

Hydrothermal Circulation and Seawater Chemistry: What's the chicken and what's the egg?

15-19 May 2023 | Agros, Cyprus

Prepared by Ann G. Dunlea, co-convenor

Executive Summary

The chemical evolution of the ocean plays a critical role in many aspects of the Earth system across all timescales, and the same is likely to be true on any habitable planet. In terms of inputs to the ocean, it has long been accepted that environmental conditions affect chemical fluxes from the continents and these have commonly been considered the key drivers of changing ocean chemistry. Recent studies, however, have suggested that environmental conditions are also critical in controlling chemical exchange between seawater and the underlying ocean crust through changes in hydrothermal fluxes. Likewise, there has recently been increased interest in the role of low-temperature hydrothermal circulation (a.k.a., seafloor weathering) in the major ion balance of seawater, and its role in the long-term carbon cycle and climate regulation both on Earth and “waterworld” exoplanets. These types of questions about the cause-and-effect relationships between hydrothermal fluxes, seawater chemistry and Earth system evolution motivated the meeting which aimed to gather a broad community of scientists with interests in ocean chemistry and Earth system evolution.

On May 15-19, 2023, an AGU Chapman Conference titled “Hydrothermal Circulation and Seawater Chemistry: What's the chicken and what's the egg?” was held to address these scientific themes. The meeting participants explored and discussed both the role that hydrothermal systems play in ocean chemistry, as well as the role that ocean chemistry plays in the chemical evolution of hydrothermal systems. We stimulated discussion among people who traditionally work in disparate sub-disciplines of the Earth Sciences, and sparked ideas for new interdisciplinary research. Our meeting included sessions addressing the following broad questions:

1. What processes and boundary conditions control high-temperature hydrothermal fluxes?
2. What processes and boundary conditions control low-temperature hydrothermal fluxes?
3. How do hydrothermal fluxes vary in space and time in the modern and recent ocean?
4. How did hydrothermal fluxes vary over the Phanerozoic under different boundary conditions?
5. What might control hydrothermal fluxes on habitable exoplanets and the early Earth?

The meeting occurred over five days with three days of oral and poster presentations, and associated discussion, and two days in the field in the Troodos ophiolite (Cyprus) – a uniquely well-preserved section of ancient oceanic crust. Overview speakers started each session providing topic introductions to ensure all participants have the background for the more detailed presentations that follow. Speakers were invited from all sub-disciplines and the meeting included a total of sixty-eight participants. Led by the co-convenors, many of the conference participants are contributing to the publication of an AGU monograph based on the discussions from this conference.

Motivation

The Earth Science community has long recognized that environmental factors strongly impact the interaction between the continents and the atmosphere and hydrosphere through, for example, important tectonic and climatic feedbacks on weathering and erosion (e.g., Urey, 1952; Walker, 1981; Berner et al., 1983). There is also widespread recognition that the precipitation of (bio)chemical sediments from the ocean (e.g., carbonates, evaporites) depends on both ocean chemistry and environmental conditions (e.g., Holland, 1972; Hay et al., 2006; Wilkinson and Walker, 1989). There has been much less research addressing how ocean chemistry, and environmental conditions more broadly, affect the chemical fluxes between the ocean and underlying oceanic crust associated with fluid-rock reaction in both on- and off-axis hydrothermal systems. However, recently numerous lines of evidence have emerged suggesting that the chemical fluxes associated with hydrothermal systems may be much more sensitive to the environmental conditions (e.g., bottom water chemistry and temperature) than has hitherto been appreciated (Brady and Gislason, 1997; Antonelli et al., 2017; Coogan and Dosso, 2015; Coogan and Gillis, 2018). Exploring the links and feedbacks between environmental conditions and hydrothermal fluxes is the focus of the proposed meeting. Scientific drilling provides the best approach to collecting the samples needed to test hypotheses about these links and feedbacks.

The accretion of new oceanic crust along the >60,000 km of mid-ocean ridges on Earth is associated with the circulation of seawater through the crust where it is chemically modified by fluid-rock reactions before being returned to the ocean. These “high-temperature” or “on-axis” hydrothermal systems generate the well-known black-smoker vents that are fed by fluids that reach temperatures of >350°C at low water-to-rock ratios (~1:1) deep in the crust at mid-ocean ridges leading to fluids that have “rock-buffered” compositions (e.g., Seyfried, 1987). However, processes operating both in the recharge zone, and in the hydrothermal plume in the water column above the ridge axis, are more seawater-dominated. For example, in the water column hydrothermal fluids are diluted ~10,000:1 by seawater before becoming non-buoyant; this means that the composition of seawater is key to the biogeochemical processes operating within hydrothermal plumes (e.g., German and Seyfried, 2014; Gartman and Findlay, 2020). These plumes can be traced 1000’s of kilometers across ocean basins away from the ridge axis and leave a fingerprint of hydrothermal inputs to the ocean in the chemistry of seafloor sediments across a similarly wide region (e.g., Boström et al., 1969; Resing et al., 2015). Off-axis hydrothermal systems, sometimes referred to as seafloor weathering, operate across much of the seafloor at temperatures typically only ~5 to 10°C above bottom water temperature. Because of the limited heating of the fluid within the crust, and large water-to-rock ratios (of the order of 1000:1), the temperature and composition of the deep ocean is thought to play a large role in controlling chemical fluxes from these systems.

Given the wide range of potential links and feedbacks that have been proposed in the last decade between ocean chemistry and hydrothermal processes it is timely to bring the research community addressing these diverse questions together. Cross-fertilization of ideas among groups working on different processes and timescales (from modern seawater chemistry transects through to the record of hydrothermal alteration in billion-year-old rocks), and from observational, experimental, and modelling perspectives, will help shape future research, especially scientific drilling, in this scientific area.

As such, we hosted an AGU Chapman Conference with sixty-eight participants (Figure 1) on 15-19 May 2023 to bring together international and diverse expertise to discuss the relationship between seawater chemistry and hydrothermal vents.

Key Workshop Highlights

- We had two and a half full days of presentations and half a day of breakout groups discussing various topics linking interdisciplinary topics (Figure 2). IODP and the scientific outcomes that have emerged from IODP were often brought up in presentations.
- Instead of more traditional breakout groups promoting discussion, we organized field excursions to view the Troodos Ophiolites, oceanic crust thrust on land. There were educational seminars presented at the various parts of the ophiolites (Figure 3) and the trip was similar to field camp. Most importantly, our goal was to provide an organic environment for scientific discussions of the previous day talks and networking opportunities. During transit to the field camp sites, participants sat with someone they didn't know on the buses, which helped foster new connections and broaden networks.
- We had members of the Cypriot Geological Survey present a talk at our meeting and helped guide our field work. They also sponsored a final group dinner for all 68 participants and a governmental official that oversees the department that includes the Cypriot Geological Survey. Their expertise about the geological wonders of Cyprus and welcoming demeanor was highly beneficial to all the conference participants.
- We also had two mingling exercises the first day. At a coffee break, each person was given a card from a deck of playing cards and had to find someone with the same card and introduce themselves. At lunch we had assigned seating, so that people were required to meet new people. Everyone participated in the mingling games and enjoyed meeting new people outside their niche field.
- The co-conveners (Sasha Turchyn of ECORD and myself) had a small presentation one day about the future of IODP and opportunities. Throughout the conference, there were discussions of how to continue research on hydrothermal systems under the reorganization of ocean drilling.
- The conference provided amazing opportunities to connect U.S. scientists with scientists from Canada, Europe, and Asia with similar interests, so that perhaps international scientific opportunities and collaborations can still be made, even if the organizations are separate.
- A conference website was created to advertise the meeting and make the scientific program public. (<https://www.agu.org/chapman-hydrothermal-circulation-seawater-chemistry>)

Outcomes and Recommendations

AGU Monograph

The conference co-conveners are coordinating with conference participants to publish an AGU Monograph based on discussions from the conference. The goal is to articulate the state of the field, to easily bring up-to-speed new researchers in the field. Ideally, it will help define requirements for future ocean drilling as well.

Networking and Mentoring

Our networking games (e.g., card matching, assigned seating at lunch, sit-with-a-stranger on the bus) played on the first day were very well received. They set the tone for the conference – to be open to meeting new people and expanding networks. I think this attitude was pervasive across the meeting and early career and more established scientists alike enjoyed the forced mingling exercises. I would highly recommend this in future conferences.

Another component of our conference that I consider a success was keeping the group of participants together during more casual break and meal times. The three days of presentations also had meal times in the hotel where tables had been designated specifically for our participants. This allowed informal networking and scientific discussions dispersed throughout the conference.

The field work and field seminars integrated into this conference also provided an incredible venue for networking and discussion groups. It is challenging to sustain attention and interest in presentations for three days straight. Our conference interspersed seminars in the conference room with seminars in the field and it was highly beneficial to the morale, enthusiasm, and attention of all participants.

Post-Conference Survey

A post-conference survey was administered to assess the participant satisfaction with the conference. There were 30 responses (out of 68 attendees). Overall, the response was extremely positive, but some room for improvement was noted.

Summary of suggestions for improvement:

Many comments reported that it would have been better to have a larger, better laid out poster hall. It was also suggested that having 3-5 minute presentations to advertise or introduce the posters would be beneficial. There were logistical concerns (e.g., communication about conference price and transportation) that should be addressed by AGU, the organizing entity. In the field, a microphone would have been beneficial. The co-conveners could have done more to ensure that some scientists were more respectful at the field sites. Visa issues prevented scientists from certain countries from attending.

Here are some quotes from participant comments that highlight their favorite parts of the conference.

- *Loved it! The non-hybrid format especially was good. Being in-person is highly preferable.*
- *Excellent mix of career stage participants. The conveners made a real effort to give students and early career stage scientists the opportunity to present, lead discussions and chair sessions.*
- *All staying in the same hotel was excellent - it allowed opportunities to meet new people and discuss science - particularly during meals*
- *This was by far my favorite AGU conference. The smaller group allowed for meaningful and helpful interactions and I am sure that some of the connections made will be carried out beyond this meeting.*
- *I think this was an excellent conference. The efforts of the organizers and local Cypriot facilitators clearly paid off. The conference location was ideal given the topic and it is clear that much effort was given to ensuring diverse participation. I especially appreciated the attendance of participants from China and*

India, which are emerging players in seafloor and oceanographic exploration, but are often excluded or marginalized in international conferences.

- *The conference was amazing and Laurence did an outstanding job of leading the field trips. Everyone I met said it was the best conference they had been to in a long while.*

Schedule AGU Chapman Conference

Table 1. Overview of Meeting Schedule.

	Monday	Tuesday	Wednesday	Thursday	Friday
Morning: 8-30 to 12-00	Session 1	Field work 1	Session 3	Field work 2	Session 5
Afternoon: 1-00 to 4-30	Session 2		Session 4		Session 6
Evening: 5-00 to 7-00	Posters		Posters		Conference dinner

Monday 15, 2023

9am – *Welcome and introductions*

Session 1: What processes and boundary conditions control high temperature (on-axis) hydrothermal fluxes?

Chaired by William Seyfried and Laurel Yohe

9:15 - *Geochemical Controls on the Composition of Hydrothermal Vent Fluids at Mid-Ocean Ridges: An Overview of Chemical and Physical Processes with Insight from New Sampling Strategies and Recent Experimental and Theoretical data. Overview talk by William Seyfried*

9:55 - *Feedbacks between tectonics and hydrothermal circulation – plausible flow scenarios for the TAG hydrothermal field. Lars Rupke*

10:15 - *Modeling of Zinc Mobilization by Magmatic-Hydrothermal Circulation in the Sub-Seafloor – Benoit Lamy-Chappuis*

10:35 – **Coffee Break and Meet Someone New**

11:20 - *Input of Isotopically Light Barium from the Rainbow Hydrothermal Vent Into the Deep Atlantic Ocean – Zhouling Zhang*

11:40 - Evaluating the fate of siderophile metals during seafloor sulfide mineralization and plume formation along Earth's hydrothermal systems: Constraints from the osmium system – Drew Syverson

12:00 - Examining Spatiotemporal Structure of Hydrothermal Plumes in the Northern Guaymas Basin with Physically-informed Probabilistic Models – Victoria Preston

12:30 – 13:30 – Lunch

Session 2: What processes and boundary conditions control low temperature (off-axis) hydrothermal fluxes?

Chaired by Rosalind Coggon and Angus Fotherby

13:30 - *Low-temperature Ridge Flank Contributions to Global Biogeochemical Cycles and Archives of Changing Global Conditions – Overview Talk – Rosalind Coggon*

14:10 - Three-dimensional Models of Hydrothermal Circulation to Constrain Crustal Permeability and Flow Rates in an Off-Axis Seamount Network – **Invited Talk** – Rachel Lauer

14:30 - Quantifying the physics of outcrop-to-outcrop flow with hydrothermal flow models – Isabel Kremin

14:50 - Seawater – basalt interactions and hydrothermal fluid flux along an off-axis transect of the Reykjanes Ridge – Justin Dodd

15:10 – **Coffee Break**

15:40 - Non-traditional isotopes ($^{26}\text{Mg}/^{24}\text{Mg}$, $^{41}\text{K}/^{39}\text{K}$) as tracers of low-temperature oceanic crust alteration: A Troodos Ophiolite case study – **Invited Talk** – Danielle Santiago Ramos

16:00 - Magnesium isotope compositions of low-T hydrothermal fluids exert new constraints on the oceanic Mg budget and point to cryptic modern dolomite formation – Netta Shalev

16:20 - Stable potassium (K) isotope systematics in hydrothermal systems: a low-temperature alteration control or something else? – Xin-Yuan Zheng

16:40 - Marine Authigenic Clay Formation and Transformation: Impact on Seawater Lithium Cycle – Sambuddha Misra (in place of Pratyusha Chanda)

17:00 – 19:30 – Posters

Tuesday 16, 2023

Everyone participated in an educational field trip directly pertinent to the topic of the conference. Along with on-site lectures and mentoring, a field guide was provided for participants that explained the geological relevance of the following stops that were made throughout the Troodos Ophiolite in Cyprus. The geologic sequences observed this day discuss the upper crust.

The Upper Crust

Stop 1.1 Sediment (carbonate and hydrothermal) directly overlying the ophiolite.

Stop 1.2 Gossan on the Kampia to Kapedes road

Stop 1.3: Holy Bishopric Tamasos and Oreinis at the Episkopeio Village (coffee/washroom)

Stop 1.4: Low temperature alteration at depth in the lavas Kamara Potamos

Stop 1.5: Seafloor weathering of the upper lavas at the Agrokipia mine site

Stop 1.6: The Agrokipia mine

Stop 1.7: Olivine phyric pillow lavas and an ancient slag deposit

Wednesday 17 May, 2023

Session 3: How do hydrothermal fluxes vary in space and time in the modern and recent ocean?

Chaired by Jessica Fitzsimmons and Lianfu Li

9:00 - Controls on metal fluxes from hydrothermal systems in the modern ocean and their impact on ocean biogeochemistry *Overview talk by Jessica Fitzsimmons*

9:40 - An assessment of the global on-axis hydrothermal element fluxes – Alexander Diehl

10:00 – Hydrothermal Impacts on Trace Element Removal in the Modern and Deglacial Oceans.
Invited Talk - Frank Pavia

10:20 – The age determination of the chemical deposits of the Perapedhi Formation will be a useful tool for decoding the hydrothermal circulation systems during the formation of the Troodos Ophiolite Complex, Cyprus - Efthymios Tsiolakis

10:40 – **Coffee Break**

11:10 – The importance of siderophores on hydrothermal iron biogeochemistry across diverse vent fields – Patrick Monreal

11:30 – Siderophores and unique organic ligands contribute to the stability and basin-scale transport of dissolved iron from diffuse hydrothermal vent systems along the Southern East Pacific Rise – Laura Moore

11:50 – Sea level changes and hydrothermal activity: Statistical evaluation of 1-100kyr variability in hydrothermal iron deposition in Juan de Fuca Ridge sediment – Jennifer Middleton

12:10 – Dissolved Manganese (III) comprises a Significant Portion of Total Manganese in High Temperature and Diffuse Hydrothermal Vent Plumes of the Southern East Pacific Rise – Jessalyn Davis

12:30 – 13:30 – Lunch

Session 4: How did hydrothermal fluxes vary over the Phanerozoic under different boundary conditions

Chaired by Lee Kump and Katherine Squires

13:30 – *Drivers for, and evidence of, variations in hydrothermal fluxes over the Phanerozoic – Overview Talk* – Lee Kump

14:10 – Balance and Imbalance in major Element Cycles – Preston Cosslett Kemeny

14:30 – Phanerozoic seawater chemistry, evolution, and climate regulation driven by tectonics and evolutionary events, through the agency of the relative role of seafloor weathering – Itay Halevy

14:50 – Uranium isotopic variations in altered mafic oceanic crust from ODP 417 and Phanerozoic Ophiolites – Joel Rodney

15:10 – **Coffee Break**

15:40 – Axial Hydrothermal Water Flux: Constraints from the Seawater Lithium Isotope Budget – **Invited Talk** – Sambuddha Misra

16:00 – From hydrothermalism to dust deposition: Tracing the Sources of Fe to the Southern Pacific Ocean over the Cenozoic – Logan Tegler

16:20 – Implications of off-axis hydrothermal alteration on the Seawater Lithium Mass and Isotope budget using marine pore-waters as archives – Juzer Shaikh

16:40 – 19:30 – Posters

Thursday 17, 2023

Everyone participated in an educational field trip directly pertinent to the topic of the conference. Along with on-site lectures and mentoring, a field guide was provided for participants that explained the geological relevance of the following stops that were made throughout the Troodos

Ophiolite in Cyprus. The geologic sequences observed this day were focused on the mid- and lower- crust and mantle.

The Mid- and Lower-Crust and Mantle

Stop 2.1 Peridotites on top of Mount Olympus

Stop 2.2 Troodos village

Stop 2.3. Plutonic rocks on the eastern flank of Mt Olympus

Stop 2.4. Troodos Geopark Visitors Center and highly serpentized peridotites

Stop 2.5. Sheeted dikes on E906

Stop 2.6. Basal lavas and uppermost dikes at Klirou bridge

Friday 19 May, 2023

Session 5: What might control hydrothermal fluxes on billion year timescales in the Precambrian and habitable exoplanets?

Chaired by Ben Tutolo and Robin Wolf

9:00 – Geochemical and geophysical controls on hydrothermal fluxes on habitable worlds -
Overview talk by Ben Tutolo

9:40 – The development and applications of insitu Raman probes for the deep-sea hydrothermal systems – **Invited Talk** – Xin Zhang

10:00 – Nutrient Transition Metals and Metalloids in Seafloor Hydrothermal Vent Fluids – Guy Evans

10:20 – Phosphorus Release through Low-Temperature Hydrothermal Alteration on Waterworld Exoplanets – Adam Stone

10:40 – **Coffee Break**

11:10 – Low-Temperature Hydrothermal Circulation in the Early Archaean: Formation of Barite from Sulfate-Poor Seawater – Desiree Roerdink

11:30 – Climate Regulation by Hydrothermal Fluxes on the Early Earth and Exoplanets **Invited Talk** – Joshua Krissansen-Totton

11:50 – Modelling seawater-basalt interaction under variable chemical, T, and fO₂ boundary conditions – Lou Derry

12:10 – Introduction to the breakout sessions for after lunch

12:30 – 13:30 – Lunch

Session 6: Breakout Discussion Groups

Friday afternoon included synchronous breakout groups. Below are the questions we posed to each breakout group. Highlighted are the suggested group leaders and note takers.

What are the key physical and hydrological constraints on chemical exchange in on- and off-axis hydrothermal systems? (Possibly break into on-axis and off-axis groups)

Robin Wolf
Isabel Kremin
Aled Evans
Benoît Lamy-Chappuis
Alexander Diehl
Drew Syverson
Bob Wintsch
Wolfgang Bach
Larry Diamond
Romain Meyer
Michelle Harris
Rachel Lauer
Roz Coggon

How can we understand hydrothermal systems on the very early Earth and other rocky bodies and what role do they play in making planets habitable?

Adam Stone
Maren Walter
Marc Hesse
Preston
Desiree Roerdink
Ben Tutolo
Joshua Krissansen-Totton
Bill Seyfried

How can new observational and experimental approaches lead to a better understanding of the links and feedbacks between hydrothermal circulation and seawater chemistry? What do we need to learn to parameterize those feedbacks in models?

Victoria Preston
John Jamieson

Rebecca Greenberger
Steve Mihaly
Leila mezri
Bousquet Romain
Angus Foitherby
Christophe Galerne
Justin Dodd
Jess Fitzsimmons

What processes control particle formation, evolution and sedimentation in hydrothermal plumes and how faithfully do marine sediments record hydrothermal fluxes?

Ann Dunlea
Katherine Squires
Jenny Middleton
Hannah Robutka
Meghan Zee
Guy Evans
Frankie pavia

How can we better understand the links and feedbacks between hydrothermal circulation and seawater chemistry using isotope tracers?

Joel Rodney
Juzer Idris Shaikh
Xinyuan Zheng
Danielle Santiago Ramos
Louis Derry
Francesca Rotondo
Sambuddha Misra
Zhouling Zhang

How does ocean biogeochemistry affect hydrothermal fluxes of bioactive elements (e.g., Fe) and how would these change under different boundary conditions?

Jess Davis
Patrick Monreal
Laura Moore
Logan Tegler
Lee Kump
Laurel Yohe

List of Participants

There were sixty-eight participants at the conference, twenty-four of which were based in U.S. institutions (Figure 1; Tables 2 and 3). Amongst the U.S. scientists, there was a wide range of career stages represented, from graduate students to emeritus (Table 2). The career diversity of scientists from other countries is not available.

Table 2. List of U.S Participants at the Chapman Conference “Hydrothermal Circulation and Seawater Chemistry: What’s the chicken and what’s the egg?”

U.S. Participant	Country	EmailAddress	Participant Affiliation	Career Stage
Lee Robert Kump	United States	lkump@psu.edu	<i>Pennsylvania State University</i>	Prof
William E Seyfried	United States	wes@umn.edu	<i>University of Minnesota Twin Cities</i>	Professor
Robert P Wintsch	United States	wintsch@indiana.edu	<i>Indiana University Bloomington</i>	Emeritus
Louis A Derry	United States	lad9@cornell.edu	<i>Cornell University</i>	Prof
Marc A Hesse	United States	mhesse@jsg.utexas.edu	<i>The University of Texas at Austin</i>	Assoc Prof
Justin P Dodd	United States	jdodd@niu.edu	<i>Northern Illinois University</i>	Assoc Prof
Jessica N Fitzsimmons	United States	jessfitz@tamu.edu	<i>Texas A&M University</i>	Assoc Prof
Drew D Syverson	United States	drew.syverson@yale.edu	<i>Yale University</i>	Asst Prof
Joshua Krissansen-Totton	United States	jkt@ucsc.edu	<i>Department of Astronomy and Astrophysics, Santa Cruz</i>	Asst Prof
Xin-Yuan Zheng	United States	zhengxy@umn.edu	<i>University of Minnesota</i>	Asst Prof
Laurel Yohe	United States	lyohe1@unc.edu	<i>University of North Carolina at Charlotte, Charlotte</i>	Asst Prof
Jennifer L Middleton	United States	jennym@ldeo.columbia.edu	<i>Lamont-Doherty Earth Observatory</i>	early career
Ann G Dunlea	United States	adunlea@whoi.edu	<i>Woods Hole Oceanographic Institution</i>	early career
Danielle Priscilla Santiago Ramos	United States	santiagoramos@marine.rutgers.edu	<i>Rutgers University</i>	early career
Preston Cosslett Kemeny	United States	pkemeny@uchicago.edu	<i>University of Chicago</i>	postdoc
Guy Evans	United States	gevans@umn.edu	<i>University of Minnesota-Twin Cities</i>	postdoc
Frank J Pavia	United States	fjpavia@caltech.edu	<i>California Institute of Technology</i>	postdoc
Victoria Preston	United States	vp Preston@whoi.edu	<i>Woods Hole Oceanographic Institution</i>	postdoc
Jessalyn Davis	United States	jessad@uw.edu	<i>University of Washington</i>	postdoc
Patrick Monreal	United States	pmonreal@uw.edu	<i>University of Washington</i>	grad student
Logan Tegler	United States	ltegler@mit.edu	<i>MIT/WHOI Joint Program in Oceanography</i>	grad student
Laura Moore	United States	moore23@uw.edu	<i>University of Washington</i>	grad student
Katherine Squires	United States	katherine.squires@whoi.edu	<i>MIT/WHOI Joint Program in Oceanography</i>	grad student
Adam Stone	United States	ats5482@psu.edu	<i>Pennsylvania State University</i>	grad student

Table 3. List of international participants at the Chapman Conference “Hydrothermal Circulation and Seawater Chemistry: What’s the chicken and what’s the egg?”

International Participant		Country	EmailAddress	Participant Affiliation
Steven F	Mihaly	Canada	smihaly@uvic.ca	University of Victoria
Meghan	Zee	Canada	meghanzee@uvic.ca	University of Victoria
Benjamin M	Tutolo	Canada	benjamin.tutolo@ucalgary.ca	University of Calgary
Rachel M	Lauer	Canada	rachel.lauer@ucalgary.ca	University of Calgary
John William	Jamieson	Canada	jjamieson@mun.ca	Memorial University of Newfoundland
Laurence A	Coogan	Canada	lacoogan@uvic.ca	University of Victoria
Hannah	Robutka	Canada	hannahrobutka@uvic.ca	University of Victoria
Xin	Zhang	China	xzhang@qdio.ac.cn	Institute of Oceanology, Chinese Academy of Sciences
Lianfu	Li	China	lilianfu@qdio.ac.cn	Institute of Oceanology, Chinese Academy of Sciences
Shichuan	Xi	China	15501265293@163.com	Institute of Oceanology, Chinese Academy of Sciences
Ming	Yang	China	ming.yang@sjtu.edu.cn	Shanghai Jiao Tong University
Efthymios	Tsiolakis	Cyprus	etsiolakis@gsd.moa.gov.cy	Cyprus Geological Survey Department
Muriel	Andreani	France	muriel.andreani@univ-lyon1.fr	University Claude Bernard Lyon 1
Benedicte	Menez	France	menez@ipgp.fr	Université Paris Cité, Institut de physique du globe de Paris, CNRS, F-75005 Paris, France
Zhouling	Zhang	Germany	zzhang@geomar.de	GEOMAR Helmholtz Centre for Ocean Research Kiel
Maren	Walter	Germany	maren.walter@uni-bremen.de	University of Bremen
Wolfgang	Bach	Germany	wbach@uni-bremen.de	Faculty of Geosciences & MARUM; University of Bremen
Alexander	Diehl	Germany	dr.alexanderdiehl@gmail.com	Faculty of Geosciences & MARUM; University of Bremen
Leila	Mezri	Germany	lmezri@marum.de	MARUM - Center for Marine Environmental Sciences
Isabel	Kremin	Germany	ikremin@geomar.de	GEOMAR Helmholtz Centre for Ocean Research Kiel
Christopher	Schmidt	Germany	cschmidt@geomar.de	GEOMAR Helmholtz Centre for Ocean Research Kiel
Christophe	Galerie	Germany	cgalerne@uni-bremen.de	University of Bremen
Anna	Hagen	Germany	anna.hagen@ifg.uni-kiel.de	University of Kiel
Lars	Rupke	Germany	lrupke@geomar.de	GEOMAR Helmholtz Centre for Ocean Research Kiel
Javier	Garcia-Pintado	Germany	jgarciapintado@marum.de	MARUM - University of Bremen
Sambuddha	Misra	India	sambuddha@iisc.ac.in	Indian Institute of Science, Bangalore
Juzer	Shaikh	India	shaikhjuzer@gmail.com	Indian Institute of Science
Pratyusha	Chanda	India	pratyushac65@gmail.com	Indian Institute of Science, Bangalore
Elliot	Carter	Ireland	elcarter@tcd.ie	Trinity College Dublin
Itay	Halevy	Israel	shlomit.sharoni@weizmann.ac.il	Weizmann Institute of Science
Romain	Meyer	Luxembourg	mail@romain-meyer.eu	Service géologique du Luxembourg
Desiree L	Roerdink	Norway	desiree.roerdink@uib.no	University of Bergen
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Netta	Shalev	Switzerland	netta.shalev@erdw.ethz.ch	ETH Swiss Federal Institute of Technology Zurich
Robin	Wolf	Switzerland	robin.wolf@geo.unibe.ch	University of Bern
Larryn	Diamond	Switzerland	diamond@geo.unibe.ch	
Francesca	Rotondo	United Kingdom	F.Rotondo@southampton.ac.uk	School of Ocean and Earth Science, National Oceanography Centre Southampton, University of Southampton, European Way, Southampton, SO14 3ZH
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Aled	Evans	United Kingdom	A.Evans@southampton.ac.uk	School of Ocean and Earth Science, National Oceanography Centre Southampton, University of Southampton, European Way, Southampton, SO14 3ZH
Angus	Fotherby	United Kingdom	af606@cam.ac.uk	University of Cambridge
Michelle	Harris	United Kingdom	michelle.harris@plymouth.ac.uk	University of Plymouth
Alexandra v	Turchyn	United Kingdom	avt25@cam.ac.uk	University of Cambridge
Joel	Rodney	United Kingdom	joel.rodney@bristol.ac.uk	University of Bristol
Rosalind M.	Coggon	United Kingdom	R.M.Coggon@soton.ac.uk	School of Ocean and Earth Science, National Oceanography Centre Southampton, University of Southampton, European Way, Southampton, SO14 3ZH

Figure 1. Group photo of conference participants taken at the Troodos Geopark Visitors Center.



Figure 2. The room where the conference was held in the Rodon Hotel in Agros, Cyprus. The poster sessions was located in an adjoining room to the left of this picture.



Figure 3. An educational lecture given by co-convener Laurence Coogan at the Troodos Ophiolite.



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