

Bamboo coral colonised by basket star (top right), goose barnacles, anemones, and cup coral (centre left). Leeuwin scarp, 628 m. © Schmidt Ocean Institute

# Marine Geochemistry

with Associate Professor Julie Trotter,  
Professor Malcolm McCulloch  
and Dr Paolo Montagna

## Talking points

### KNOWLEDGE

1. What are geochemical proxies?
2. What kind of sample does a CTD-Rosette system collect?

### COMPREHENSION

3. Why is the Southern Ocean one of the world's windiest places?
4. Why is the Southern Ocean important?
5. How do phytoplankton help mitigate against climate change?

### APPLICATION

6. In some coral species, the ratio of lithium/magnesium that they take into their skeletons is dependent on the temperature of the surrounding seawater. How could you use this information to learn about the past?
7. Imagine you are an expert on deep-sea ecosystems. How could you work with scientists from other disciplines to advance your research?

### ANALYSIS

8. What are the challenges of working on a research vessel, and how might new technology reduce these?
9. What role has cross-disciplinary collaboration played in Julie, Malcolm and Paolo's research?

### SYNTHESIS

10. How could Julie, Malcolm and Paolo's research into the Southern Ocean be used in the global effort to understand and predict the impacts of climate change?
11. Imagine you are a researcher studying ocean circulation and CO<sub>2</sub> exchange between the ocean and atmosphere. How could the team's research inform your own?

### EVALUATION

12. How important do you think this research could be in the context of global climate change and food security?
13. Cross-disciplinary collaboration has been vital for Julie, Malcolm and Paolo. How do you think this approach could be used outside of the scientific world?

## Activity

### Write your own blog from on-board RV *Falkor*

Julie, Malcolm and Paolo have provided some details about what life is like on board a research vessel like the Schmidt Ocean Institute's RV *Falkor*:

- The day starts at 6:30 am with a meeting between the Chief Scientist and ship's Captain and executive officers.
- The Chief Scientist meets with science crew to discuss the operations and work that will be conducted that day and evening, and what resources will be required.
- Some of the day-time jobs include launching the CTD-Rosette system, launching the ROV to conduct site surveys and to collect samples, and analysing seawater samples on retrieval of the CTD-Rosette system.
- Evening jobs include continuing the seawater analyses, preparing the samples brought back by the ROV (labelling, photographing, cleaning, drying and archiving), planning for the next day's tasks (including the ROV sites to decide where the ship should go next), ongoing bathymetric mapping, processing data, generating bathymetry maps to find new dive sites, and establishing seawater compositional profiles.
- The ship is operational 24 hours a day, seven days a week. There is always something going on, so time on board involves early mornings and night shifts.





- Rough weather can often be a problem, particularly in the Southern Ocean. Gear can break and dive sites can become inaccessible, so it is important to be adaptable.
- Living conditions are not private. You share small cabins and bathrooms with colleagues.
- While the days are busy and demanding, with many different tasks going on at the same time, every day is rewarded by a new discovery!

Imagine you are a research scientist on board the RV *Falkor*. One of your jobs is to write a blog so that people can keep up to date with how the research voyage is going. The aim of this blog is to give people a realistic idea of what life as a research scientist on board RV *Falkor* is like, and also to communicate some of the science that the team is investigating.

Write a week's worth of blog posts that achieves this aim. Use the information above as a basis for your blog, and refer to the research information in Julie, Malcolm and Paolo's article.

Be creative and have some fun with your writing. Think about:

- What you would find rewarding about life on board a research vessel. For example, what would you enjoy about experiencing this unusual environment? How would you feel if you discovered new and rarely seen habitats? How would you feel knowing you were working towards the global effort of understanding climate change and its impacts?
- What you would find challenging. For example, how would you feel working so far from home? How would you cope with the unusual living conditions?

## More resources

- The Italian National Research Council has a project called 'Il Linguaggio della Ricerca' which means 'The Language of Research'. The project includes classroom seminars and other initiatives for middle and high schools: [cnr.it](http://cnr.it)
- The Schmidt Ocean Institute provides education programmes which include opportunities to connect to their SOI ship-to-shore programme: [schmidtocean.org/education](http://schmidtocean.org/education)  
View SW Australian canyon cruises FK150301 (2015) and FK200126 (2020) via: [schmidtocean.org/cruises](http://schmidtocean.org/cruises)
- At The University of Western Australia, graduate programmes include the multi-disciplinary 'Masters of Ocean Leadership' for those interested in expanding opportunities in marine management:  
[www.uwa.edu.au/study/courses/master-of-ocean-leadership](http://www.uwa.edu.au/study/courses/master-of-ocean-leadership)  
Also check school websites for announcements for summer schools and internships.
- Marine Parks Australia:  
[parksaustralia.gov.au/marine/parks/south-west](http://parksaustralia.gov.au/marine/parks/south-west)
- Some journal articles for you to explore:
  - McCulloch, M et al. 2012. Nature Climate Change. DOI: [10.1038/NCLIMATE1473](https://doi.org/10.1038/NCLIMATE1473)
  - Montagna, P. et al. 2014. Geochimica et Cosmochimica Acta. DOI: [10.1016/j.gca.2014.02.005](https://doi.org/10.1016/j.gca.2014.02.005)
  - Trotter et al. 2019. Frontiers in Marine Science. DOI: [10.3389/fmars.2019.00173](https://doi.org/10.3389/fmars.2019.00173)
  - Trotter et al. 2022. Progress in Oceanography. DOI: [10.1016/j.pocean.2022.102904](https://doi.org/10.1016/j.pocean.2022.102904)
  - Trotter et al. 2022. Quaternary Science Advances. DOI: [10.1016/j.qsa.2022.100052](https://doi.org/10.1016/j.qsa.2022.100052)