and shape our planet's future.

- VISION: To be globally recognized as the source of authoritative information about ocean and Earth system history and its links to society. The 2050 Framework guides scientists on important research frontiers that scientific ocean drilling should pursue, as outlined by seven Strategic Objectives, five Flagship Initiatives and a backbone of Enabling Elements to advance the aims of scientific ocean drilling. Three versions of the framework have been produced to suit various audiences, including a 2-page general summary flyer, a 12-page general summary brochure and the complete 126-page Science Framework. All are available for download directly from the IODP: <http://www.iodp.org/2050-science-framework>

In July 2020, ANZIC sought applications for analytical funding from our Australian and New Zealand members to support studies of legacy scientific ocean drilling material and/or data. We had a record high of 32 applications, double our normal number of applications, seeking total support of just over \$583,000. Submissions were received from 28 Australian and four New Zealand applicant teams across 13 ANZIC member institutions. 43% of all applications were led by women Chief Investigators. In total, a maximum of 14 out of 28 Australian applications were successful and an additional three out of four New Zealand applications were

also successful, representing consortium support of just under A\$250K and NZ\$40K, respectively.

ANZIC's future remains tied to the outcome of government funding. Having applied for NCRIS 2020 funding, ANZIC was advised by the Dept. of Education, Skills and Employment (DESE) in October that our bid was unsuccessful due to the Australian Government's focus on completing the 2016 Roadmap priorities that remained outstanding. DESE, nonetheless, has encouraged ANZIC to participate in the future 2021 National Research Infrastructure Roadmap process and the subsequent 2022 Investment Plan, from which our future support through NCRIS can be assessed in the future.

Fortunately, ANZIC's additional funding request to the Australian Research Council LIEF scheme, led through RSES by Prof. Eelco Rohling was successful. It was announced by the Hon. Minister Dan Tehan on December 3, 2020, that ANZIC's proposal received \$3M over 18 months. The next stage of ANZIC's subscription to the IODP should commence in the second half of 2021 and enables us to maintain our IODP subscription for an additional two years.

ANZIC also submitted a request to AuScope under their Opportunity Fund for a two year pilot Land-2-Sea proposal that involves the International Continental Drilling Program (ICDP) and drilling with a New Zealand-led international consortium in the Antarctic. Due to COVID-impacts on our proposal implementation timeline under this proposal, AuScope has asked us to resubmit this very interesting proposal in the 2021 round.

Locally, the ANZIC Office was located off campus for seven months in 2020. However, we are now all back on board and look forward to seeing ANU and other ANZIC members pass through from time to time. We also said farewell to Prof. Richard Arculus as the ANU representative after decades of service to the running and enthusiasm behind holding the ANZIC Office here at RSES. We also said farewell to Prof. Stephen Eggins as the ANU Host representative and welcomed Prof. Dorrit Jacobs as his replacement as she took up the role of RSES School Director in September 2020.

**Assoc. Prof. Leanne Armand**  
ANZIC Program Scientist

# New Zealand IODP Report

Te Riu-a-Māui / Zealandia is Earth's eighth continent. It forms the surface landscape and continental shelf areas extending over nearly 5 million square kilometres of the South Pacific and the Southern Ocean. Scientific ocean drilling research has a crucial role in determining how successfully New Zealand manages Te Riu-a-Māui / Zealandia by understanding global-scale environmental change, variability and impacts; improving predictive capability for hazards and disasters; identifying new sustainable resources, and developing transformational new technologies.

Stuart Henrys is a Principal Scientist and Research Leader of Land and Marine Geosciences at GNS Science, based in Wellington, New Zealand. GNS Science is a New Zealand Government Crown owned Institute that undertakes earth science research in New Zealand and the Ross Sea, Antarctica. Stuart Henrys has led the New Zealand consortium of institutions that comprise the IODP membership since 2015.

Prior to his leadership role, Stuart served on the ANZIC Science Committee 2008-2011 and was a representative on the IODP Site Survey Panel from 2009-2011.



New Zealand benefits greatly from the economies of scale of the pooled international resources of the IODP, enabling access to world-class facilities. New Zealand's investment since 2008 has leveraged over US\$80M of international funding for drilling expeditions connecting GNS Science, the National Institute of Water and Atmospheric Research (NIWA), the University of Auckland, Victoria University of Wellington, and the University of Otago in complementary science projects. In recognition of the value that international collaboration brings to scientific drilling challenges, the Ministry of Business, Innovation, and Employment (MBIE) this year granted additional support for the next phase of our membership in the IODP and the International Continental Drilling Programme (ICDP).

Participation in the IODP expeditions in 2020 was affected by the global COVID-19 pandemic. However, the IODP was fortunate enough to be able to schedule one leg at the beginning of 2020. Expedition 378: South Pacific Paleogene climate took place between January 3 and February 4. ANZIC participants included Chris Hollis (micropaleontologist, GNS Science) and Claire Concannon (outreach officer, Otago Museum), as well as Simon George (Macquarie University). The expedition was widely publicized on social media channels and blogs. Audiences were also engaged through multiple ship-to-shore events. Claire also produced a podcast series on the voyage, which was broadcast on a Dunedin radio station.

Rupert Sutherland (VUW, Expedition 371 co-chief), Wanda Stratford, and Hugh Morgans (both GNS Science) attended the Expedition 371 field trip and post-cruise meeting, 9-14 February, Victoria University of Wellington, Wellington, New Zealand. The three-day field trip prior to the main workshop was based in the Wairarapa region and included outcrop sites selected as being contemporary with or analogous to the sediments cored on the Tasman Sea 371 voyage. The fieldtrip was hosted by GNS

Science and led by Kyle Bland and Hugh Morgans. All participants presented scientific results from the cruise encompassing the two main topics addressed by the voyage; subduction initiation and Paleogene paleoclimate. The new cores were collected on the Expedition 371 voyage, which also provided knowledge beyond the original scope of the project and research outcomes on New Caledonian tectonics and Neogene climate were also presented at the workshop.

In 2020, several new IODP pre-proposals within New Zealand's EEZ and the Southern Ocean were submitted, and others acquired new site survey data, with the aim of submitting Full Proposals in 2021 and 2022. Fabio Caratori Tontini (GNS Science) and the research team held a workshop and developed a pre-proposal targeting the Kermadec Arc: "from arc splitting to oceanic spreading: testing models of back-arc basin formation". Rob McKay (VUW) and the team submitted a new Ross Sea pre-proposal "tracing Antarctic cryosphere origins to climate and tectonics". Aaron Micallef (GEOMAR), Joshu Mountjoy (NIWA) and collaborators submitted a pre-proposal: "Canterbury Bight offshore freshened groundwater".

Furthermore, Ingo Pecher (UoA) successfully completed a 23-day site survey voyage of the R/V Tangaroa during June/July 2020. These data are in support of the proposal "accumulation and release of carbon dioxide from geologic sources in the South Pacific: Chatham Rise, New Zealand" (led by Lowell Stott, USC).

NZ-IODP research was represented at the Geosciences Society of New Zealand conference held at Canterbury University, Christchurch, (November 22-25). Stuart Henrys and Marianna Terezow (both GNS Science) presented the IODP 2050 Science Framework, highlighting the fresh approach these global strategies bring to earth science in Aotearoa New Zealand. The many benefits of an IODP membership were showcased at the booth, resulting in several conversations

with early career researchers and students interested in getting involved in ANZIC.

Fabio Caratori Tontini et al. won the NZ Geophysics Prize for their Nature paper that has inspired the new Kermadec Arc IODP pre-proposal. The team of scientists involved in the Hikurangi subduction margin project was awarded the inaugural Hayward Geocommunication Award. Both awards are administered by the Geosciences Society of New Zealand. Chris Hollis (GNS Science) has been appointed a member of the IODP Curatorial Advisory Board for a 4-year term, starting October 1, 2020. Also, in 2020, Jess Hillman (GNS Science) was appointed as the primary representative and Wanda Stratford (also GNS Science) as an alternate representative for the IODP Science Evaluation (SEP) Sites Panel. Fabio Caratori Tontini was appointed as an alternate representative for the SEP Science Panel.

**Stuart Henrys**  
New Zealand Lead Representative  
GNS Science

# A brief history of ANZIC and scientific ocean drilling

Australia has been a member of the international group carrying out scientific ocean drilling since 1988, where it has worked with twenty or so other nations to develop and direct operations of the largest international program in Earth sciences. Australian and New Zealand scientists have been active in scientific planning committees, evaluation panels, executive management and theme workshops. Since the program first came to our region in 1973, Australian scientists have participated at sea on many expeditions and as part of post-cruise research activity. All the scientific data generated has been published in the public domain, with a major overview and thousands of academic papers being openly accessible. More than 400 km of sample cores are stored in repositories around the world and are openly available to any scientist. A single vessel has been the workhorse in successive phases of the ocean drilling program, such that they have spent time in our region only when overall planning has allowed, interspersed with long periods when pursuing expeditions elsewhere in the world.

Increasing vessel size and improvements in drilling and laboratory technology have enabled larger numbers of scientists and technicians to participate in shipboard expeditions that have progressively revolutionized the understanding of global geoscience spanning plate tectonics, climate and oceanographic change, and the nature and history of marine sedimentary basins and volcanic basement and arc rocks. Much of our continents are built of oceanic sediments and rocks, accreted over vast periods of time, that can be best understood in the context of marine geology. In fact, ocean drilling has revolutionised geological ideas in the last 50 years.

## 1966-1983: Deep Sea Drilling Project (DSDP)

This initial phase of scientific ocean drilling began in 1966 using the *Glomar Challenger*, the first ocean-going vessel to take cores of sediment and rock beneath the seafloor. The DSDP conducted exploratory drilling and coring operations in all the world's oceans and some seas. The *Glomar Challenger* advanced the technology of deep-ocean drilling and introduced continuous rather than spot coring. The DSDP was fully funded by the US National Science Foundation, and foreign scientists were welcomed aboard the vessel despite the limited scientific contingent of twelve. Remarkably, fifteen Australians and ten New Zealanders took part in the eight expeditions in our region, and there were four Australian co-chief scientists.

## 1983-2003: Ocean Drilling Program (ODP)

The more capable *JOIDES Resolution* replaced the *Glomar Challenger* at the start of the Ocean Drilling Program, which was a truly international, cooperatively funded effort in which scientific hypotheses of global significance were tested in critical



areas. Proposals for drilling generated by consortia of researchers were assessed purely on scientific merit and feasibility, a system that remains in place today. Much deeper holes were drilled as appropriate. Later in the program, repeated hydraulic drilling at single sites to about 400 m deep provided continuous composite cores to investigate detailed Cenozoic ocean history in carbonate oozes. In 1988, Australia was funded to join ODP by various institutions, including the Australian Research Council, under the leadership of the Australian Geological Survey Organisation (now Geoscience Australia). Over a hundred expeditions with 70 participating Australian researchers were undertaken, including twenty-six expeditions in our region that involved seven Australian co-chief scientists and 40 Australian researchers and an additional three New Zealander researchers, even though New Zealand was not a member.

## 2003-2023: IODP

The decade-long Integrated Ocean Drilling Program and subsequent decade of International Ocean Discovery Program, built upon earlier international partnerships and scientific successes by continuing to test hypotheses of global significance and by employing multiple drilling platforms with finance and contributions from university and government agency partner

institutions across Australia and New Zealand. Together, Australia and New Zealand have created an influential partnership that has attracted a large number of expeditions to our region.

## 2003-2013: Integrated Ocean Drilling Program (IODP 1)

Fifty-one expeditions were mounted around the world, 32 using the *JOIDES Resolution*, 14 using the *Chikyu* and 5 using alternative platforms, of which five *JOIDES Resolution* expeditions were conducted in our region. Of particular note was *Chikyu* Expedition 343, mounted soon after the great Japanese earthquake and tsunami. It drilled the thrust on which the tectonic plates slid and found slippery clays had allowed all the stress to dissipate, indicating no repeat earthquakes are likely for centuries.

To increase the number of drilling expeditions in our region, Australia inspired an Indian Ocean IODP workshop in 2011 held in India and co-hosted by Indian-ODP and ANZIC. Ten expeditions were consequently conducted in the Indian Ocean in 2015 and 2016 by the *JOIDES Resolution*. This success inspired an ANZIC-hosted Southwest Pacific IODP workshop in Sydney in 2012, which led in turn to eight *JOIDES Resolution* expeditions, five of which were in New Zealand waters in the final phase of IODP from 2017 to 2020. ANZIC's contribution to this program is covered in detail by Neville Exon (editor), 2017: exploring the Earth under the sea – Australian and New Zealand achievements in the first phase of the IODP scientific ocean drilling, 2018-2013, ANU Press, 213 pp.

## 2014-2020: International Ocean Discovery Program (IODP 2)

In this most recent phase, the individual vessels were no longer controlled jointly but by the respective US, Japanese and European consortium platform providers. Nonetheless, the scientific proposals and expedition programs have continued to be developed and planned jointly. Thirty-nine expeditions were conducted around the world, thirty-two by the *JOIDES*

*Resolution*, four by the *Chikyu* and three using alternative platforms, collectively involving fifty-seven ANZIC participants. Thirteen *JOIDES Resolution* expeditions were in our region, with seven led by New Zealand co-chief scientists and one by an Australian co-chief scientist.

Two major IODP planning workshops were inspired and hosted by ANZIC in Australia during this period. The Australasian Regional IODP Planning Workshop, held in Sydney in 2017, was designed to initiate the next round of drilling proposals. A second workshop was held in Canberra in 2019 under the title Ocean Planet, to bring together scientists from around the world to begin to develop a new strategic plan for international scientific ocean drilling from 2024 to 2034. This workshop proved very successful, leading to detailed expedition plans that have since been submitted to funding agencies and are now in the process of approval.

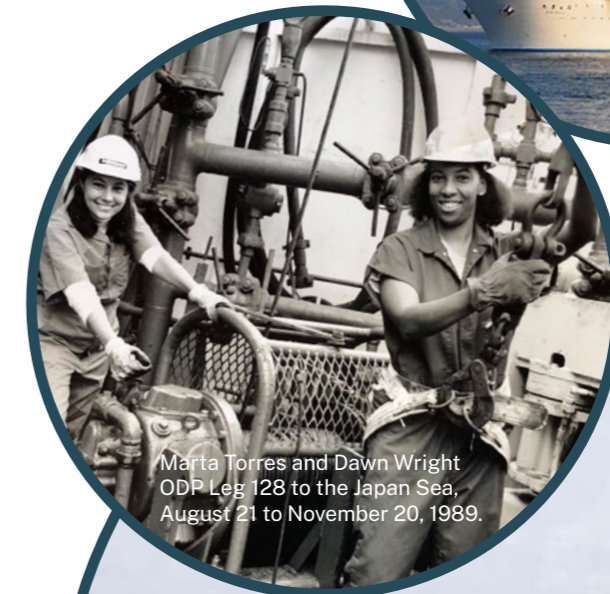
## Neville Exon - Former ANZIC Program Scientist



Glomar Challenger



D/V Chikyu



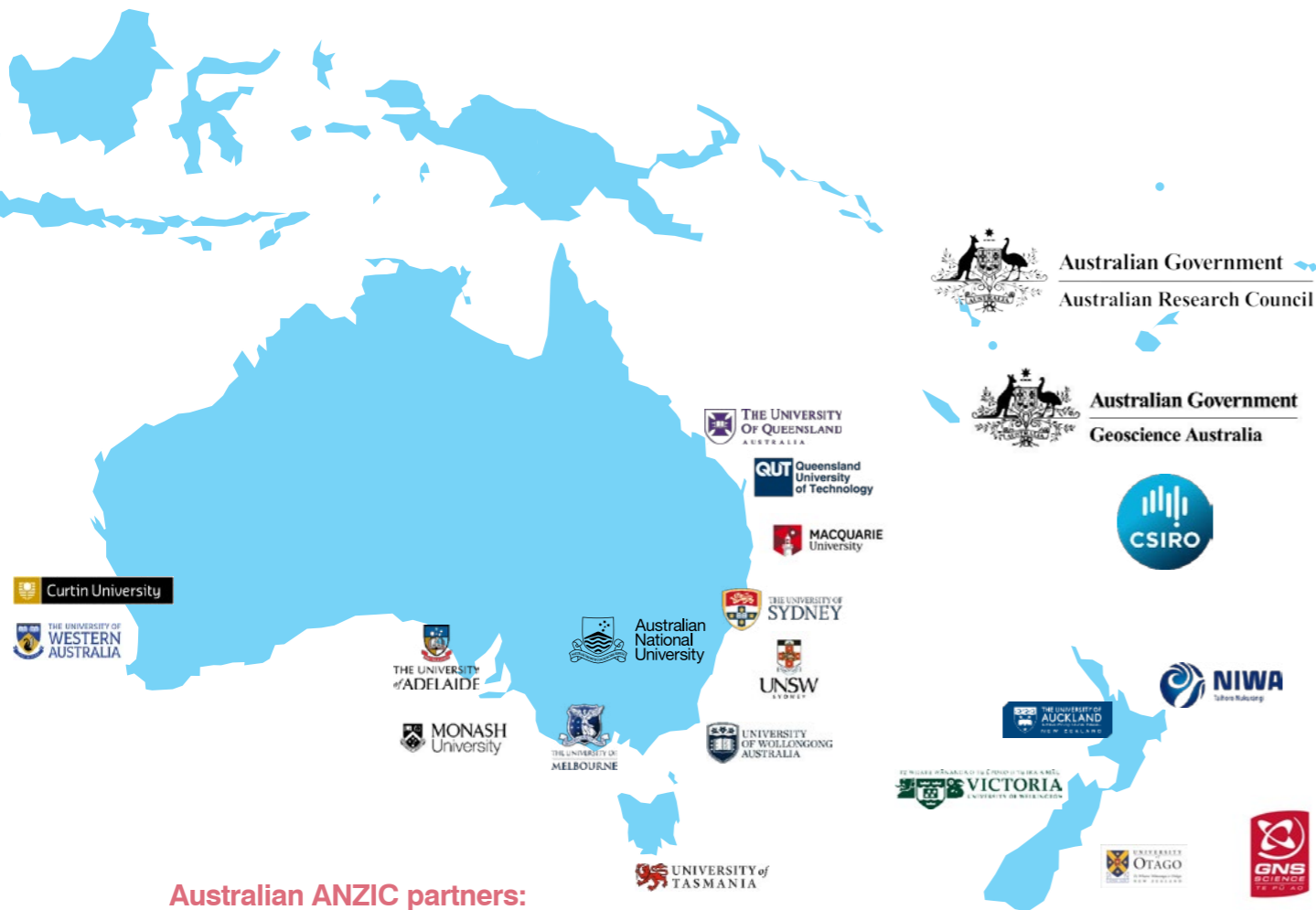
Marta Torres and Dawn Wright  
ODP Leg 128 to the Japan Sea,  
August 21 to November 20, 1989.



The JOIDES Resolution

ODP technician crew - Leg 117 to the Oman Margin in the Northern Indian Ocean, Aug 19 - Oct 18, 1987.

# ANZIC Membership



## Australian ANZIC partners:

- The Australian Research Council
- The Australian National University
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Geoscience Australia
- Curtin University
- Macquarie University
- Monash University
- The University of Queensland
- Queensland University of Technology
- University of New South Wales
- The University of Sydney
- The University of Adelaide
- The University of Melbourne
- The University of Tasmania
- The University of Western Australia
- University of Wollongong

## New Zealand ANZIC partners:

- GNS Science
- National Institute of Water and Atmospheric Research (NIWA)
- The University of Auckland
- University of Otago
- Victoria University of Wellington

Two-thirds of the world is covered by oceans, and 60% of Australia's and 95% of New Zealand's territory lies beneath the ocean. Much of this marine environment remains unexplored. The IODP brings together international researchers from Earth, ocean, atmospheric and life sciences with a common goal, to understand the Earth's past, present and future.

The IODP carries out scientific drilling in all the world's oceans using a variety of platforms, to establish borehole observatories and to obtain sediment, rock, fluid and biological samples from deep beneath the seafloor. IODP expeditions target global research questions, acquire samples and make observations to test and 'ground truth' hypotheses that are otherwise commonly inferred largely by remote sensing techniques. New technologies and concepts in geoscience are continuously being developed through IODP.

The primary drilling platforms are the US vessel *JOIDES Resolution* and Japanese vessel *Chikyu*. The European Consortium for Ocean Research Drilling (ECORD) charters various platforms to drill in locations that are not suited to the primary vessels.

Cores from the various expeditions are studied by scientists around the world and stored in specialised core repositories that provide ongoing long-term access for all scientists.

IODP's key research areas, as described in the IODP Science Plan for 2013-2023, are:

- **Climate and Ocean Change: reading the past, informing the future**
- **Biosphere Frontiers: Deep life, biodiversity, and environmental forcing of systems**
- **Earth Connections: deep processes and their impact on Earth's surface environment**
- **Earth in Motion: processes and hazards on human time scales**

ANZIC provides opportunities for researchers at all career stages (including PhD students) to participate in a variety of shipboard roles—including, but not limited to, sedimentologists, microbiologists, micropalaeontologists, inorganic and organic geochemists, palaeomagnetists, petrologists, petrophysicists, and borehole geophysicists.

Australia and New Zealand form the Australia-New Zealand IODP Consortium (ANZIC), through which the two countries gain access to all IODP activities including shipboard and post-cruise research, participation in planning committees and panels and visits from outstanding scientific researchers.

## ARC LIEF CIs & PIs

Every member institution has a representative Chief Investigator (CI) or Partner Investigator (PI).

## LEGACY GRANTS

ANZIC provides grants between \$10,000 and \$20,000 to member institution researchers to analyse previously recovered ocean drilling material and data.

## EXPEDITIONERS:

Researchers from ANZIC member institutions can apply to sail on IODP expeditions. A total of 53 ANZIC scientists, 38 from Australia and 15 from New Zealand, have participated in expeditions between 2014-19.

## EXPEDITIONER and POST-CRUISE FUNDING

ANZIC contributes on average \$377,000 per expeditioner berth and provides Australian expeditioners with up to \$40,000 for post-cruise analytical work. 42 researchers have received post-cruise funding from ANZIC during the period 2014-2019. Note: New Zealand does not currently offer post-cruise support.



The annual ANZIC Marine Geoscience Masterclass introduces up to 30-high achieving undergraduate students from member institutions to the specialist techniques and unique research opportunities available through the IODP. Students are selected by their institutions and ANZIC provides a budget of \$65,000 for the Masterclass to be run by ANZIC members.

## CONFERENCE/WORKSHOPS

ANZIC provides members with travel support and/ or funding to attend relevant workshops and conferences relating to the IODP and ANZIC activities in Australia and abroad.



## ANZIC GOVERNANCE:

ANZIC is overseen by a Governing Council steered by our independent chair, Dr Ian Poiner. The Council provides scientific and financial oversight of Australian activities including those of the Australian-IODP Office and the Science Committee.

## ANZIC SCIENCE COMMITTEE

The ANZIC Science Committee encourages and assists in the development of science proposals, organises topical workshops, and evaluates cruise applications, funding applications and candidates for the IODP panel membership. The Science Committee has a chair, a vice-chair, and 14 representatives from our consortium members, with expertise across the four current IODP science plan themes.

## INTERNATIONAL IODP PANELS AND BOARDS

ANZIC members represent and serve on the international - IODP panels and boards including platform facility boards, which make decisions on fulfilling the objectives of the IODP Science Plan, including the expedition schedule. Other advisory panels include the Science Evaluation Panel and the Environmental Protection and Safety Panel, which evaluate the science, sites, environmental protection, and safety of proposed expeditions.

# ANZIC Activities



ANZIC Australian and New Zealand scientists have access to a range of resources and opportunities.

Every year, ANZIC members represent ANZIC at various conferences, meetings and forums and have access to all IODP activities including shipboard and post-cruise research, workshops, participation in planning committees and panels, and visits from outstanding scientific speakers.

## Expeditions

Expedition 378 (South Pacific Paleogene Climate) began on January 3, 2020 in Lautoka, Fiji, and ended on February 6, 2020 in Papeete, Tahiti.

The ANZIC team for Exp. 378 included Dr. Chris Hollis from GNS Science, Claire Concannon from the Otago Museum and Prof. Simon George from Macquarie University.

## The new Science Framework through to 2050

ANZIC representatives contributed to the writing and working groups of the new IODP 2050 Science Framework.

The Writing Team included: Kliti Grice (Curtin University); Anais Pages (Dept of Water & Env. Regulation); Laura Wallace (GNS) and Rob McKay (Victoria University Wellington); and the Working Group included: Mike Coffin (University of Tasmania); Anais Pages (Dept of Water & Env. Regulation) and Stuart Henrys (GNS).

The Writing Team met prior to the AGU Meeting in San Francisco December 2019 and throughout the year to write and review the 2050 Science Framework.

## 9-14 February, IODP Exp 371: Tasman frontier subduction initiation and Paleogene climate: post-cruise meeting.

The post cruise field trip and workshop for the IODP Expedition 371 were held in Wellington from the 9th to the 14th of February. The meeting was the first time most of the scientists had met together since the cruise in 2017. The majority of the shipboard science party made it to the meeting, with the rest joining online. The meeting commenced with a three-day field trip to the Wairarapa, where overseas visiting scientists were introduced to New Zealand Geology. The outcrops visited were selected to be contemporary with or analogous to the sediments cored in the Tasman Sea by Exp 371. The fieldtrip was hosted by GNS Science researchers Kyle Bland and Hugh Morgens, who hold a wealth of experience and in-depth knowledge of Zealandia's Paleogene sediments.

The IODP Expedition 371, Townsville to Hobart, Australia 27 July to 26 September 2017. Co-chief scientists were Rupert Sutherland (Victoria University of Wellington) and Gerald Dickens (Rice University) and Staff Scientist Peter Blum.

## 10-11 March, IODP – Preliminary proposal workshop

A workshop to develop an IODP preliminary proposal to investigate the early evolution of back-arc basins by drilling in the Havre Trough was held at GNS Science with presentations and discussions, finishing with a draft pre-proposal.

## ARC LIEF Proposal

An 18-month ARC LIEF proposal was submitted and proposed to cover the IODP subscriptions and the organisation of Australian-New Zealand IODP interests. This bid represented 13 universities and two partner institutions. The proposal, led by Prof. Eelco Rohling from the Research School of Earth Sciences,

Australian National University, has a total value of \$4.74M, of which \$3M is requested from the ARC.

## 22-25 November, Geosciences conference 2020 (GSNZ20)

Scientific drilling at the forefront of this year's Geosciences Society of New Zealand Annual Conference in Aotearoa.

GeoDiscoveryNZ is the New Zealand banner for scientific drilling that incorporates both ANZIC and IODP. At GSNZ 2020, ANZIC ran a booth promoting the newly published 2050 Science Framework document. ANZIC held a presentation on the IODP 2050 Science Framework and the new Science Plan of IODP, highlighting the fresh approach these global strategies bring to Earth science.

This might have been the only global event for our community in 2020. The many benefits of GeoDiscoveryNZ membership were showcased at the booth and generated multiple conversations with early-career researchers and students interested in getting involved in ANZIC and IODP. Some of the current and future GeoDiscoveryNZ projects presented in Christchurch include:

- Accumulation and Release of Carbon Dioxide from Geologic Sources in the South Pacific: Chatham Rise, New Zealand. Lowell Stott, Ingo Pecher et al.
- Tracing Antarctic Cryosphere Origins to Climate and Tectonics. Rob McKay et al.
- SWAIS: Sensitivity of the West Antarctic Ice Sheet in a Warmer World. Richard Levy et al.
- An idea: scientific drilling project "interaction": interaction between life, rifting and caldera tectonics in Okataina. Pilar Villamor et al.

The GSNZ Annual Conference in Christchurch was perhaps one of the only global geoscience conferences to run in-person this year, with 410 participants including 315 oral and poster presentations. Stuart Henrys and Marianna Terezow represented ANZIC with a booth. The NZ team displayed a map, part of a family of maps of Zealandia bathymetry and tectonics, which Marianna and Stuart worked on with Jenny Black (GNS).

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## IODP Expedition 390C: South Atlantic transect reentry systems

During Expedition 390C, the *JOIDES Resolution* completed its transit from Kristiansand, Norway, to Las Palmas, Gran Canaria, Canary Islands, Spain, and took on fuel. We then began the

transit to Site U1556 in the South Atlantic.

## 2020 AGU Asahiko Taira International Scientific Ocean Drilling Research Prize

Rob McKay was awarded the 2020 Asahiko Taira International Scientific Ocean Drilling Research Prize for outstanding contributions to Antarctic glacial history, especially through leadership of research through scientific ocean drilling, which is an extraordinary achievement. Given in partnership between the American Geophysical Union and the Japan Geoscience Union, the prize recognizes outstanding, transdisciplinary research

accomplishments in ocean drilling. Rob joins an illustrious cohort of previous honorees who represent the vanguard of scientific ocean drilling research. Rob is the first ANZIC recipient of this prize and we hope others will be honoured.

## 2020 Marsden Fund

Congratulations to Lorna Strachan, who has received funding from the Marsden Fund. She and her team of researchers, including ANZIC members, will work on the IODP core from the Hikurangi margin to answer the question: "Does climate influence volcanic activity and earthquakes?"

# Micropaleontological Reference Center (MRC) Collections

GNS Science has one of five international Micropaleontology Reference Centers (MRCs), and the only one in the Southern Hemisphere, holding identical sets of representative microfossil preparations of calcareous nannofossils, foraminifera, radiolarians and diatoms from Deep Sea Drilling Project (DSDP) and Ocean Drilling Program (ODP) cores from a wide range of geographical areas and geological ages.

The Micropaleontology Reference Center at GNS Science also holds extensive DSDP/ODP/IODP collections of processed and unprocessed microfossil samples, resulting from decades of biostratigraphic and paleoclimate research in the Southwest Pacific and the Southern Ocean by local micropaleontologists and overseas colleagues.

Microfossil material from the MRC has contributed to numerous journal publications in the last few years and has supported student research projects, conference presentations, teaching and outreach activities. Current research topics include a study of the Middle Miocene Climatic Optimum, reconstructing latitudinal temperature gradients in the early Eocene, and Late Cretaceous to Paleocene dinoflagellate cyst biostratigraphy and zonation refinement.

Research by GNS scientists on the

regional impacts of extreme climate events during the early Cenozoic has made extensive use of the microfossil collections in the MRC, including reviews of microfossil assemblages from DSDP expeditions 21, 28 and 29 and ODP expeditions 181 and 189. The studies helped to stimulate recent expeditions in the region, IODP expeditions 371 and 378, and have resulted in several publications and two Ph.D. theses; Pascher, K. M., 2017, Paleobiogeography of Eocene radiolarians in the Southwest Pacific. Ph.D.: Victoria University of Wellington, 323 p.

Shepherd, C. L., 2017, Early to middle Eocene calcareous nannofossils of the SW Pacific: paleobiogeography and paleoclimate. Ph.D.: Victoria University of Wellington, 171 p.

The research has increased our understanding of the impacts of global warming on regional climate and oceanic ecosystems during the

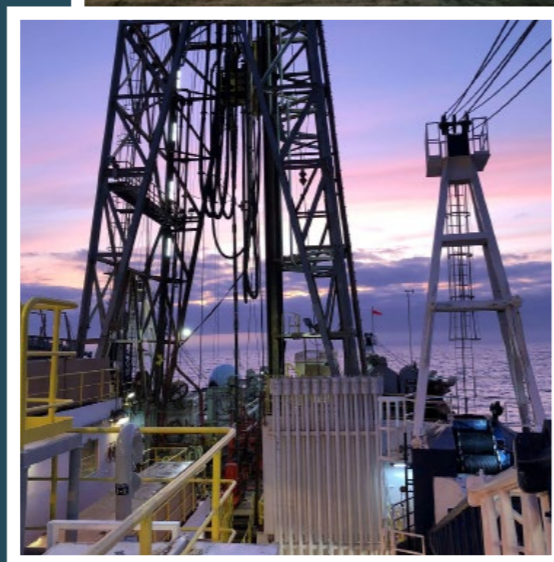
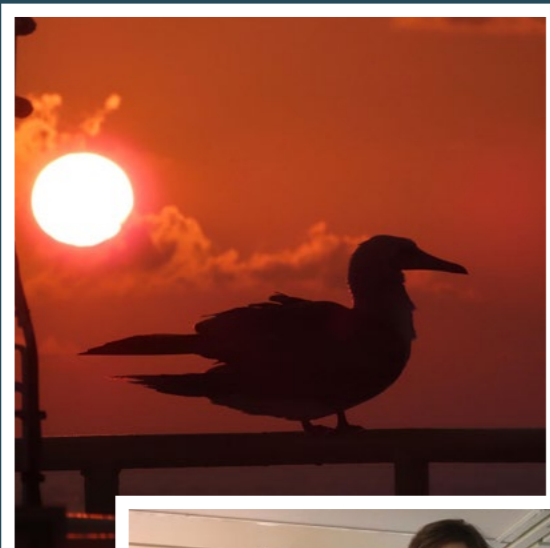
early Cenozoic, especially during the early Eocene. It has also led to a comprehensive review of radiolarian biostratigraphy during the Paleogene, leading to the establishment of a new southern hemisphere biozonation for Paleogene radiolarians and incorporating it into the recently updated international geological timescale.



Students discover the world of microfossils found in ocean sedimentary cores, using material from the MRC.



# Expedition Report



## Expedition 378: South Pacific Paleogene climate

*JOIDES Resolution* (January 3, 2020- February 3, 2020).

ANZIC Expeditioners: Simon George, Chris Hollis and Claire Concannon.



Expedition 378 recovered the first continuously cored, multiple-hole Paleogene sedimentary section from the southern Campbell Plateau at Site U1553, New Zealand (Thomas et al., 2020). This southern high-latitude site builds on the legacy of Deep Sea Drilling Project (DSDP) Site 277, a single, partially spore-cored hole that provides a unique opportunity to refine and augment existing reconstructions of early Cenozoic climate history. Multiple cored intervals were recovered from the Eocene–Oligocene transition (EOT), the Middle Eocene Climatic Optimum (MECO) and other Eocene Thermal Maximum events, as well as the Paleocene–Eocene Thermal Maximum (PETM). Expedition 378 also discovered a new expanded Paleocene siliciclastic formation (Unit V) that had never been drilled before, with an earliest Paleocene age at the base of the core (Thomas et al., 2020).

Expedition 378 had a rather chequered preparation. It was originally scheduled for late 2018, but was postponed in August of that year when inspection of the *JOIDES Resolution's* propellers in dry dock revealed cracks in both the port and starboard propellers. A few people had to drop out, but luckily, by and large, the shipboard party was retained for the rescheduled expedition. Rescheduling was for 8 weeks from January 3 to March 3, 2020. You can imagine the horror of the shipboard

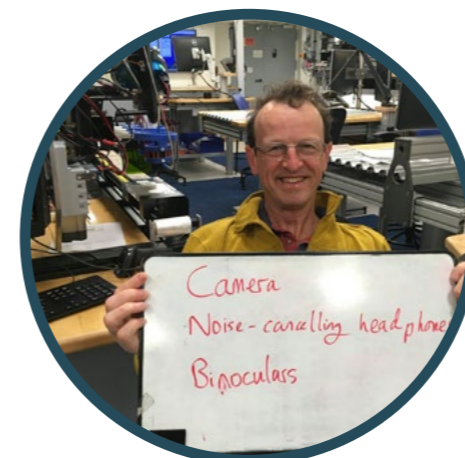
party receiving the following email on Christmas Eve 2019: "Recent testing and evaluation of the *JOIDES Resolution* derrick has determined that it will not support deployment of drill strings in excess of 2 km. This means that only the first site of Expedition 378, the redrill of DSDP Site 277, will be implemented." This unwelcome information, just 9 days out from travel, meant that we were unable to drill any of the deepwater South Pacific holes that were planned. The revised 4 week expedition went ahead from 3 January to 6 February 2020, departing from Fiji, drilling to the south of the South Island of New Zealand on the Campbell Plateau, and returning to Tahiti. The good news is that we came back to shore with loads of sediment, sedimentary rock, data, and new collaboration plans, and we just missed COVID-19. In fact, this was one of the few crewed oceanic scientific expeditions that was completed in 2020.

Three ANZIC scientists sailed on Expedition 378: Simon George from Macquarie University in Sydney, Chris Hollis from GNS Science, and Claire Concannon from the Otago Museum. Post-cruise research plans have been quite disrupted and delayed by COVID-19, leading to remote work for writing the full expedition report and no sample party. Virtually no samples were taken onboard, but the group of dedicated IODP technical staff at the Texas repository was able to carry out all the sampling necessary by early 2021. These samples have now been distributed, and the post-cruise research work is getting underway.

We very much appreciate the support and assistance of ANZIC-IODP for making our participation in this exciting expedition possible.

Thomas, D.J., Röhl, U., Childress, L.B., and the Expedition 378 Scientists, 2020. Expedition 378 Preliminary Report: South Pacific Paleogene Climate. International Ocean Discovery Program. doi:10.14379/iodp.pr.378.2020

Simon George and Chris Hollis



Sunset with a seabird (Credit: Simon George & IODP) [Photo ID: exp378\_025], *The JR* docked at Lautoka, Fiji. (Credit: Simon George & IODP) [Photo ID: exp378\_026], Sunset from the helipad. (Credit: Lindy Newman & IODP), Exp 378 South Pacific Paleogen Sunset. (Credit: Ursula Röhl & IODP), Albatross flies in a storm east of Wellington and Cook Strait. (Credit: Simon George & IODP) T, Claire Concannon (Credit: -)

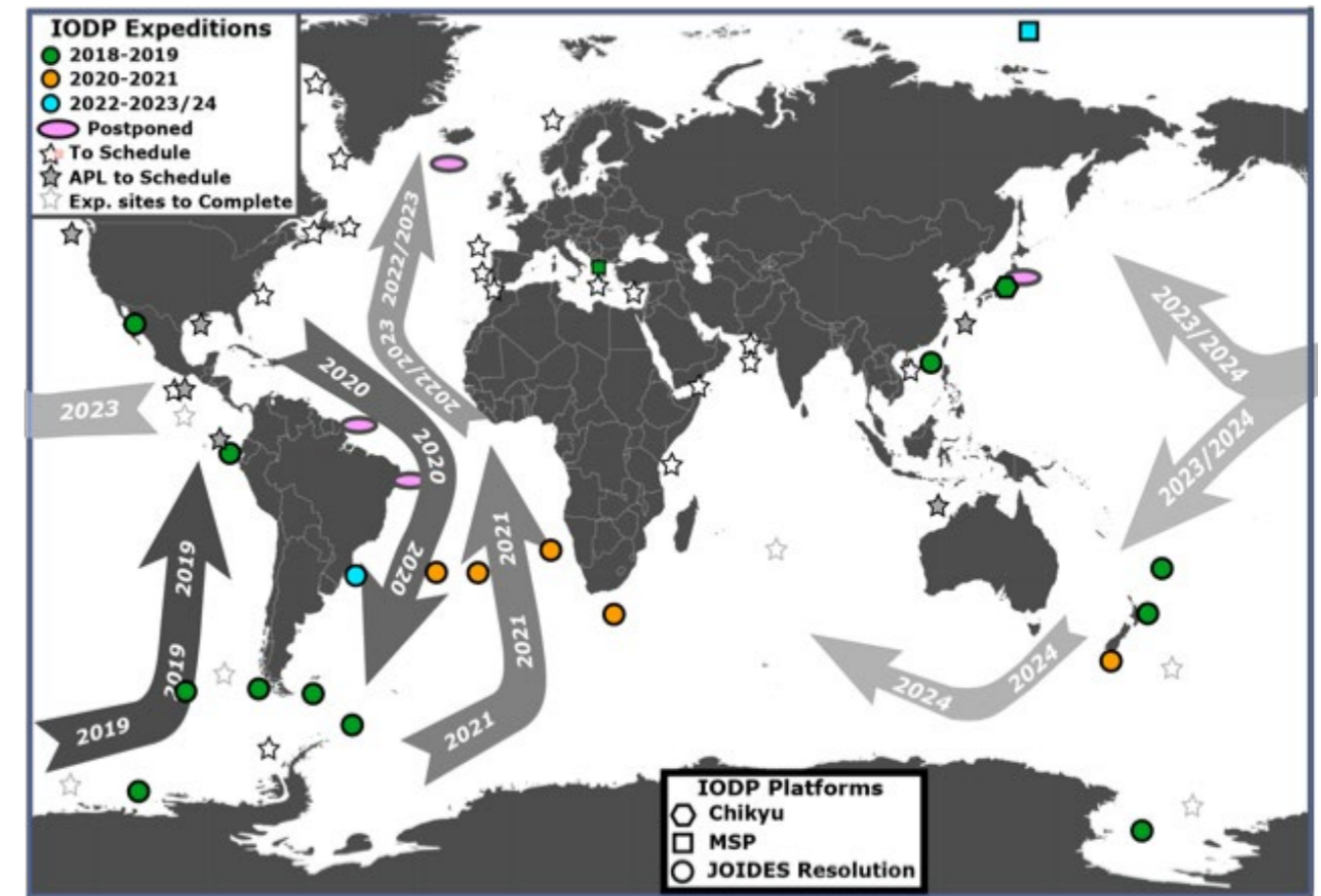
# Future IODP Expeditions

The *JOIDES Resolution* operates for the program as close to a full-year schedule as possible and the Japanese riser-drilling platform DV *Chikyu* operates on average 2 months/year.

Mission specific EU chartered platforms are used in challenging environments such as high Arctic, shallow water and carbonate reefs, and conduct an average of one operation every two years.

## Future IODP Planned Expeditions 2021- 22

Expedition Name	#	Dates	Ports	
Complete South Atlantic Transect Reentry Installations	395E	April 6- June 6, 2021	Cape Town / Reykjavik	JRSO
Japan Trench Paleoseismology	386	April 13- June 1, 2021	Yokosuka / Yokosuka	ESO
Reykjanes Mantle Convection and Climate	395	June 6 - Aug 6, 2021	Reykjavik / Reykjavik	JRSO
Mid-Norwegian Continental Margin Magmatism	396	Aug. 6 - Oct. 6, 2021	Reykjavik / Kristiansand	JRSO
Walvis Ridge Hotspot	391	Dec. 6, 2021 - Feb. 5, 2022	Cape Town / Cape Town	JRSO
Agulhas Plateau Cretaceous Climate	392	Feb. 5 - Apr. 7, 2022	Cape Town / Cape Town	JRSO
South Atlantic Transect 1	390	Apr. 7 - June 7, 2022	Cape Town / Montevideo	JRSO
South Atlantic Transect 2	393	Jun. 7- Aug. 7, 2022	Montevideo / Montevideo	JRSO
Arctic Ocean Paleoceanography	377	Aug.- Sep. 2022	TBD	ESO



As approved by the JRFB in May 2020

For up-to-date schedules please refer to [www.iodp.org/expeditions/expeditions-schedule](http://www.iodp.org/expeditions/expeditions-schedule). This map was produced by IODP.

# ANZIC Scientist Stories



**“Helen Bostock** is an Associate Professor in the Oceanography School of Earth and Environmental Sciences, at the University of Queensland. Specialising in researching past, present and future conditions in the Southern Ocean.

During my Ph.D. at ANU, I was lucky enough to get the opportunity to participate as a student in the sedimentology team on ODP Leg 207 to the Demerara Rise in the Caribbean. This ODP expedition, which was focused on ocean anoxic events during the Cretaceous had very little to do with my Ph.D. work, which was focused on working on Quaternary marine sediment cores from the Southern Great Barrier Reef, but in many ways, it was a key moment in my training as a marine geologist. During that two month expedition, I learnt a wide range of hard and soft skills, and I fell in love with going to sea. With a sea-going expedition (and an equator crossing certificate) under my belt, I finally felt like I could call myself a marine geologist. This was also my ticket to my subsequent job at the National Institute of Water and Atmospheric Research in Wellington, New Zealand. For 12 and a half years, I worked at NIWA in the Ocean Geology and Sediments team. During that time, I participated in 8 research voyages on the RV Tangaroa, leading and co-leading several of these voyages.

I have always recruited Ph.D. and MSc students to participate in these voyages as it is critical that we train the next generation of marine geologists, test their sea legs and teach them practical sea-going skills that you cannot learn from lectures or talks. I recently moved to the University of Queensland, where I teach courses in marine geology and oceanography and am always looking for excuses to get out to sea with my students. I continue my connection to the ANZIC IODP as it provides great opportunities for research scientists from Australia and New Zealand to propose projects in this region to answer important scientific questions. It also provides opportunities for students and scientists to learn hands-on skills and be part of a global network of marine geologists.

**“Rob McKay** is the current Director of the Antarctic Research Centre at Victoria University of Wellington, and credits his involvement with the ANZIC International Ocean Discovery Program as being central to his early career development.

In 2020, he was awarded the Asahiko Taira Scientific Ocean Drilling Research Prize by the American Geophysical Union (AGU) and his scientific drilling work was an important part of the “Melting Ice and Rising Seas” team that won the 2019 New Zealand Prime Minister’s Science Prize. He began his career in geological drilling during his Ph.D., as a member of the ANDRILL drilling program that documented the first sedimentary evidence of West Antarctic ice sheet variability over the Pliocene to Pleistocene (past 5 million years). Following his Ph.D., Rob began his career-long involvement with the IODP when he was selected to join the IODP Wilkes Land Expedition 318 in 2010 as a sedimentologist. His research with IODP Expedition 318 showed that the Wilkes subglacial basin, just like the West Antarctic Ice Sheet, has been highly dynamic over the past 5 million years. Rob then led the successful proposal for IODP West Antarctic Ice Sheet drilling in the Ross Sea region, and was co-chief scientist of IODP Expedition 374 in early 2018. The results of this expedition are still in the process of being published but will shine new light on environmental conditions in Antarctica over the past 20 million years.



The IODP and ANZIC have also played a critically important role in nurturing Rob’s broader leadership skills, including being chairman of the Science Committee between 2015 and 2018; and more recently, a member of the ANZIC Governing Council. He was a key organiser of workshops (e.g. the Sydney 2017 IODP regional proposal workshop and the Antarctic 2107 drilling workshop in Texas) for shaping future drilling proposals. Most recently, he was a lead author on the “exploring Earth through scientific ocean drilling 2050 Science Framework”, which outlines a >25-year ambition for future international ocean drilling collaborations. Rob notes that he is “hugely grateful that the ANZIC community was willing to give me leadership responsibility early in my career, and this gave me a huge amount of confidence to step up into scientific leadership roles both internationally, as well as within my university.”

# Legacy Funding

Every year ANZIC provides legacy grants to researchers for analytical research on previously recovered ocean drilling material.

This successful program has supported many legacy grant projects centred on the analysis of previously collected DSDP/ODP/IODP samples and has facilitated the rapid production of high-quality publications, conference presentations and/or outreach activities.

The International Ocean Discovery Program not only offers the global community the opportunity to propose, undertake and participate in expeditions to address challenges outlined in the IODP Science Plan (2013-2023) but also values the collected cores for future scientific research open to the global community. Collected cores are housed in three core repositories based in the US (Gulf Coast Repository - GCR), Japan (Kochi Core Centre - KCC) and Germany (Bremen Core Repository - BCR) (<http://www.iodp.org/resources/core-repositories>). Cores are curated based on broad expedition-based geographic locations (illustrated below). The majority of samples collected from the Australian region are curated in the Kochi Core centre (Japan), whilst Antarctic cores are maintained in the Gulf Coast Repository, USA.

ANZIC ensures that our members make use of the vast collections of previously collected DSDP,ODP, IODP-I and IODP-II, under the ANZIC IODP Legacy Analytical Funding Program (AILAF).

In July 2020, ANZIC sought applications for Analytical Funding from our Australian and New Zealand members to support studies of legacy scientific ocean drilling material and/or data. We had a record high of 32 applications, double our normal number of applications, seeking total support of just over \$583,000. Submissions were received from 28 Australian and four New Zealand applicant teams across 13 ANZIC member institutions. 43% of all applications were led by women Chief Investigators. In total, a maximum of 14 out of 28 Australian applications were successful and an additional three out of four NZ applications were also successful, representing consortium support of just under A\$250K and NZ\$40K, respectively.

*Note: New Zealand members of ANZIC currently do not participate in this program.*

Institution	Applicant	Project	Funding (AUD)
QUT	Balz Kamber	Elemental fluxes from alteration of sub-aqueously emplaced plateau basalt	\$19,540.00
USYD	Bree Morgan	Unravelling a trace element fingerprint for low-temperature dolomite formation in the Great Australian Bight	\$19,122.00
UQ	Helen Bostock	Ocean circulation and Australian climate change across the Mid-Pleistocene Transition (MPT)	\$19,600.00
ANU	Ian Campbell	What is under the Antarctic ice?	\$17,200.00
UTAS	Isabel Sauermilch	The Lost Atlantis between Australia and Antarctica - Pin down the subsidence of the South Tasman Rise	\$20,000.00
ANU	Katharine Grant	Oxygen isotope stratigraphy of IODP site U1464	\$13,000.00
USYD	Maria Seton	Bringing ODP/IODP into the classroom: remote learning resources for marine geoscience	\$20,000.00
UQ	Mark Kendrick	The timing of ocean floor carbonation and global Co2 cycling	\$19,800.00
MU	Oliver Nebel	Metal (re-) mobilisation in oceanic crust at Atlantis Bank (ODP Hole 735B, Leg 176)	\$11,150.00
ANU	Penny King	Identifying submarine volcanism in the Izu-Bonin-Marianas Forearc	\$20,000.00
ANU	Stewart Fallon	Understanding the origin of millennial-scale abrupt global climate changes	\$20,000.00
UQ	William Defliese	Sea temperature reconstruction through the Middle Miocene Climatic Optimum and Transition, central Campbell plateau ODP site 1120	\$19,750.00
CU	Yebo Liu	Testing late cretaceous true polar wander on the Western Australian Margin	\$19,300.00
MQ	Nathan Daczko	Significance of syn-deformational melt migration for oxide enrichment in oceanic crust	\$ 9,926.00

# EXPLORING EARTH BY SCIENTIFIC OCEAN DRILLING



**2050 SCIENCE  
FRAMEWORK  
Summary**



# NEW SCIENCE FRAMEWORK TO 2050

ANZIC's activities during 2020 were heavily focused on Australian and New Zealand science expertise defining future research challenges and opportunities for collaborative international scientific ocean drilling encapsulated in the Ocean Planet Workshop report (<https://iodp.org.au/files/2020/01/Ocean-Planet-Workshop-Report-Jan-2020-sm.pdf>). This report made a significant contribution to the development of the international 2050 Science Framework: Exploring Earth by Scientific Ocean Drilling report, which can be downloaded from: <https://doi.org/10.25911/5e1c39629af61>.

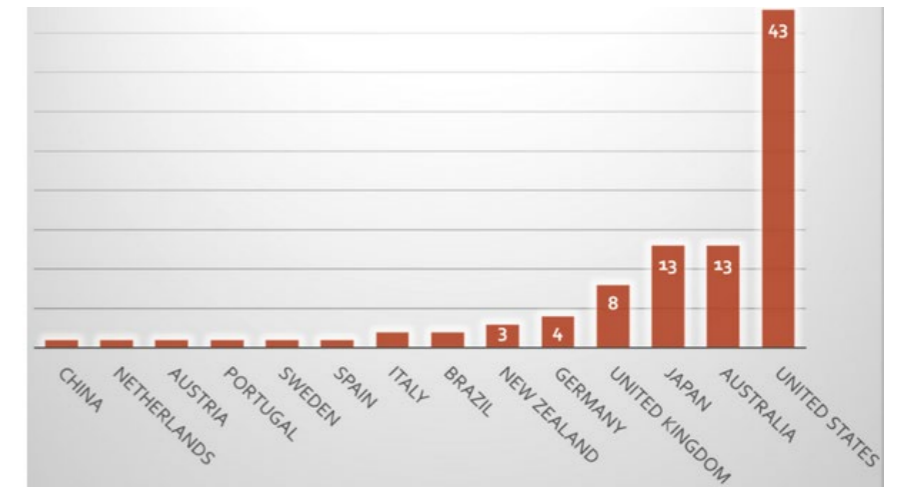
As a result of ANZIC's highly regarded Ocean Planet Workshop report, six ANZIC scientists were selected to the international Science Framework Writing & Reviewing Team and Working Group that developed the 2050 Science Framework.

The Writing & Reviewing Team included; Kliti Grice (Curtin University), Rob McKay (Victoria University of Wellington), Anaïs Pagès (Western Australia Department of Water & Environmental Regulation), and Laura Wallace (GNS).

The Working Group included; Mike Coffin (University of Tasmania), Stuart Henrys (GNS), and Anaïs Pagès (Western Australia Department of Water & Environmental Regulation).

The Working Group met in New York in July 2019 and in Osaka in September 2019 to develop an outline and timeline for the 2050 Science Framework, and to nominate members of the Writing & Reviewing team. Both the Working Group and the Writing & Reviewing Team met in San Francisco in December 2019, and subsequently virtually through finalisation of the 2050 Science Framework in September 2020.

The first opportunity for the international community to comment on the first public draft of the 2050 Science Framework closed in February 2020, with Australia providing 13 submissions, New Zealand providing three, and ANZIC providing one (see graph) of the just over 100 submissions made globally.



Graph showing by country the 100 submissions made globally on the public draft of the 2050 Science Framework.

This is an exceptional result for Australian and New Zealand input to and consequently influence on international scientific ocean drilling. ANZIC's major thematic contribution to the 2050 Science Framework centred on inclusion of Diagnosing Ocean Health as a Flagship Initiative. ANZIC Working Group and Writing & Reviewing Team members provided significant input to each of the Framework's seven Strategic Objectives, the four other Flagship Initiatives, and multiple Enabling Elements that advance the aims of scientific ocean drilling. The ANZIC Science Committee, members of the Governing Council, and the ANZIC community also provided significant feedback to the two international community input requests as the Framework was developed and finalised. The 2050 Science Framework was published in October 2020.

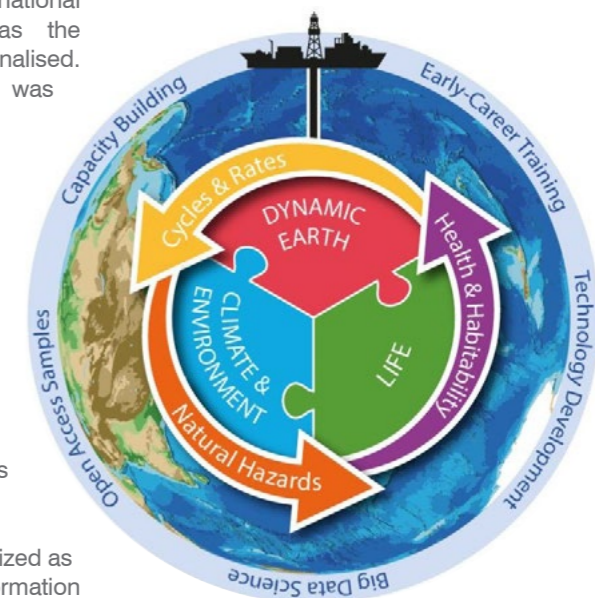
The 2050 Science Framework's Mission and Vision are:

- **MISSION:** The 2050 Science Framework for Scientific Ocean Drilling guides multidisciplinary subseafloor research into the interconnected processes that characterize the complex Earth system and shape our planet's future.

- **VISION:** To be globally recognized as the source of authoritative information

about ocean and Earth system history and its links to society.

The Framework guides scientists on important research frontiers that scientific ocean drilling should pursue, as outlined by to advance the aims of scientific ocean drilling. Three versions of the 2050 Science Framework have been produced to suit various audiences, including a 2-page general summary flyer, a 12-page general summary brochure, and the complete 126-page Framework. All are available for download directly from IODP: <http://www.iodp.org/2050-science-framework>.



# IODP Committees, ANZIC Governing Council & Science Committee



## IODP Panels, Boards, and Forums

IODP evaluates proposals for scientific drilling expeditions based on impact, logistical feasibility, and cost through a system of Facility Boards and Advisory Panels whose membership is drawn from the international scientific community.

Drilling proposals are first evaluated by the Science Evaluation Panel (SEP), which is responsible for evaluating the scientific objectives and technical approach of submitted proposals at all stages, and for forwarding ready-to-drill and top-priority proposals to the appropriate Facility Board. The Environmental Protection and Safety Panel (EPSP) provides critical support to the review process, and engineering panels are convened as needed by the platform operators.

The *JOIDES Resolution* Facility Board (JRFB) oversees the operations of the *JOIDES Resolution*, including scheduling expeditions, approving program plans, monitoring the advisory panels to ensure efficient and effective review of drilling proposals, and developing and monitoring policies for data collection, publications, and core curation. Independent Facility Boards also oversee DV *Chikyu* (*Chikyu* IODP Board) and Mission Specific Platform (ECORD Facility Board) operations. The ANZIC Program Scientist is our representative on all three facility boards.

The IODP Forum is a venue for exchanging ideas and views on the scientific progress of the International Ocean Discovery Program. The Forum is the custodian of the IODP Science Plan 2013-2023 and provides advice to the IODP Facility Boards on Platform Provider activity. The IODP Forum meets annually and membership is open to all countries, consortia, or entities that provide funds for IODP platform operations.

ANZIC has participation rights on IODP Scientific Advisory Structure panels, with ANZIC representatives listed below.

Committee or Panel	Member	Institution
<b>JOIDES Resolution Facility Board</b> <b>Chikyu IODP Facility Board</b> <b>ECORD Facility Board</b>	Leanne Armand	ANZIC/The Australian National University
<b>Science Evaluation Panel</b>	Chris Elders Ron Hackney Alternate: Helen McGregor	Curtin University Geoscience Australia University of Wollongong
<b>Environmental Protection and Safety Panel</b>	Ingo Pecher Alternate: Myra Keep	The University of Auckland The University of Western Australia
<b>Core Curation Board</b>	Richard Arculus	The Australian National University
<b>IODP Forum</b>	Leanne Armand Mike Coffin Joanna Parr	ANZIC/The Australian National University The University of Tasmania CSIRO
<b>ANZIC 2050 Science Framework Writing Group (WG) and Writing Team (WT)</b>	Mike Coffin (WG) Stuart Henrys (WG) Anais Pages (WG, WT) Kliti Grice (WT) Rob McKay (WT) Laura Wallace (WT)	The University of Tasmania GNS Science CSIRO Curtin University Victoria University of Wellington GNS Science

# 2020 ANZIC Governing Council

The Governing Council is a steering committee for the Australia and New Zealand IODP Consortium (ANZIC), and looks after mission and strategic direction, ensuring effective overall governance and management, and responsible finance and risk management. The membership of the Governing Council was determined on a contribution-based arrangement agreed to by the Governing Council in 2013/14.

# 2020 ANZIC Science Committee

The Science Committee encourages and assists the development of science proposals, organises topical workshops, assesses cruise applicants, applicants for IODP panel membership, and applications for special analytical funding.

The Committee is chosen to broadly represent the IODP's key research areas:

- **Climate and Ocean Change:** reading the past, informing the future,
- **Biosphere Frontiers:** Deep life, biodiversity, and environmental forcing of systems
- **Earth Connections:** deep processes and their impact on Earth's surface environment

Committee members, who provided valuable and appreciated service in 2020, are listed below.



**Dr Ian Poiner**  
Chair/Independent Scientist



**Assoc. Prof. Robert McKay**  
Victoria University of Wellington



**Prof. Richard Arculus**  
Lead ARC LIEF CI /  
The Australian National University



**Prof. Jody Webster**  
University of Sydney



**Assoc. Prof. Leanne Armand**  
ANZIC Program Scientist /  
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Assoc. Prof. Stephen Gallagher – University of Melbourne; Prof. John Foden – University of Adelaide; Dr Craig Sloss - Queensland University of Technology; Assoc. Prof. Oliver Nebel – Monash University; Dr Richard Jones – Monash University; Dr Lorna Strachan - University of Auckland; Assoc. Prof. Helen Bostock – University of Queensland; Dr Joshu Mountjoy - NIWA; Prof. David Cohen - ANTSO; Assoc. Prof. Helen McGregor – University of Wollongong; Dr Christina Riesselman – University of Otago; Dr Anthony Kemp – University of Western Australia; Dr Mick O’Leary - University of Western Australia; and Prof. Mike Coffin - University of Tasmania.

# ANZIC Outputs

ANZIC scientists contribute significant knowledge to advance our global understanding of the Earth's geology, climatic evolution, geohazards and biosphere.

Since the inception of scientific ocean drilling in 1968, through to our current International Ocean Discovery Program in 2019, ANZIC scientists have contributed over 37,725 publications, representing 11.8% of publications globally.

Our publication successes are founded on the ANZIC community's genuine engagement facilitated either by participation in Expedition (on-board or shore-based) scientific parties or through the unique ANZIC Legacy analytical grant support program. The 2019 record of ANZIC contributions are extracted from the Scientific Ocean Drilling Bibliographic Database, compiled annually by the *JOIDES Resolution* Support Office (JRSO).

Peer-reviewed scientific ocean drilling articles including authors representing Australia or New Zealand and published in top-tier journals, compared to all peer-reviewed scientific ocean drilling articles.

Date of Publication	Scientific ocean drilling journal articles in top three science journals*			Scientific ocean drilling journal articles in next top twenty Earth science journals†			All peer-reviewed scientific ocean drilling journal articles	
	Articles with an author representing Australia	Articles with an author representing New Zealand	All articles	Articles with an author representing Australia	Articles with an author representing New Zealand	All articles	Articles with an author representing Australia and/or New Zealand	All articles
1968–1987	2	3	176	1	0	348	33	1,990
1988–2003	18	1	181	50	11	1,324	221	4,052
2004–2007	3	1	72	19	8	585	108	1,570
2008–2013	8	5	107	45	25	985	140	2,111
2014–2015	8	1	30	24	12	356	66	797
2016–2020‡	5	3	45	72	33	729	179	1,633
<b>Total</b>	<b>45</b>	<b>14</b>	<b>616</b>	<b>206</b>	<b>77</b>	<b>3,881</b>	<b>750</b>	<b>12,000</b>

**Notes:** This table was prepared in October 2021 by IODP Publication Services based on data in the Scientific Ocean Drilling Bibliographic Database, a subset of GeoRef hosted by the American Geosciences Institute (<http://iodp.americangeosciences.org/vufind>). Date ranges are categorized based on funding periods: 1968–1987 = Pre-Australian membership (indirect), 1988–2003 = Australian Ocean Drilling Program (ODP) membership; 2004–2007 = ODP/Integrated Ocean Drilling Program Phase 1 (indirect), 2008–2013 = Integrated Ocean Drilling Program ANZIC Phase 1, 2014–2015 = IODP ANZIC Phase 2 (direct), 2016–2020 = IODP ANZIC Phase 3 (direct). \* = Top three science journals (based on Clarivate Analytics journal impact factor) = Nature, Science, and Nature Geoscience. † = Next top twenty Earth science journals (determined by impact factor of journals in ISI Web of Knowledge categories related to Earth science) = Earth-Science Reviews; Proceedings of the National Academy of Sciences of the United States of America; Geology; Earth and Planetary Science Letters; Global and Planetary Change; Geochimica et Cosmochimica Acta; Geological Society of America Bulletin; Geophysical Research Letters; Journal of Petrology; Marine and Petroleum Geology; Climate of the Past; Sedimentology; Quaternary Science Reviews; Contributions to Mineralogy and Petrology; Chemical Geology; Lithos; Tectonophysics; Journal of Geophysical Research (including Solid Earth and Oceans); Geochemistry, Geophysics, Geosystems; and Organic Geochemistry. Criteria for country-specific queries were the journal International Standard Serial Number (ISSN), the date ranges

Scientific ocean drilling publications\* including authors representing Australia or New Zealand compared to all scientific ocean drilling publications produced internationally.

Date of publication	Publications with an author representing Australia	Publications with an author representing New Zealand	Total publications with an author representing Australia and/or New Zealand	Total scientific ocean drilling publications	Percentage of publications with an author representing Australia and/or New Zealand
1968–1987	223	181	290	9,085	3.2
1988–2003	2,192	150	2,309	13,830	16.7
2004–2007	330	87	385	3,788	10.2
2008–2013	385	239	586	5,394	10.9
2014–2015	233	105	297	2,114	14.0
2016–2020†	459	239	650	4,174	15.6
<b>Total</b>	<b>3,832</b>	<b>1,007</b>	<b>4,532</b>	<b>38,542</b>	<b>11.8</b>

**Notes:** This table was prepared in October 2021 by International Ocean Discovery Program (IODP) Publication Services based on data in the Scientific Ocean Drilling Bibliographic Database, a subset of GeoRef hosted by the American Geosciences Institute (<http://iodp.americangeosciences.org/vufind>). The criteria for the country-specific queries were the date ranges listed and institutional affiliation containing the words "Australia" or "New Zealand." Date ranges are categorized based on funding periods: 1968–1987 = Pre-Australian membership (indirect), 1988–2003 = Australian Ocean Drilling Program (ODP) membership; 2004–2007 = ODP/Integrated Ocean Drilling Program Phase 1 (indirect), 2008–2013 = Integrated Ocean Drilling Program ANZIC Phase 1, 2014–2015 = IODP ANZIC Phase 2 (direct), and 2016–2020 = IODP ANZIC Phase 3 (direct). \* = Totals include peer-reviewed articles in science journals; published conference proceedings and abstracts; books and chapters in books; theses; and Deep Sea Drilling Program, ODP, Integrated Ocean Drilling Program, and IODP publications. † = Statistics for 2020 only reflect citations that were added to the database by June 2021 and may not represent a complete total of 2020 publications.



# 2020 Outputs Authored by ANZIC Members



In 2019 ANZIC members produced 100+ scientific outputs, including publications and presentations. The following alphabetical list includes records from the Scientific Ocean Drilling Bibliographic Database (<http://iodp.americangeosciences.org/vufind/>) and the IODP publications website (<http://publications.iodp.org/index.html>) as of November 2021 that were published in 2020, with ANZIC members highlighted in bold type.

A 60 000-year record of environmental change for the wet tropics of north-eastern Australia based on the ODP 820 marine core, by **Moss, Patrick T.; Dunbar, Gavin B.; Thomas, Zoe; Turney, Chris; Kershaw, A. Peter; Jacobsen, Geraldine E.** Published in 2017, doi: 10.1002/jqs.2977

Across-arc diversity in rhyolites from an intra-oceanic arc; evidence from IODP Site U1437, Izu-Bonin rear arc, and surrounding area, by Heywood, Luan J.; DeBari, Susan M.; Gill, James B.; Straub, Susanne M.; Schindlbeck-Belo, Julie C.; Escobar-Burciaga, Ricardo D.; **Woodhead, Jon.** Published in 2020, doi: 10.1029/2019GC008353

Assessment and integration of bulk and component-specific methods for identifying mineral magnetic assemblages in environmental magnetism, by **Qian, Yao; Roberts, Andrew P.; Liu Yan; Hu, Pengxiang; Zhao, Xiang; Heslop, David; Grant, Katharine M.; Rohling, Eelco J.;** Hennekam, Rick; Li Jinhua. Published in 2020, doi: 10.1029/2019JB019024

Bioerosion traces in the Great Barrier Reef over the past 10 to 30 kyr, by **Patterson, Madhavi A.; Webster, Jody M.; Hutchings, Pat;** Braga, Juan-Carlos; Humblet, Marc; Yokoyama, Yusuke. Published in 2020, doi: 10.1016/j.palaeo.2019.109503

Cenozoic increase in subduction erosion during plate convergence variability along the convergent margin off Trujillo, Peru, by Herbozo, Gery; Kukowski, Nina; Clift, Peter D.; **Pecher, Ingo;** Bolaños, Rolando. Published in 2020, doi: 10.1016/j.tecto.2020.228557

Constraining the age and evolution of the Tuaheni Landslide complex, Hikurangi Margin, New Zealand, using pore-water geochemistry and numerical modeling, by Luo Min; Torres, Marta E.; Kasten, Sabine; **Mountjoy, Joshu J.** Published in 2020, doi: 10.1029/2020GL087243

Continental-scale geographic change across Zealandia during Paleogene subduction initiation, by **Sutherland, R.;** Dickens, G. R.; Blum, P.; Agnini, C.; Alegret, L.; Asatryan, G.; Bhattacharya, J.; Bordenave, A.; Chang, L.; Collot, J.; Cramwinckel, M. J.; Dallanave, E.; Drake, M. K.; Etienne, S. J. G.; Giorgioni, M.; Gurnis, M.; Harper, D. T.; Huang, H. H. M.; Keller, A. L.; Lam, A. R.; Li, H.; Matsui, H.; Morgans, H. E. G.; Newsam, C.; Park, Y. H.; **Pascher, K. M.;** Pekar, S. F.; Penman, D. E.; Saito, S.; **Stratford, W. R.;** Westerhold, T.; Zhou, X. Published in 2020, doi: 10.1130/G47008.1

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Coral record of Younger Dryas Chronozone Warmth on the Great Barrier Reef, by Brenner, Logan D.; Linsley, Braddock K.; **Webster, Jody M.;** Potts, Donald; Felis, Thomas;

**Gagan, Michael K.;** Inoue, Mayuri; **McGregor, Helen;** Suzuki, Atsushi; Tudhope, Alexander; **Esat, Tezer;** Thomas, Alex; Thompson, William; **Fallon, Stewart;** Humblet, Marc; Tiwari, Manish; Yokoyama, Yusuke Published in 2020, doi: 10.1029/2020PA003962

Coupled evolution of stable carbon isotopes between the Southern Ocean and the atmosphere over the last 260 ka, by Hu Rong; **Bostock, Helen C.;** Greaves, Mervyn; Piotrowski, Alexander M.; McCave, I. Nicholas. Published in 2020, doi: 10.1016/j.epsl.2020.116215

Data report; Evaluation of shipboard magnetostratigraphy by alternating field demagnetization of discrete samples, Expedition 361, Site U1475, by Just, Janna; Hall, Ian R.; Hemming, Sidney R.; LeVay, Leah J.; Barker, Stephen R.; Berke, Melissa A.; **Brentegani, Luna;** Caley, Thibaut; Cartagena-Sierra, Alejandra; Charles, Christopher D.; Coenen, Jason J.; Crespin, Julien G.; Franzese, Allison M.; Gruetzner, Jens; Han Xibin; Hines, Sophia K. V.; Espejo, Francisco J. Jimenez; Koutsodendrís, Andreas; Kubota, Kaoru; Lathika, Nambiyathodi; Norris, Richard D.; dos Santos, Thiago Pereira; Robinson, Rebecca; Rolison, John M.; Simon, Margit H.; Tanguan, Deborah; van der Lubbe, Jeroen J. L.; Yamane, Masako; Zhang Hucai, Published in 2020, doi: 10.14379/iodp.proc.361.202.2020

Data report; Isotopic records for carbonate and organic fractions from IODP Expedition 369, Hole U1515A by Quan, Tracy M.; Wu, Tao; Hobbs, Richard W.; Huber, Brian T.; Bogus, Kara A.; Batenburg, Sietske J.; Brumsack, Hans-Jürgen; Guerra, Rodrigo do Monte; Edgar, Kirsty M.; Edvardsen, Trine; Garcia Tejada, Maria Luisa; Harry, Dennis L.; Hasegawa, Takashi; Haynes, Shannon J.; Jiang Tao; Jones, Matthew M.; Kuroda, Junichiro; Lee, Eun Young; Li Yongxiang; MacLeod, Kenneth G.; **Maritati, Alessandro;** Martinez, Mathieu; O'Connor, Lauren K.; Petrizzo, Maria Rose; Richter, Carl; Riquier, Laurent; Tagliaro, Gabriel T.; **Wainman, Carmine C.;** Watkins, David K.; **White, Lloyd T.;** Wolfgring, Erik; Xu Zhaokai. Published in 2020, doi: 10.14379/iodp.proc.369.201.2020

Data report; Petrology and volcanic stratigraphy at Site U1513, IODP Expedition 369, by Tejada, Maria Luisa G.; Lee, Eun Young; Chun, Seung Soo; Harry, Dennis L.; Riquier, Laurent; **Wainman, Carmine C.** Published in 2020, doi: 10.14379/iodp.proc.369.202.2020

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Depositional and erosional signatures in sedimentary successions on the continental slope and rise off Prydz Bay, East Antarctica; implications for Pliocene paleoclimate by Huang Xiaoxia; Bernhardt, Anne; De Santis, Laura; Wu Shiguo; Leitchenkov, German; Harris, Peter; **O'Brien, Philip.** Published in 2020, doi: 10.1016/j.margeo.2020.106339

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The earliest stage of Izu rear-arc volcanism revealed by drilling at Site U1437, International Ocean Discovery Program Expedition 350, by Sato, Tomoki; Miyazaki, Takashi; Tamura, Yoshihiko; Gill, James B.; **Jutzeler, Martin;** Senda, Ryoko; Kimura, Jun-ichi. Published in 2020, doi: 10.1111/iar.12340

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Eocene to Miocene subduction initiation recorded in stratigraphy of Reinga Basin, northwest New Zealand by **Orr, D.;** **Sutherland, R.;** **Stratford, W. R.** Published in 2020, doi: 10.1029/2019TC005899

Evidence for non-marine Jurassic to earliest Cretaceous sediments in the pre-breakup section of the Mentelle Basin, southwestern Australia by **Wainman, Carmine C.;** **Borissova, Irina;** Harry, Dennis L.; Hobbs, Richard W.; **Mantle, D. J.;** **Maritati, Alessandro;** Lee, E. Y. Published in 2020, doi: 10.1080/08120099.2019.1627581

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The evolving paleobathymetry of the Circum-Antarctic Southern Ocean since 34 ma; a key to understanding past cryosphere-ocean developments, by Hochmuth, Katharina; Gohl, Karsten; Leitchenkov, German; **Sauermilch, Isabel;** **Whittaker, Joanne M.;** Uenzelmann-Neben, Gabriele; **Davy, Bryan;** De Santis, Laura Published in 2020 doi: 10.1029/2020GC009122

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Late Cretaceous (99-69 Ma) basaltic intraplate volcanism on and around Zealandia; tracing upper mantle geodynamics from Hikurangi Plateau collision to Gondwana breakup and beyond by Hoernle, Kai; Timm, Christian; Hauff, Folkmar; **Tappenden, V.**; Werner, Reinhard; Jolis, Ester Muñoz; **Mortimer, N.; Weaver, Steve D.**; Riefstahl, Florian; Gohl, Karsten Published in 2020, doi: 10.1016/j.epsl.2019.115864

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Late Cretaceous stratigraphy and paleoceanographic evolution in the Great Australian Bight Basin based on results from IODP Site U1512 by K. MacLeod, **L. White, C. Wainman**, Martinez M., M. M. Jones, J.Batenburg, L. Riquier, S.J. Haynes, D.K. Watkins, K.A. Bogus, H.-J. Brumsack, R. do Monte Guerra, K.M. Edgar, T. Edvardsen, D.L. Harry, T. Hasegawa, R.W. Hobbs, B.T. Huber, T. Jiang, J. Kuroda, E.Y. Lee, Y.-X.Li, **A. Maritati**, L.K. O'Connor, M.R. Petrizio, T.M. Quan, C. Richter, M.L.G. Tejada, G. Tagliaro, E. Wolfgring, Z. Xu : out in Gondwana Research doi:10.1016/j.gr.2020.01.009

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