

Featured Scientist: Dr Roz Coggon

Dr Rosalind Coggon is a Royal Society University Research Fellow in the School of Ocean and Earth Science at the University of Southampton. Her research focuses on the role of fluids in the formation and evolution of the ocean crust, with a particular emphasis on quantifying the thermally driven chemical exchanges between the aging ocean crust and the overlying oceans and the consequences of hydrothermal fluid-rock interaction for the properties of ocean crust and sea water over time. Dr Coggon is Co-Lead Editor of the recently published 2050 Science Framework: Exploring Earth by Scientific Ocean Drilling [<https://iodp.org/2050-science-framework>], which will guide future scientific ocean drilling beyond 2023.



How did you first become involved in scientific ocean drilling?

In the very early stages of my PhD research I used ODP samples from Leg 168, to learn geochemical techniques in the lab. The results of this initial study led to my longer-term interest in carbonate veins in ocean crust and how they can be used to reconstruct past ocean chemistry. Then, one year into my PhD I got the opportunity to sail on ODP Leg 206. I sailed as a metamorphic petrologist but I also became the lead sedimentologist on board, responsible for writing the sedimentology report (because it was a hard rock expedition there was no dedicated sedimentologist sailing. Being willing to take on this role outside my area of expertise allowed me to contribute more to the team and it was also a really useful learning experience.

How have you continued your journey in scientific ocean drilling?

Later in my PhD I sailed on Expedition 301 (the first expedition of IODP!) as a petrologist and geochemist, once again helping to characterise the sedimentary as well as metamorphic and igneous rocks. I was also a proponent for “SuperFast 2&3”, the return to site 1256 (originally drilled on ODP Leg 206). The proposal was successful and in 2005 IODP expeditions 309 and 312 returned to continue drilling at this site. I sailed on Expedition 312 as a US scientist as I had accepted a postdoc at the University of Michigan, and I finished writing my thesis on board the JR on Christmas Day, just before we transited through the Panama Canal!



Dr Coggon beginning her ocean drilling journey, onboard the JOIDES Resolution on ODP Leg 206

“I see ocean drilling as a parallel to the space programme. We are doing the same thing – making new measurements and taking new samples from places that people haven’t been to before.”

All of my subsequent research has made use of IODP samples, both from cruises that I sailed on and others from the extensive scientific ocean drilling archives. In 2010 I became a Royal Society Dorothy Hodgkins Fellow, investigating natural CO₂ sequestration in ocean crust using Ocean Drilling samples. Since autumn 2018 I have been a Royal Society University Fellow, using sections of ocean crust recovered along age transects by ocean drilling, in order to quantify hydrothermal contributions to global cycles.

I also served as the UK IODP Renewal Fellow in 2017-18, responsible for compiling evidence for the successful case for renewal (led by Damon Teagle) of the UK’s subscription to IODP for the next 10 years.

I have been a proponent for various proposals, including “SuperFast 4”, which led to another return to site 1256 while I was on maternity leave, and the “M2M Moho to Mantle” mission. I was the lead proponent of IODP proposal 853, which led to Expeditions 390 and 393, which will drill a South Atlantic Transect – a multidisciplinary scientific ocean drilling project. This project will recover complete sedimentary sections and the upper ~250 m of the underlying oceanic crust along a slow/intermediate spreading rate Mid-Atlantic Ridge crustal flow line at ~31°S to investigate: the history of the low-temperature hydrothermal interactions between the aging ocean crust and the evolving South Atlantic Ocean and quantify past hydrothermal contributions to global geochemical cycles; sediment and basement-hosted microbial community variation with increasing substrate age; the paleoceanographic evolution of the South Atlantic Ocean; and the deep-ocean and subtropical gyre responses to changing global climate. It was of course a great disappointment when Expeditions 390 and 393 had to be rescheduled because of the challenges of getting the shipboard science party to the ship as a result of Covid-19. However, it is fantastic that the JR is currently conducting engineering work (Exp 390C) installing re-entry cones and casing in preparation for the South Atlantic Expeditions – thanks to the extraordinary efforts of the JOIDES Resolution Science Operator. Having seen glimpses of the intriguing cores of the sediment-basement interface already recovered at

Sites 1556 and 1557 I am really excited to sail as Co-chief scientist on Expedition 390 and core further into basement. More details on the South Atlantic Transect, and updates on the progress of Exp 390C can be found here: http://iodp.tamu.edu/scienceops/expeditions/south_atlantic_transect.html

How has scientific ocean drilling impacted your career?

It is my career! Scientific ocean drilling has expanded the scientific scope of my research. In my PhD I initially used ophiolite samples, but getting involved in ODP provided a much wider range of sample material to work on and as a result it enabled me to better address the global role of crustal aging in the long-term evolution of the Earth system. But I think probably an even greater impact has come from the opportunities to receive mentoring and connect with international colleagues, which have led to postdocs and fellowships and facilitated my career pathway, and furthermore, the opportunities to take a leading role in scientific endeavours while still an ECR (e.g. leading research groups on the ship, writing proposals, convening workshops and meetings), including at a programme level, shaping the programme itself and the future of scientific ocean drilling.

What is your favourite thing about being involved in scientific ocean drilling?

Being an explorer and going to places no one has ever been before and seeing things no one has ever seen. When I put my finger on the dyke-gabbro boundary the first time it was ever recovered from in situ ocean crust I knew that we were the first people to ever see it! I see ocean drilling as a parallel to the space programme. We are doing the same thing – making new measurements and taking new samples from places that people haven't been to before. Scientific ocean drilling is exploring with a purpose, not just for the sake of discovery, but it is exploring all the same. There are always surprises and you never know what you will find so it is always exciting! Even with the best geophysical surveys and robust hypotheses there are always uncertainties and until you ground truth with core, we don't know, and I like finding out!

I also really enjoy meeting current PhD students, seeing their enthusiasm for ocean drilling and encouraging them to get involved, because it has done so much for me and I want to share that. I love that the programme lets PhD students and ECRs do so much, they just have to embrace it and put themselves out there. It's the one environment where I've worked where I haven't been told that I can't do something yet because I'm not senior enough.



“Exploring” the dyke-gabbro transition during IODP Expedition 312

“Working with experts in different fields I gained a new appreciation for the importance of all that scientific ocean drilling has contributed and will contribute to, beyond my own area of expertise.”

The New 2050 Science Framework

What is the purpose of the Science Framework?

The Science Framework is a document that forms the foundation for scientific ocean drilling from 2023 to 2050. It is designed to inspire new approaches and guide multidisciplinary scientific research below the seafloor, helping researchers to identify important science questions that can only be answered by scientific ocean drilling. Put simply it should help scientists to formulate research questions that they should be proposing to address through future drilling expeditions.

How did you get involved in developing the Framework?

In 2019 the various member consortia of IODP decided to hold a series of international workshops to respond to the challenge of building a programme to be a successor to IODP, and to develop a Science Plan for what that programme would do, as the current Science Plan was written for the period from 2013 to 2023. ECORD decided to convene the PROCEED Workshop in Vienna in April 2019 as part of this series, with the aim of initiating concepts and defining new goals for a future international scientific ocean drilling programme to be developed beyond 2023. The organising committee of executives nominated a science committee to convene the workshop and I was nominated as one of five UK members of the 17-person science committee. I was subsequently nominated by that group to co-chair the workshop along with Michi Strasser (University of Innsbruck).



Coggon speaking at the PROCEED Workshop in Vienna, 2019

Representatives from each of the six international workshops were asked to join the Science Framework Working Group, which met in New York in July 2019. At that meeting we looked for synergies in outcomes from all six workshops as a basis for the structure of the Framework and a road map to producing it. The outcomes were discussed and endorsed by the IODP Forum in Osaka in September 2019. The Working Group then nominated Anthony Koppers (Oregon State University) and me to be Co-Lead Editors, tasked with establishing an international writing and review group to write the framework, seek and implement feedback in two rounds of community review and work with a professional writer

and illustrator to produce a fully formatted framework document. I enjoyed contributing to writing sections, editing large portions and developing many graphics, from scratch or in collaboration with other scientists and the professional illustrator.

What were the challenges and rewards of the experience for you?

It was extremely challenging working on such a short timeframe and doing much remotely due to the pandemic. It was also hugely rewarding putting together a document that will shape the future of ocean drilling far beyond my career. I learnt so much from the experience. Working with experts in different fields to understand the challenges in those areas I gained a new appreciation for the importance of all that scientific ocean drilling has contributed and will contribute to, beyond my own area of expertise. I also found it a very educational experience working with a professional writer and, from the strategy side, working out how to take something broad and all-encompassing and put it together in a coherent plan without dividing it into blocks whilst making sure everything was included in a logical way.

How does the new Science Framework differ from the previous Science Plan?

As it is a framework rather than a plan it is drastically different in structure, focussed on the science, not its implementation. It is being put in place prior to the programmes that will implement it and is the foundation on which those programmes will be built. It is the justification for developing those new programmes. The biggest difference is that the new Framework is much longer-ranging (multi-decadal rather than only one decade), designed to be relevant across multiple program cycles; this means it needs to be maintained, evaluated and revised over its lifespan. It has been designed to be purposefully broad and open to allow innovation and evolution of the science and to be as all-encompassing as possible. This has implications for how the community will develop proposals and monitor our successes. Fundamentally, it focusses on multi-disciplinary science and interconnected Earth processes with an emphasis on science with societal impact and of interest. The longer timespan allows for inclusion of flagship initiatives that will inherently require co-ordinated multi-expedition strategies to achieve ambitious scientific goals.

How did the wider ocean drilling community engage with the development of the Framework?

The first request for community input was made in August 2019, with the opportunity for all to review the roadmap that the Framework Working Group had put together showing the structure and strategy for developing the document. The feedback we received, along with IODP forum discussions, led to refinement of the proposed Framework structure.

In February 2020 we shared a first draft of the Framework and welcomed the very constructive reviews and useful feedback (a database of thousands of comments!) from the community. This round of community review was focussed on the science content and helped us to make sure the science was correct and complete and to identify missing content. In July 2020 a second, fully formatted draft document was shared and again we received extensive community feedback that helped us to refine the graphics used to illustrate the text and to refine the scientific content and writing.

We are tremendously grateful for the thousands of community comments we received in each round of review. Thank you to everyone who took the time to review the drafts!

What are your hopes for the Framework moving forward?

I hope that people will read it and enjoy it!

I hope that it will inspire new and exciting ideas for expeditions but also help people to come together and better appreciate what other members of our very diverse community are working on, because it has certainly helped me to do that.

I hope that in the next 28 years many of the ambitious ideas in the Framework will come to fruition, but that will only happen if the community takes up the baton to build a new Drilling Programme beyond 2023, supported by lots of exciting proposals that will drive the science forwards. Probably the most important thing about the Framework is that it was produced by the community, for the community. Scientific Ocean Drilling will remain a bottom - up programme that requires scientists to propose expeditions to realise the community's ambitions as outlined in the Framework.