

# **InterRidge: International Cooperation in Ridge-Crest Studies**

[www.interridge.org](http://www.interridge.org)



**Steering Committee Meeting 2018**

**20-22 June 2018  
Bergen, Norway**

**Jérôme Dyment, Co-Chair  
Nadine Le Bris, Co-Chair  
Kamil Szafranski, Coordinator**

**October 2018**

**InterRidge Office  
Institut de Physique du Globe de Paris  
1, rue Jussieu  
75238 Paris cedex 05  
France**

**email: [interridge@ipgp.fr](mailto:interridge@ipgp.fr)**

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### List of participants:

Chuanlun Zhang (China)  
Chair Professor  
Department of Ocean Science and Engineering  
South University of Science and Technology  
Shenzhen 518055, China  
zhangcl@sustc.edu.cn

Nadine Lebris (France, InterRidge Co-Chair)  
Universite Pierre et Marie Curie  
LECOB UPMC-CNRS UMR 8222  
Observatoire Océanologique de Banyuls,  
66650 Banyuls-sur-mer, France  
lebris@obs-banyuls.fr

Daniel Sauter (France)  
Institut de Physique du Globe de Strasbourg  
IPGS UMR7516 CNRS  
1 rue Blessig  
FR-67084 Strasbourg  
daniel.sauter@unistra.fr

Cédric Hamelin (Norway)  
Centre for Geobiology,  
University of Bergen,  
Allegaten 41, N-5007 Bergen, NORWAY  
cedric.hamelin@geo.uib.no

Steffen Leth Jørgensen  
Department of Earth Science  
University of Bergen  
Allegaten 41, N-5007 Bergen, NORWAY  
Steffen.Jorgensen@bio.uib.no

Peter Michael (USA)  
Department of Geosciences  
The University of Tulsa  
800 S. Tucker Avenue  
Tulsa, OK 74104  
pjm@utulsa.edu

Miriam Perner (Germany)  
GEOMAR Helmholtz Centre for Ocean Research Kiel  
and Christian-Albrechts Universität zu Kiel  
Wischhofstr. 1-3  
24148 Kiel, Germany  
mperner@geomar.de

John Kurian Palayil (India)  
ESSO – National Centre for Antarctic & Ocean  
Research,  
Headland Sada, Vasco-da-Gama, Goa 403804, India  
john@ncaor.gov.in, kurianjohn@gmail.com

Shinsuke Kawagucci (Japan)  
JAMSTEC  
2-15 Natsushima-cho,  
Yokosuka 237-0061, Japan  
kawagucci@jamstec.go.jp

Sung-Hyun Park (Korea)  
Korea Polar Research Institute  
Songdo Techno Park  
7-50 Songdo-dong, Yeonsu-gu  
Incheon 406-840, South Korea  
shpark314@kopri.re.kr

Jérôme Dymont (InterRidge Co-Chair, non voting)  
Géosciences Marines  
Institut de Physique du Globe de Paris & CNRS  
1 rue Jussieu,  
75238 Paris Cedex 05, France  
jdy@ipgp.fr

Anne Brias (WG Co-Chair, non voting)  
Bureau Gravimétrique International  
CNRS - Lab. Géosciences Environnement Toulouse -  
GET  
Obs. Midi-Pyrenees, 14, Ave. Edouard Belin  
31400 Toulouse, France  
anne.briais@cnrs.fr

Thibaut Barreyre (WG iMOVE leader)  
University of Bergen  
KG Jebsen Centre for Deep Sea Research  
Allegaten 41, N-5007 Bergen, Norway  
thibaut.barreyre@uib.no

Kamil Szafranski (Coordinator, non voting)  
InterRidge Office  
Institut de Physique du Globe de Paris  
1, rue Jussieu  
75238 Paris cedex 05, France  
interridge@ipgp.fr

**Absent Steering Committee Members:**

Kim Juniper (Canada)

Jiabiao Li (China)

Richard Hobbs (UK)

Dan Fornari (USA)

**Meeting Agenda Day 1, Wednesday, 20 June 2018; 9:30 – 18:30**

<b>1</b>	<b>9:30</b>	Morning coffee
<b>2</b>	<b>10:00</b>	Welcome address
<b>3</b>	<b>10:20</b>	Adoption of the Agenda, and confirm Steering Committee Members
<i>10:40 Coffee break</i>		
<b>4</b>	<b>11:00</b>	Adoption of the minutes from 2017 Steering Committee Meeting
<b>5</b>	<b>11:15</b>	InterRidge Coordinator's report
<i>12:00 Lunch, group photo</i>		
<b>6</b>	<b>13:30</b>	National updates
<b>7</b>	<b>15:40</b>	Status of Membership: 2018, 2019
<i>16:00 Coffee break</i>		
<b>8</b>	<b>16:20</b>	Working groups - updates
<b>9</b>	<b>17:00</b>	New Working groups – evaluation of proposals
<i>18:30 End of Day 1</i>		
<i>19:30 DINNER at Spisekroken</i>		

**Meeting Agenda Day 2, Thursday, 21 June 2018; 9:00 – 19:10**

<b>1</b>	<b>9:00</b>	InterRidge – SCOR, International Indian Ocean Expedition II, Goa Meeting
<b>2</b>	<b>9:30</b>	InterRidge – ISA, participation at ISA 23 <sup>rd</sup> & 24 <sup>th</sup> Session
<i>10:00 Coffee break</i>		
<b>3</b>	<b>10:20</b>	InterRidge Code of Conduct
<b>4</b>	<b>10:50</b>	InterRidge Theoretical Institute in 2019
<i>12:00 Lunch</i>		
<b>5</b>	<b>13:20</b>	InterRidge Fellowships, InterRidge Cruise Bursaries
<b>6</b>	<b>14:20</b>	Budget 2017, 2018, and preliminary budget 2019
<i>15:30 Coffee break</i>		
<b>7</b>	<b>15:50</b>	Discussion: How to improve InterRidge? Following the questions of B. Murton and D. Fornari
<b>8</b>	<b>17:20</b>	Bid for next InterRidge Office
<b>9</b>	<b>17:50</b>	Next Steering Committee meeting location and date
<b>10</b>	<b>18:00</b>	List of actions
<b>11</b>	<b>18:15</b>	Meeting adjourns
<i>18:20 End of Day 2</i>		
<i>19:00 DINNER</i>		

**Meeting Agenda Day 3, Friday, 22 June 2018; 9:00 – 13:30**

<b>1</b>	<b>9:00</b>	Boat trip
<b>2</b>	<b>12:00</b>	Lunch
<i>13:30 End of Day 3</i>		



## **1 Welcome and introduction**

Local organizers welcomed members and guests to the University of Bergen.

## **2 Adoption of the Agenda, and confirm Steering Committee Members**

Meeting agenda has been adopted unanimously.

### Current Steering Committee members:

China – John Chen

China – Jiabiao Li

France – Daniel Sauter

France – Nadine Le Bris (also InterRidge Co-Chair)

Germany – Philipp Brandl

India – John Kurian

Japan – Shinsuke Kawagucci

Korea – Sung-Hyun Park

Norway – Rolf Pedersen

Norway – Cédric Hamelin

UK – Richard Hobbs

USA – Dan Fornari → Peter Michael (delegated)

InterRidge Co-Chair – Jérôme Dymont

InterRidge Coordinator – Kamil Szafranski

## **3 Adoption of the minutes from 2017 Steering Committee Meeting**

The agenda of the 2017 Steering Committee meeting was circulated electronically to all Steering Committee members, national representatives, Working Group Chairs and guests prior to the meeting. The 2017 meeting report can be found on the InterRidge website: [http://interridge.org/files/interridge/St\\_Comm\\_Report\\_2017\\_s.pdf](http://interridge.org/files/interridge/St_Comm_Report_2017_s.pdf)

Minutes from the previous meeting have been accepted unanimously.

#### **4 InterRidge Coordinator's report**

##### **InterRidge – International Cooperation in Ridge-Crest Studies**

Since its creation in early 1990's, [InterRidge](#) has been an international forum for mid-ocean ridge (MOR) scientists, expanded to other oceanic spreading centers and related processes. InterRidge promotes interdisciplinary studies by creating a global research community, planning and coordinating new science programs that no single nation can achieve alone, exchanging scientific information, and sharing new technologies and facilities. InterRidge plays a dual role. Its primary aim is to favor the emergence of new concepts and makes possible ambitious experiments at international level. InterRidge also supports community-wide initiatives such as the definition and dissemination of a code of conduct for scientific studies in relation to chemosynthetic hot-spot ecosystems and their vulnerable environments. More recently, with the growing interest of countries and industries for deep-sea mineral resources, including sea-floor massive sulfide (SMS) deposits at MOR, InterRidge has become a voice of expert scientists in different fora. Through its observer status at the International Seabed Authority (since 2012), particularly, InterRidge developed formal interactions with this organization created under the United Nations Law of the Sea (UNCLOS).

InterRidge scientific activities are currently led under the frame of the 3rd Decadal Plan 2014-2023 'From Ridge Crest to Deep-Ocean Trench: Formation and Evolution of the Oceanic Crust and Its Interaction with the Ocean, Biosphere, Climate and Human Society' launched in 2012. Beside its affiliation with SCOR, InterRidge program has links with international research programs such as the International Ocean Discovery Program and the International Lithosphere Project. InterRidge activity includes meetings and workshops where the advancement of scientific knowledge, new issues, methodological improvements and standardized protocols are discussed. InterRidge also dedicates itself to interact with the public, scientists and governments, and to provide a unified voice for ocean ridge researchers worldwide. While committed to the level of fundamental science, an increasing role for InterRidge is our involvement in compiling information and advice for policy makers. The multidisciplinary coverage of InterRidge working groups give the organization a key role in future discussions concerning the exploration and exploitation of mineral resources associated with Ridges, volcanic arcs and back-arcs and associated hydrothermal systems.

InterRidge has a Steering Committee comprising representatives of the member countries and of working group chairs that are scientists nominated for their expertise in a particular field. The Steering Committee meets at least once a year (the last meeting was held on 20-21 July 2017 in Paris (France), the next one is planned on 20-22 June 2018 in Bergen (Norway)). The Steering committee considers updates to its Science Plan, endorses InterRidge memberships, approves the InterRidge budget, decides on membership fees, oversees the operation of the InterRidge Office, reviews bids for the InterRidge Office and nominates the Program's chair. It also evaluates working group progress, assesses and admits/rejects working group proposals, and nominates the working group chairs.

The InterRidge contribution is 25 000 US\$ for a Principal Member country and 5 000 US\$ for a Regular Member country. Considering the present membership (China, France, Norway and USA as Principal members and Canada, Germany, India, Japan, South Korea and UK as Regular members) and the double contribution for the host country, the resulting annual budget is c.a. 150 000 US\$.

## **Achievements and changes during the last year**

### **InterRidge Office**

The InterRidge Office is hosted at the Institut de Physique du Globe de Paris (IPGP), which is responsible for the budget management and administration of the program. The French National Center for Scientific Research (CNRS) is the French institution affiliated to InterRidge and is paying the French host contribution. Jérôme Dymet ([jdymet@ipgp.fr](mailto:jdymet@ipgp.fr); IPGP - CNRS, marine geophysics) and Nadine Le Bris ([lebris@obs-banyuls.fr](mailto:lebris@obs-banyuls.fr); Sorbonne Université - CNRS, Marine ecology and marine environmental sciences) are the co-chairs of the program. Kamil Szafranski ([interridge@ipgp.fr](mailto:interridge@ipgp.fr)) is the InterRidge Coordinator since 1st April 2017. Since the final establishment of an operational office in early 2017, all the activities of InterRidge have been restarted.

### **Steering Committee**

The Steering Committee met on 20-21 July 2017 in Paris and discussed the different aspects of the InterRidge activity. The discussions and the decisions related to all matters of importance for the program (scientific strategies, actions to be taken, procedures, budget...). Below the summary of the discussions and the decisions taken:

a) Twelve voting representatives, both co-chairs and two Working Group leaders participated at the meeting. National and Working Group updates were presented by the national representatives. The coordinator summarized the activity of InterRidge Office in its report.

b) The Steering Committee has decided to support the creation of two new Working Groups (Working Group on Oceanic Transform Faults & Working Group IMOVE: Integrating Multidisciplinary Observations in Vent Environments), pending minor modifications of the proposals, and has recommended some more substantial improvements after which the three other proposals will be reconsidered, if the proponents choose to resubmit them.

c) The applications for IR/ISA Endowment Fund fellowships of Seyedeh Elnaz Naghibi, Surya Prakash and Egidio Marino have been accepted for funding, pending acceptance of the ISA. Two applications for the InterRidge Cruise Bursaries (Alexander Diehl and Zhongwei Zhao) have also been validated by the Steering Committee.

d) The application of Poland to join InterRidge as Corresponding Member has been accepted unanimously by the Steering Committee. Dr Teresa Radziejewska (University of Szczecin) will be the Polish national correspondent and will interact with the InterRidge Office.

e) The Steering Committee has accepted the budget of InterRidge for 2017 and the

preliminary budget for 2018, pending some minor modifications to the proposed funding plans.

f) The Steering Committee has discussed an improvement of IR rules for more efficiency (budget use, earlier bid for a better transition to next Office, role and rotation of National correspondents). InterRidge will start collecting ideas within the community for update of the IR Code of Conduct.

g) InterRidge has attended the 23rd Session of ISA on 8-18 August 2017 and the 24th session meeting of the ISA Council on 5-9 March 2018. The InterRidge observer status gives opportunity to discuss IR – ISA collaboration like the joint fellowships, reports on IR activity, and contribute discussions about legal questions concerning research activity in the area of permits.

h) Because of the delay in the IR Office installation in France, the Steering Committee members have agreed unanimously to postpone the Office rotation to the end of 2019, pending acceptance by the French funding agencies.

i) An InterRidge Theoretical Institute will be organized in 2019. The Office will collect ideas for such an Institute within the community and will launch its organization.

j) Norway has invited the Steering Committee meeting to take place in Bergen on 20-21 June 2018.

### **InterRidge Working Groups**

InterRidge Working Groups build small task forces to meet, brainstorm on specific topics and ultimately draft reports and plans. Working Groups convene group meetings and community-wide workshops, promote and coordinate new cruises, experiments, and related work. They generally expand their interaction with the interested community by organizing an InterRidge Workshop or a session at an international conference. Working Groups should address emerging research themes or bridge communities working on a unique geographic setting along global ridge-crests and spreading centers. New proposals should be innovative in their objectives as regard to existing or former Working Groups. They are coordinated by two co-chairs and are gathering about ten active members reflecting the national and disciplinary diversity of InterRidge, which work closely with the InterRidge Steering Committee and the InterRidge Office. Working Groups convene group meetings and community-wide workshops, promote and coordinate new cruises, experiments, and related work.

The first call for new Working Group proposals was launched on 24 April 2017 and open to the whole international community. Proposals of about two page-long describing the WG objectives, importance and timeliness to ridge-related science, available and required means, and expected achievements, should have at least four proponents from at least three InterRidge member countries. A special attention is paid to cross-disciplinary projects, although this is not mandatory. Deadline for submissions was fixed on 9th June 2017. The Office has received 5 proposals. The Steering Committee has decided to support the creation of two new Working Groups (Working Group on Oceanic Transform Faults & Working Group IMOVE: Integrating Multidisciplinary Observations in Vent

Environments), pending minor modifications of the proposals, and has recommended some more substantial improvements after which the three other proposals will be reconsidered at the next Steering Committee meeting if the proponents choose to resubmit them.

See more details in the chapter on Working Groups.

**InterRidge Info** is a e-newsletter sent to our subscribers on InterRidge-members mailing list, and is published every 2-3 weeks. It contains current and most important information to be disseminated within the InterRidge community. So far, 25 newsletters and 1 special on AGU Fall Meeting were sent (15 in 2017; 10 in 2018). Past issues, starting from 24th April 2017, can be consulted in the InterRidge Info archive at <http://interridge.org/publications>.

**Cruise Information** is a section of InterRidge website promoting the exchange of information, technologies and facilities among international research groups. All scientists are continuously invited to provide InterRidge with any details on recent or upcoming ridge-related cruises to feed the InterRidge Cruise Database.

#### **InterRidge actions for early-career scientists**

- InterRidge Fellowships promote the involvement of young scientists in international, collaborative, and interdisciplinary studies of oceanic spreading centers. The fellowships are designed to encourage international collaboration on any aspect of InterRidge science by graduate students or postdoctoral researchers, fostering long-standing partnerships for their future careers.

InterRidge announced the launch of the Student and Postdoctoral Fellowship Program on 9th May 2017. Up to 6 IR Fellowships including 3 joint IR-ISA Endowment Fund Fellowships could be granted. The Fellowships of up to 5000 US\$ each can be used for any field of research identified in the InterRidge 3rd decade plan (<http://interridge.org/thirddecade>). Applications were to be submitted to the IR Office by 13th June 2017 for the first call and by 6th November 2017 for the second call. Five applications were received after the first call (including 2 to the IR/ISA Endowment Fund fellowships) and another 5 after the second one. Fellowships have been awarded to 6 young scientists (3 at each call).

In 2018, up to 6 IR Fellowships including 1 joint IR-ISA Endowment Fund Fellowship can be granted. The Office is currently waiting for applications (deadline on 17th June 2018).

- InterRidge Cruise Bursaries

These bursaries are awarded for travel and subsistence costs to encourage new collaborations across the InterRidge member nations and to enable early-career scientists to participate to research cruises. Bursaries of up to 2 000 US\$ may serve for travel costs to join the cruise. Applicants should have a clear role on the research cruise and not be part of the original research team. Preference is given to applicants from InterRidge member countries and from countries other than those of the cruise leader. The call for IR

Cruise Bursaries was launched on 22nd May 2017. Candidates can apply at all time. Five bursaries were granted until now.

- InterRidge-related international Symposia.

The International Symposium on Chemosynthesis-Based Ecosystems is a community-wide meeting organized every 4 years (3 year for the next edition), started at the initiative of the Biology working group of InterRidge. In 2017, the 6th International Symposium on Chemosynthesis-Based Ecosystems (CBE6), organized by Woods Hole Oceanographic Institution (WHOI), took place from 27th August to 1st September in Woods Hole (Massachusetts, USA).

More than 160 participants took part in the symposium, which included 4 plenary sessions and 72 talks. A total of 68 posters were presented along with 18 selected flash talks. The program of the congress included several sessions dedicated to topics such as biogeography, biogeochemistry, chemosynthetic habitats and society, community structure and dynamics, evolution and evolutionary history, metapopulation and metacommunity (including connectivity and resilience), microbiology, physiology and adaptation, symbiosis, and trophic interactions (including chemosynthetic energy transfer). The Symposium closure included a panel discussion on Questions about current knowledge gaps and challenges for the of research on chemosynthesis-based ecosystem the deep-sea research were the main subject of the panel discussion ending the conference.

InterRidge organized an open meeting took place on 29th August. Kamil Szafranski (IR coordinator) introduced the activities of the program, with particular focus on actions supporting early career scientists. Stace Beaulieu (WHOI) presented the vent database and highlighted some aspects of its upcoming revision. Nadine Le Bris (IR co-chair) has launched the discussion about the revision of the Code of Conduct on responsible research practices at hydrothermal vents. The Symposium offered the IR office the opportunity to attend the General Assembly of the Deep-Sea Biology Society, followed by young scientist meeting. IR Office took the opportunity to present and discuss about InterRidge support initiatives to early career scientists at the DSBS young scientist meeting.

InterRidge has awarded Travel Grants to 11 students and 3 post-docs from 8 countries attending the Symposium, with the primary aim of in order to fostering exchange across fields and disciplines and promote international collaboration, by increasing the participation of early career scientists at symposia.

- Support to InterRidge Workshop on Oceanic Transform Faults

The Organizing Committee has awarded travel grants (300 - 700€) to encourage the participation of young scientists. Five attendants were supported: 3 from USA, 1 from China and 1 from Germany.

- Spare berths information is a section of InterRidge website informing about any berth availability for young scientists, that could eventually led to support request by the Cruise Bursary program. All members are asked to notify the IR Coordinator about any berths available.

## **Update of the IR website and Vent Database**

The InterRidge website ([www.interridge.org](http://www.interridge.org)) and vent database (<http://vents-data.interridge.org/>) are running at IPGP and are updated regularly since April 2017.

The InterRidge Vents Database (<http://vents-data.interridge.org/>), upgraded to Version 3.4 and revised by Stace Beaulieu ([stace@whoi.edu](mailto:stace@whoi.edu)) (supported by the [NSF Grant “Metacommunity Dynamics at Hydrothermal Vents”](#)) and in relation with the InterRidge Office, has a total of 701 records – confirmed or inferred active vent fields in the database and the corresponding kml file for visualization in Google Earth. InterRidge coordinator is progressively taking the responsibility for the Database management and updating, in connection with Stace Beaulieu.

## **Bridges between the scientific community and the society:**

- **A scientific voice to international/national agencies, policy makers, etc.**

InterRidge has built a privileged relationship with the International Seabed Authority (ISA). It is affiliated to the Scientific Committee for Ocean Research (SCOR) and has developed specific interactions through joint working groups and conferences. Through these specific relationships and new partnerships to be developed, InterRidge should be recognized as the voice of the scientific community, providing authoritative advises on societal topics such as environmental impacts of Sea-floor Massive Sulfides (SMS) exploration or exploitation.

The peculiar ecosystems found at MOR hydrothermal systems are important with respect to biodiversity, and several of such systems have been recognized as EBSA (Ecologically and Biologically Significant Areas) and are or may be later proposed as Marine Protected Areas (MPAs). InterRidge may provide decision-makers with the most accurate and recent knowledge and identify knowledge gaps to help considering the need for conservation and/or management with the necessary scientific exploration and provide relevant scientific information in the design and regulations of such MPAs.

- **23rd and 24th annual sessions of the International Seabed Authority**

Jérôme Dymont (IR co-chair) and Kamil Szafranski (IR coordinator) attended the 23rd annual session of the International Seabed Authority (ISA), held on 8-18 August 2017 in Kingston. The presence of InterRidge at the ISA Assembly and Council sessions gave the opportunity to introduce IR activities in extending our knowledge on mid-ocean ridges (e.g. working groups and workshops), disseminating information (e.g., vent database), and developing capacity building (e.g., fellowships and cruise-bursaries). InterRidge expressed its readiness to collaborate with the ISA through our collective scientific expertise, to ensure a proper balance between sustainable development and protection of the marine environment.

Both co-chairs (Nadine Le Bris & Jérôme Dymont) attended the first part of 24th Session of the Council of the ISA on 5-9 March 2018. This time, the InterRidge observer status allowed to emphasize the importance of up-to-date knowledge bases, interdisciplinary integration and international cooperation as proposed by InterRidge in supporting best

available evidence and expertise for the assessment of risks, elaboration of norms and management plans in this context. InterRidge reminded the Council "the crucial need of fundamental knowledge to answer questions on the vulnerability of ecosystems, the scales and intensity of environmental perturbations, the cumulative impacts of climate change and exploitation. This should involve all willing research teams, beyond those associated with the permit holders".

### **Outreach**

Although InterRidge does not have the resource to produce its own outreach material – a task that would be hampered by the diversity of languages in which this material should be produced – the office can play a role in facilitating attempts by Working Groups, member countries or any third party to produce media material related to MOR and ABA (e.g., papers for the general press, movies, websites...).

### **Plans for future development of InterRidge**

- maintain and reinforce **InterRidge as an efficient scientific forum**
- open new **InterRidge Working Groups**, co-organize **workshops** with current Working Groups
- organize **SCOR - InterRidge Meeting** on "Mid-Ocean Ridges and Other Geological Features of the Indian Ocean"
- update the **Code of Conduct** for responsible research at hydrothermal vent
- organize an **InterRidge Theoretical Institute**



## 5 National Updates

### France National Update 2018

*Daniel Sauter & Nadine Le Bris*

In 2018 and 2019 the French ridge community focuses its research effort over the Mid-Atlantic Ridge (MAR). The Carlsberg Ridge and the back arc basins of the western Pacific will also be visited in 2019.

The aim of the BICOSE2 cruise (PI, M.A. Cambon-Bonavita) on board the R/V *Pourquoi pas ?* in February - March 2018 was to pursue the studies initiated during the BICOSE 2014 cruise in the TAG and Snake Pit areas using the submersible NAUTILE. A fine geochemical characterization of these two deep-sea hydrothermal sites, plume and surrounding areas have been realized together with an inventory of the biodiversity in these habitats (biology and microbiology), and a description of the assemblages with regard to geochemical constraints. In vivo experiments included chemoreceptive abilities studies on shrimps and adaptation capabilities of the shrimp and symbionts to environmental modifications. Special attention has been paid to the life cycle of *Rimicaris sp.* with an *in situ* larvae and sex repartition survey and *in vivo* experimentations to test seasonality hypothesis and to appreciate adaptation/dispersion capabilities, and infer connectivity. (see <http://dx.doi.org/10.17600/18000004> and <https://wwz.ifremer.fr/L-ocean-pour-tous/Nos-ressources-pedagogiques/Suivez-nos-campagnes/Campagne-BICOSE-2>)

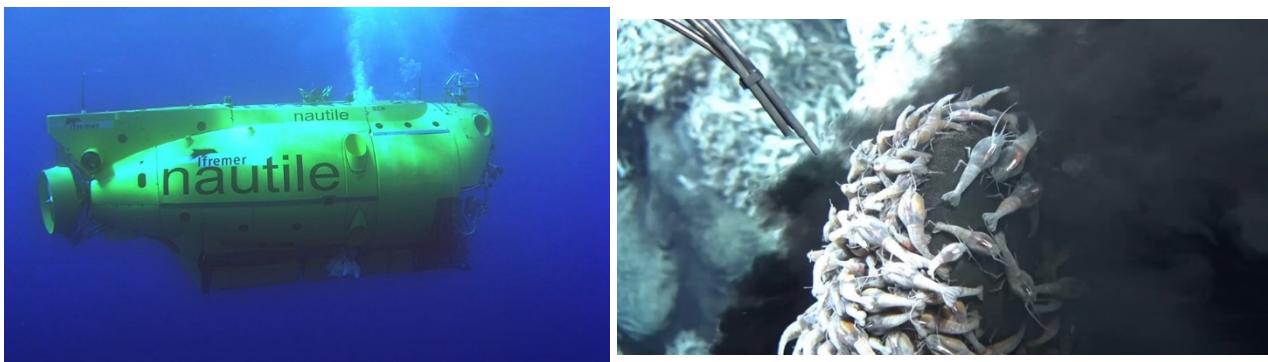


Fig: The Nautilite and a picture of *Rimicaris sp* (BICOSE2 cruise Nautilite / IFREMER 2018)

Three other deep-sea hydrothermal sites of the MAR (Lost City, Rainbow and Broken Spur) will be visited by the ROV Victor 6000 during the interdisciplinary TRANSECT cruise (PI N. Le Bris) associating ecologists (microbes and fauna), geneticists and physiologists, with marine biogeochemists and geochemists on board the R/V *L'Atalante* in July-August 2018. The aim of the cruise is to better understand the constraints on biomass formation in hydrothermal ecosystems and their influence on chemical fluxes exported by plumes. Special focus will be put on primary producers in ultramafic-hosted vent fields vs basalt-

hosted vents and on the relation with the biogeographic and genetic diversity of dominant vent taxa.

The third cruise along the MAR is the ILAB-SPARC cruise (PI Satis Singh) on board the R/V *L'Atalante* that is scheduled in September 2018. This is the 3rd stage of the geophysical study of the lithosphere asthenosphere boundary (LAB) in the equatorial Atlantic after a first ultra deep seismic reflection cruise in 2015 and a second cruise in 2016 when ocean bottom seismometers (OBS) and magnetotelluric (MT) instruments have been deployed. In 2018 a long 2D seismic refraction profile coincident with a part of the ultra-deep seismic data will be shot. This 1200-km long profile equipped with 70 OBS will image 0-50 Ma lithosphere on the African plate. The aim is to image the LAB at different scales continuously from zero age at the ridge axis to 75-80Ma near the continental margin.

In the Atlantic Ocean, the European Multidisciplinary Seafloor and water-column Observatory EMSO-Azores (also called MoMAR Monitoring the Mid-Atlantic Ridge ; MAR), located on the Lucky Strike volcano, on the MAR south of the Azores is maintained since 2010 with annual cruises (see <http://www.emso-fr.org/fr/EMSO-Azores>). EMSO-Azores is a fixed-point buoyed observatory with a multidisciplinary approach (from geophysics and physical oceanography to ecology and microbiology) that acquires time-series data at and around active hydrothermal vents.

Monitoring the seismic activity on the MAR south of the Azores is also the aim of the HYDROMOMAR experiment which is of a long-term program since 2012. Several cruises deployed and retrieved hydrophones in the SOFAR channel leading to a large catalog of events down to MB=2.1-3.2. The last cruise, in 2016, moored 5 instruments that will be retrieved in 2018.

The monitoring of the seismic activity of the three Indian ridges is going on with the array of hydrophones of the OHA-SIS-BIO experiment moored between Réunion Island and the French Austral and Antarctic Territories (TAAF). The network is annually serviced during the R/V *Marion Dufresne* cruises for maintenance of the TAAF stations in Crozet, Amsterdam and Kerguelen islands.

In 2019, efforts of the French community on the MAR will go on with the SMARTIES (Smooth regions at the Mid-Atlantic Ridge Transform Intersections under extreme thermal gradients) cruise (PI Marcia Maia) which is scheduled in summer 2019 on board of the R/V *Pourquoi pas ?* at the Romanche transform intersection with the MAR. The aim is to recognize the boundaries of the Smooth Seafloor domain (possibly exhumed mantle domains) and its persistence through time and to explore in detail the change in deformation patterns on selected targets with high-resolution AUV surveys and NAUTILE dives.

The CHUBACARC cruise (PI S. Hourdez), scheduled in 2019 on board the R/V *L'Atalante*, is a pluridisciplinary cruise, associating several disciplines of life sciences (ecology, populations biology, genetics) and of geosciences (fluid and plume geochemistry, high resolution mapping of sites) to better understand the causes of hydrothermal biodiversity partitioning in the West Pacific back-arc basins at regional scale.

Finally, two cruises will be dedicated to the Carlsberg ridge in 2019: the VARUNA cruise and the CARLMAG cruise on board the R/V *Beautemps-Beaupré* (PI, M. Rodriguez and N. Chamot-Rooke, respectively). The objective of the VARUNA cruise is to characterize the Owen transform fault system and the related structures while the objective of the CARLMAG cruise is to study in details the last 50 Ma opening kinematics at the Carlsberg ridge.

### **JapanNational Update 2018**

*Kyoko Okino*

The InterRidge-Japan program continues efforts to promote ridge-related studies in Japan and to maintain our community. The outline of the ongoing project and other activities are described below.

#### **Domestic Situation**

We are forced to get along without an umbrella project supporting InterRidge-Japan activity, and ridge-related studies are performed using individual project funding. A government-led program "Next-generation technology for ocean resources exploration" has started in Japanese FY2014 until FY2018. JAMSTEC and other national research institutions join the program, and some IRJ members press forward the studies on hydrothermal fields in the Okinawa Trough under the program. Total shiptime for proposal-based cruises is decreasing in these years. Especially, the usage of AUV, ROV or HOV is highly competitive. Long-term plan (2019-2021) for R/V Hakuho-maru was discussed in late 2017 and proposals for Scotia Sea, Central Indian Ridge and Philippine Sea backarc basins were accepted.

#### **Domestic Meeting**

On November 27-28 2017, an InterRidge-Japan symposium was held at Atmosphere and Ocean Research Institute, University of Tokyo. Special session on the serpentinization of oceanic lithosphere was held. Total number of participants is 111 and 43 papers from geophysics, geochemistry and microbiology were presented.

On May 23 2018, a business meeting was held at a Japan Geoscience Union Meeting 2018, where we shared information on a budget of the IR, cruises, and international affairs and discussed the InterRidge-Japan annual activity plan. The membership fee payment as Regular member is shared by JAMSTEC and The University of Tokyo in 2018.

#### **Finished and ongoing cruises FY2017-2018**

The extensive hydrothermal explorations were also done in the Okinawa Trough, including AUV dives. Many IR-Japan members are involved in the Oman ophiolite drilling and the

core description and analysis project “Chikyu-Oman” was conducted on the drilling ship Chikyu anchored in Shimizu port in July-September, 2017. Two cruises to study oceanic core complexes and fracture zones in the Philippine Sea is scheduled in 2018 summer. R/ V Mirai will visit the Chile Ridge.

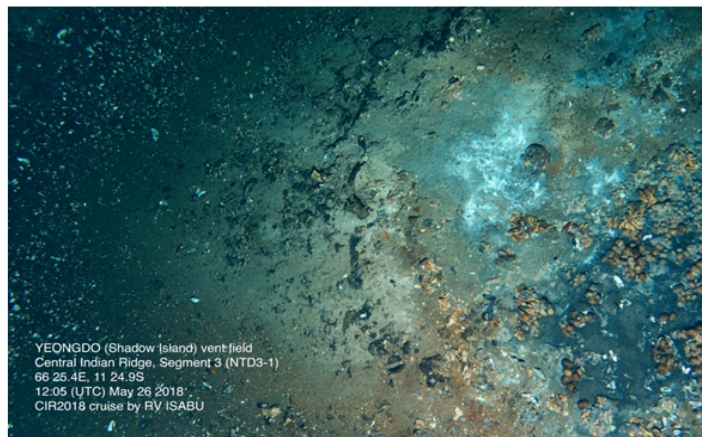
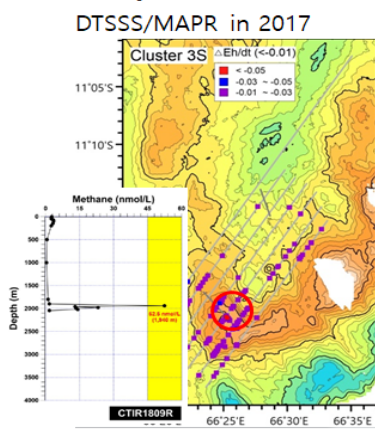
## Korea National Update 2018

*Sung-Hyun Park*

KIOST (Korea Institute of Ocean Science and Technology) is currently operating two research programs on hydrothermal system in the Central Indian Ridge from 2017. One is a R&D program on SMS deposit in the Exploration Area under the contract with ISA and. The other is a R&D program focused on understanding echo-system of hydrothermal vent in the Central Indian Ridge of which area is not limited within the Exploration Area for SMS deposit.

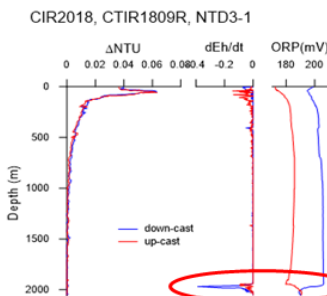
In 2018, KIOST operated two exploration onboard RV ISABU, a new research vessel launched in 2017, for both programs. During the exploration, we identified several new active and inactive hydrothermal deposits along the segments between 8°S and 12°S by camera tow survey. Especially, an active hydrothermal vent field, named “KIOST vent” tentatively, showed high density of benthic organisms. This new active vent field is characterized by high ORP anomaly and dissolved methane concentration without optical backscattering, indicating diffuse vent dominant system. This site will be further investigated in upcoming survey in 2019.

### Examples of results from 2018 works



### Discovery of new active hydrothermal vent field during the RV ISABU cruise in May 2018

- At the summit of abyssal hill, possibly OCC structure
- ORP only, no light backscattering, CH<sub>4</sub> rich
- “YEONGDO” (Shadow Island) vent field (named after new location of KIOST campus in Busan. Also it appears to hide in shadow (i.e. no light backscattering signal)



Significant ORP anomaly near bottom

KOPRI (Korea Polar Research Institute) have no ridge related cruise in 2018, but is preparing the cruise on Australian-Antarctic Ridge in 2019/2020 seasons.

InterRidge Korea has several meetings for improving collaborations between Institutions and Universities. We hope to make a collaborative Ridge program beyond a single Institution.

### **Philippines National Update 2018**

*Gabriel Theophilus Valera<sup>1</sup>, Betchaida Payot<sup>1</sup>, Carla Dimalanta<sup>1\*</sup>, Leo Armada<sup>1</sup>, Noelynna Ramos<sup>1</sup>, Valerie Shayne Ofindo<sup>1</sup>, Jeanne Myrtia Macalalad<sup>1</sup>, Florence Anette Labis<sup>1</sup>, and Graciano Yumul Jr.<sup>2</sup>*

<sup>1</sup>Rushurgent Working Group, National Institute of Geological Sciences, University of the Philippines, Diliman, Quezon City 1101, Philippines (\*corresponding author: cbdimalanta@up.edu.ph)

<sup>2</sup>Apex Mining Company Inc., Ortigas Center, Pasig City 1605, Philippines

#### **1. Geology and Geochemistry of Ophiolites**

Ridge research in the Philippines is currently focused on geologic mapping and detailed petrological studies of ophiolite suites (Figure 1) that may provide important clues in the reconstruction of the tectonic and geodynamic evolution of the Philippine island arc system. In the past year, our group conducted geologic mapping of the Pujada and Palawan ophiolites. Located in southeastern Mindanao, the Pujada Ophiolite possibly represents trapped slivers of oceanic lithosphere exhumed during the collision of Halmahera arc with the Sangihe arc (e.g. Pubellier et al., 1999). The Palawan Ophiolite is located in western Philippines and has been interpreted to be the exhumed forearc segment of the Cagayan arc - Cagayan de Sulu ridge emplaced during collision with the North Palawan continental terrane (NPCT; e.g. Keenan et al., 2016).

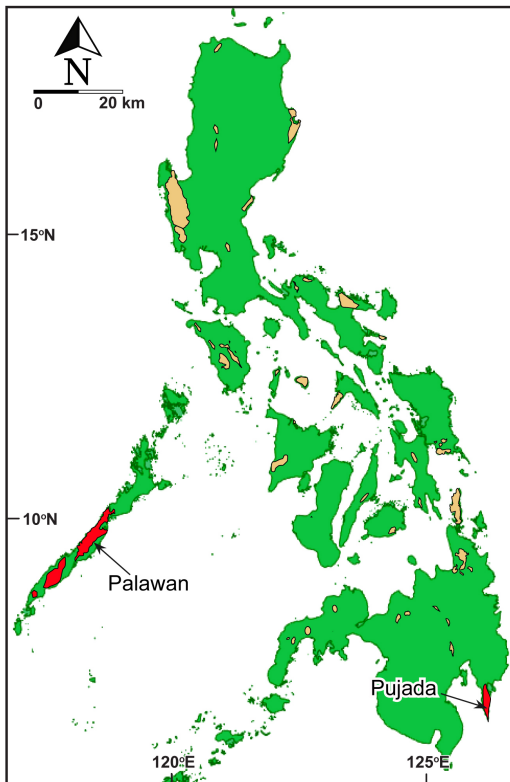


Figure 1. Map of the Philippines showing the distribution of the different ophiolite and ophiolitic bodies (beige) including Palawan and Pujada (red) (map is modified from Guotana et al., 2016).

### **Pujada Ophiolite**

The Pujada ophiolite is a well-preserved oceanic lithosphere exposed in the Pujada Peninsula at the southeastermost tip of Mindanao. Geologic mapping conducted in 2016 revealed that the base of the ophiolite is comprised of the Bitagan metamorphic unit. This metamorphic unit, composed of garnet amphibolites and quartz muscovite schists, corresponds to the metamorphic sole of the Pujada Ophiolite. The mantle section is represented by fresh exposures of lherzolites, harzburgites and dunites which occur as two separate belts, the Surop (Figure 2a) and Nagas peridotites (Figure 2b). Occasional chromitite pods and lenses are enveloped by massive dunite bodies of the Nagas peridotites. Limited exposures of isotropic gabbros and sheeted dikes are observed as NW-SE trending units separating the two ultramafic belts. Interstratified pillow basalts, ribbon cherts, siliceous mudstones and tuffaceous clastic rocks were also mapped as a distinct unit bound by either thrust faults or the Diwata Mélange. The latter is composed of heavily fractured clasts of peridotites, gabbros and cherts set in a scaly tectonized matrix.

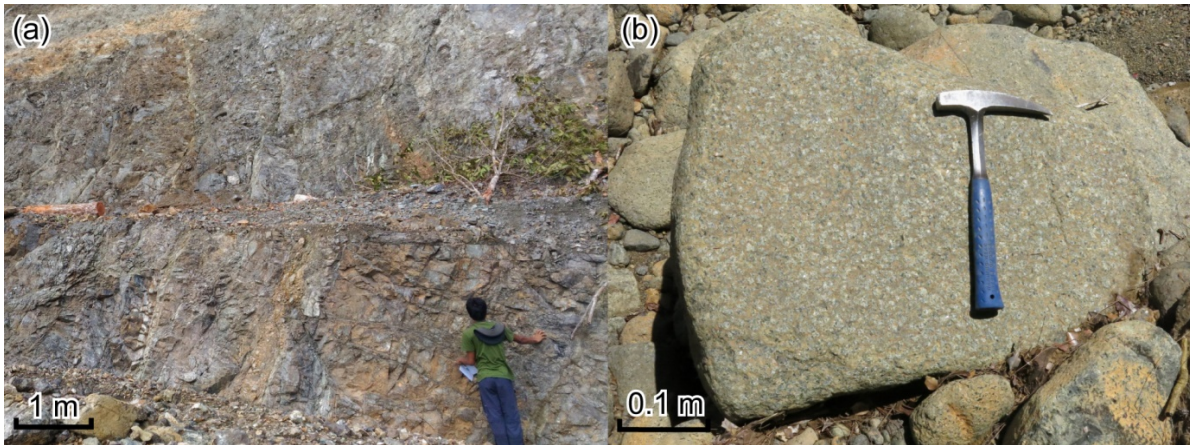


Figure 2. A. Harzburgite outcrop of the Surop belt in Brgy. Tiblawan. B. A sample of fresh lherzolite of the Nagas belt composed of pyroxenes, olivine and spinel from Brgy. Macambol in the Pujada Peninsula.

### Palawan Ophiolite

Palawan island is a rifted block on the southeastern margin of the South China Sea. The island is comprised of two contrasting terranes with continental lithologies (e.g. quartz arenites and granites) dominating the northern half. On the other hand, ophiolite-related units thrust over metamorphosed continental rocks are extensively exposed in the central and southern sections. Field mapping campaigns conducted in central and southern Palawan this year (2017) revealed a harzburgite-dominated residual mantle (Figure 3). These refractory units are overlain by an extensive crustal section composed of mafic-ultramafic layered and isotropic cumulates and pillow lavas with intercalated sediments.

Detailed petrographic and geochemical analysis of the different lithologies comprising these two exhumed oceanic lithospheres is underway. Ultimately, information from the two ophiolites will be used to further refine and complement models on the geologic evolution of this region.

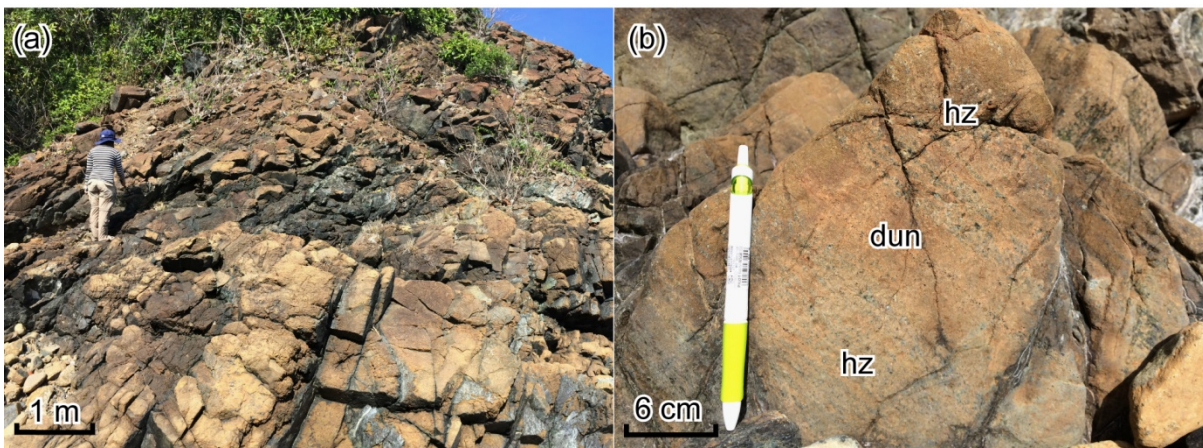


Figure 3. A. Massive outcrop of harzburgite exposed along Bentoan point, Palawan. B. Sample from the same locality shows interlayers of harzburgite (hz), rough surface with aligned grains, and dunite (dun), uniformly brown layers.

## **2. Marine Geophysics Along Eastern South China Sea**

Recent marine geophysical surveys were conducted along the eastern South China Sea (SCS) to investigate the structures of the extinct mid-ocean ridge in the Scarborough seamount chain area and the subduction zone along the Manila trench. These marine surveys were conducted in partnership with our Taiwanese collaborators within the framework of the Philippines-Taiwan collaboration on Earth Sciences. Seismic reflection, gravity, and magnetics data were collected in the eastern SCS along profiles crossing the ridge and trench axes. The research cruise was conducted to investigate the structure and deformation in the mega-thrust region as well as in the structure of the extinct spreading center on the eastern SCS. The results of this study contribute to our knowledge on subduction zone processes and mega-thrust structures. This research also provides new data that can be the basis for future marine geophysical experiments in the eastern SCS and the Manila Trench region.

Multichannel seismic (MCS) reflection and bathymetric datasets reveal the along-trench variations in the structure of the subducting South China Sea slab (Figure 4). High resolution seafloor data shows the seafloor spreading fabric and well as post-spreading features on the eastern margin of the SCS such as the Scarborough Seamount Chain (SSC). In terms of the morphology at the subduction interface as imaged by the MCS survey, the northern part of the subduction is smoother and the mega-thrust appears to be localized at the thick sediment cover of the subducting SCS oceanic slab. In the south, the subduction interface is rougher owing to the thin overlying sediments in the subducting oceanic slab as well as the basement topographic anomalies. Seamounts and ridges at the incoming SCS crust are at various stages of subduction and appear to influence the varying modes of deformation along the trench. The rough patches in the subduction interface can act as asperities where future great earthquakes are initiated or as rupture barriers of slip that started elsewhere in the mega-thrust surface. This study provides information relevant to earthquake rupture and tsunami modelling in the Manila trench region. Information gleaned from this work have implications on our capacity to assess mega-thrust earthquake and tsunami hazards around the SCS.



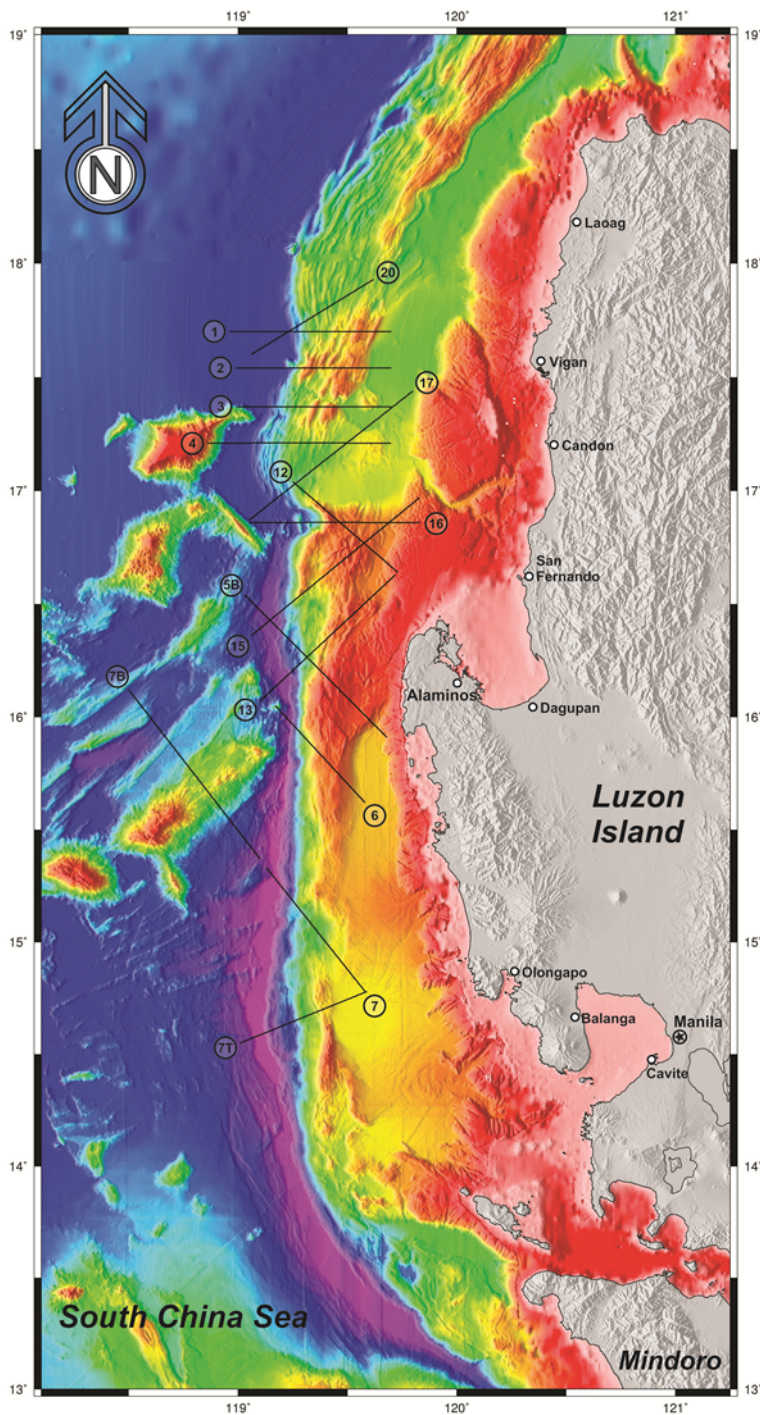


Figure 4. Bathymetry of the eastern South China Sea and the Manila Trench region. Warm colors depict shallow depths while cool colors correspond to the deeper parts of the seafloor. Black lines and numbers indicate multichannel seismic reflection survey lines. The easternmost portion of the Scarborough Seamount Chain is seen at ~15.5°N latitude. Cities on the western coast of Luzon Island are also indicated to emphasize the direct impact of earthquake and tsunami hazards on these areas.

## **Poland National Update 2018**

*Teresa Radziejewska*

### **Activities of and development in Poland of relevance to InterRidge**

July 2017: Poland joined InterRidge as a corresponding member

July 2017: the Polish Government adopted a Programme of Geological Exploration of the Oceans (ProGeO)

August 2017: the Polish government submitted application to ISA for a contract for exploration of deep-sea massive polymetallic sulphides in an area of the Mid-Atlantic Ridge

August 2017: the Polish government's application to ISA for a contract for exploration of deep-sea massive polymetallic sulphides (PMS) in an area of the Mid-Atlantic Ridge (MAR) approved by the Legal and Technical Commission of ISA and accepted by the ISA Council

February 2018: the contract for exploration of PMS on MAR concluded between the ISA and the Government of Poland

April-May 2018: Dr Dominik Zawadzki of the University of Szczecin participated, as an InterRidge bursary recipient, in a cruise to the Cocos-Nazca Spreading Centre on board RV Sally Ride

27-29 June 2018: ISA workshop on Developing a Framework for Regional Environmental Management Plans (REMPS) for Polymetallic Massive Sulphide Deposits on Mid-Ocean Ridges to be held at the Faculty of Geosciences, University of Szczecin, Szczecin, Poland

## **Canada National Update**

 *Kim Juniper*

There have been two major Canadian-led ridge research initiatives in the past year, both centred on the Juan de Fuca Ridge.

Endeavour-Middle Valley with Tully/ROPOS – Scientists from the Canadian Department of Fisheries and Oceans (DFO) and academic researchers from the Canadian Healthy Oceans Network (CHONe), staged a joint cruise to the Endeavour Segment and Middle Valley hydrothermal fields on the Juan de Fuca Ridge in collaboration with geologists from Memorial University of Newfoundland. The Endeavour Segment vents lie within a Marine Protected Area established by Canada in 2003. The 2-week cruise (2-16 August 2017)

deployed the remotely-operated vehicle ROPOS from the Canadian Coast Guard Ship John P. Tully for sampling and survey operations. Dives in the Endeavour MPA focussed on collecting samples of vent fauna and microbes and sulphide minerals.

The biological sampling involved collecting replicate submersible grab and suction samples from siboglinid tubeworm assemblages from adjacent locations that were subjected to high and low hydrothermal discharge, the so-called 'high flow' and 'low flow' tubeworm assemblages. Samples are being analyzed to assign ecosystem functional properties to the faunal and microbial assemblages within the two tubeworm habitats. A unique component of this study is the inclusion of microbes (prokaryotes and protists) in the evaluation of ecosystem function.

Geological surveys and sampling were led by Dr. John Jamieson of Memorial University of Newfoundland. The primary goal of this work was to use the ROV for direct observation and sampling of putative sulphide deposits identified in high resolution multibeam bathymetry. This ground truthing exercise is an important component of the development of this potential exploration technique for seafloor massive sulphides. The exploration dives also provided an opportunity to test the exploration potential of an ROV-mounted magnetometer provided by Seafloor Geophysics of Vancouver, British Columbia.

Two survey and sampling dives were also conducted at Middle Valley, a sedimented hydrothermal site on the Juan de Fuca Ridge, north of the Endeavour Segment. The first dive explored the Bent Hill sulphide mineral deposit area that was drilled by the International Ocean Drilling Program during the 1990's. Several small active vents were found on the southern edge of the Bent Hill site. The second dive visited the more active Dead Dog hydrothermal field, sampling bivalves, tubeworms (*Ridgeia* and *Lamellibrachia*) and sulphide minerals.

Expansion of Observatory Infrastructure at Endeavour Segment - Ocean Networks Canada in collaboration with Dr. Laurence Coogan of the University of Victoria and his collaborators at the University of Minnesota, the University of Washington and the Sanya Institute of Deep-Sea Science and Engineering (SIDSE), has initiated a major expansion of the cabled observatory infrastructure at the Endeavour Segment hydrothermal vents. The project is funded by the Canada Foundation for Innovation and SIDSE, with additional support from other partners. When completed in 2018, three hydrothermal fields will be instrumented with sensors ranging from short-period seismometers to high and low temperature fluid samplers and cameras. Extension cables, junction boxes and sensor platforms have been deployed at the new locations and most instruments will be installed during cruises planned for the summer of 2018.

## **China National Update**

*Jiabiao Li and Y. John Chen*

In 2016-2017, China has organized 5 ocean science cruises, in which the “*Jiaolong*” manned submersible was used for investigation in the mid-ocean and trench areas.

On the other side, deep-sea detection vehicles gradually goes into application after testing, such as the “*Qianlong*” series AUVs and the “*Hailong*” series ROVs to provide powerful guarantee for resources exploration and scientific researches.

### **Ridge and Trench Surveys**

In Southwest India Ridge Cruise, Second Institute of Oceanography of China (PI: Dr. C Tao) used the R/V “*Xiangyanghong 10*” on November 2015 to May 2016, November 2016 to June 2017 and R/V “*Dayang Yihao*” on December 2015 to June 2016, to conduct polymetallic massive sulfide resources exploration and environment baseline research. The deep-tow system, “*Qianlong II*” AUV, and the electromagnetic detection system, 20m borehole coring system was used to obtain geological, geophysical, environmental and biological samples and data of the investigation area. On the cruise, the “*Qianlong II*” finished 16 diving work with underwater operation time up to 239 hours, total mission distance 747 km to obtain high resolution three-dimensional seabed topography.

Second Institute of Oceanography of China (PI: Dr. X Han) use the manned submersible *Jiaolong* with the R/V “*Xiangyanghong 9*” on February to June 2017 to investigate the Carlsberg ridge in the northwestern Indian Ocean for hydrothermal vent systems.

Meanwhile, in a trench cruise, China Deepsea Research Center used “*Jiaolong*” manned submersible on April to July 2016 by the R/V “*Xiangyanghong 9*” to investigate the Vega Seamounts, Yap Trench and Mariana Trench in the northwestern Pacific. A total of 22 diving operations were carried out, with the maximum depth of 6,796 meters, and a large number of seabed organisms, sediment samples and underwater video, photographs and environmental data were obtained.

In another trench cruise, the Institute of Deepsea Science and Technology of Chinese Academy of Science used R/V “*Tansuoyihao*” to explore the Challenger Deep of Marianas Trench during 22 June to 12 August 2016. This voyage last 52 days, carried out 84 items of comprehensive tasks with ten-thousands-meters-deep launcher used first time.

### **Other Surveys**

IODP Expeditions 367 and 368, with Dr. Z Sun of the Institute of South China Sea and Dr. Z Jian of the Tongji University as chief scientists, were carried out from February to June 2017. It addresses the mechanisms of lithosphere extension during continental breakup. State of the art deep reflection seismic data show that the northern South China Sea (SCS) margin offers excellent drilling opportunities that can address the process of plate rupture at a magma-poor rifted margin.

### ***Symposiums and National Conferences***

1. The 2016 International Conference on Marine Science and Technology was held at the Shanghai international conference center on 10 to 13 April. The meeting organized by Shanghai Jiaotong University, which is the largest marine science and technology meeting hold in mainland China for the first time. It provides a good communication platform for exchange of the new progress and new direction in marine technology research, development and utilization. Over 800 scientists and students participated in this conference.

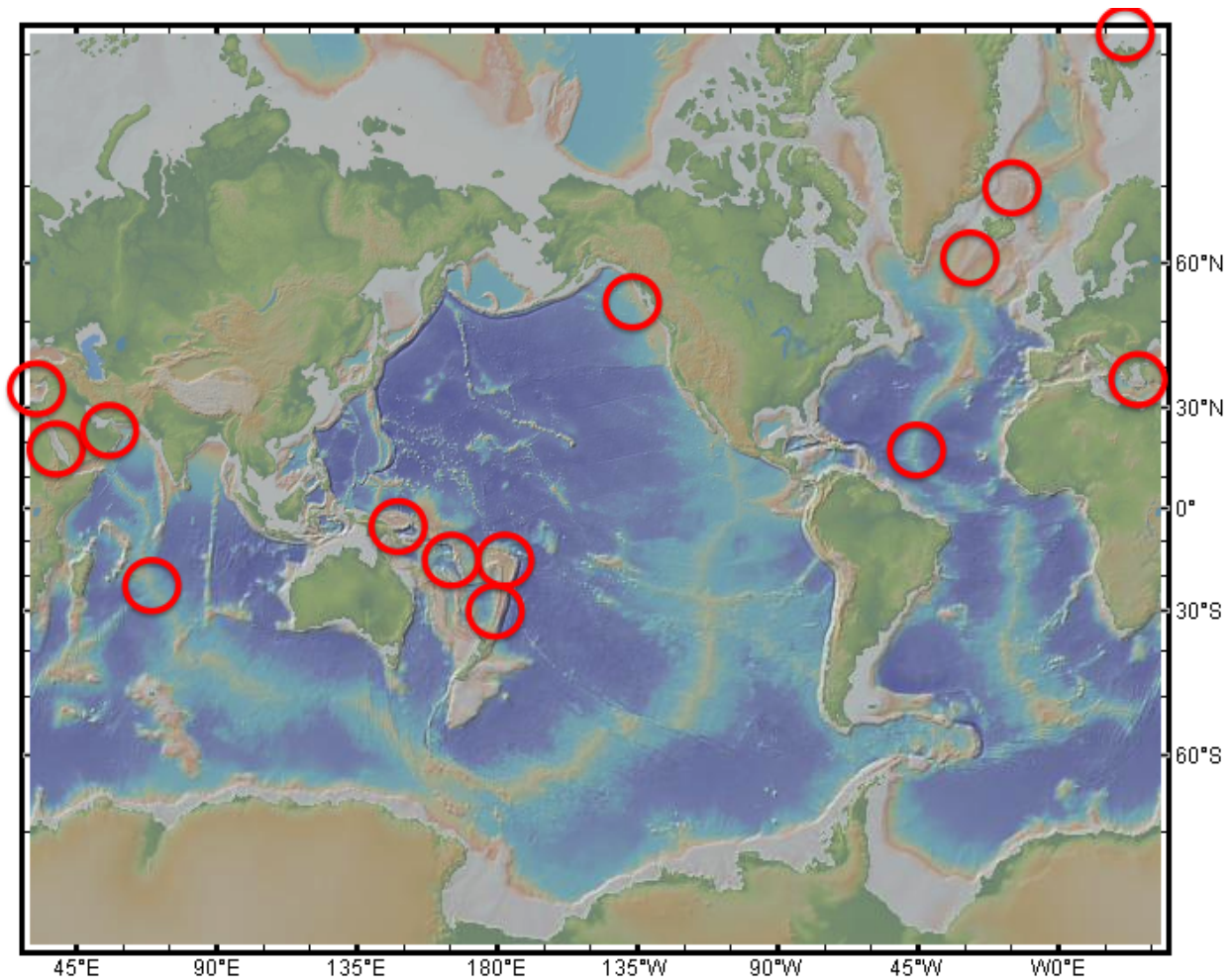
2. On 30 to 31 May 2016, the fifth International Symposium on the Scientific and Legal Aspects of the Regimes of the Continental Shelf and the Area held in Nanjing organized by China Institute for Marine Affairs, SOA and Second Institute of Oceanography, SOA. More than 80 scientists and lawyers from more than 20 countries and regions attended the meeting.

3. The 4th Conference on Earth System Science Symposium was held in Shanghai on 4-6 July 2016. Over 1000 Chinese scholar come from domestic and overseas participated in this meeting. This conference strongly focused on interdisciplinary studies in ocean science including biological evolution and environment, ocean and climate, biogeochemical cycle, deep process and planetary cycle, deep-sea resources and technology, earth system dynamics etc. Two sessions “The deep structure and dynamic process of the continental margin of Asia” and “The South China Sea: a natural laboratory for deep-sea processes” were organized by China ridge program.

### **Germany National Update**

*Sent by Philipp Brandl*

After a break of some years, 2017 sees Germany coming back as an active member of InterRidge at the Regular Member level. This year has also seen a change in leadership of the InterRidge community in Germany, with Philipp Brandl taking over from Colin Devey.



Ridge-related science is alive and well in Germany, with groups from many institutes around the country studying active and fossil ridges. Foci of recent research are: Magma plumbing and crustal accretion at oceanic ridges, volatile fluxes, hydrothermal cooling of the oceanic crust, seafloor massive sulfides, arc rifting and backarc formation. A map of the regions currently being targeted by German scientists is given in Figure 1. *Figure 1: Locations around the globe where German scientists are carrying out or planning ridge-related research.*

***Some highlights of German ridge-related research in recent times include:***

**A major strengthening of marine mineral studies in Germany:** This includes the establishment, in 2014, of the Marine Mineral Resources group at GEOMAR, under the leadership of Prof. Mark Hannington (formerly Ottawa). The German marine research consortium (KDM - representing the leadership of Germany's major marine science institutes) also set up a Marine Mineral Resources strategy group to help make marine mineral science more accessible to policy-makers. Research in this field is carried out by the Federal Institute for Geosciences and Natural Resources (BGR) in their license area in the Indian Ocean (in collaboration with GEOMAR, HafenCity Universität Hamburg, GeoZentrum Nordbayern, Christian-Albrechts-Universität zu Kiel *et al.*) and by GEOMAR

within the Marine Mineral Resources Group and the EU-funded project Blue Mining (see below).

**Blue Mining:** In the framework of the EU-funded FP7 project "Blue Mining" two multi-disciplinary research cruises were conducted near the TAG active hydrothermal field in the Central Atlantic. The first cruise with the German research vessel RV Meteor (led by Sven Petersen, GEOMAR, Germany) performed large-scale, high-resolution AUV-based mapping to develop exploration tools for detecting inactive massive sulfide occurrences. This was combined with 2D seismic observations and the investigation of surface sediments to determine the structure of the deposits, the geological controls of the deposits and to develop vectors to ore. Further exploration and assessment of those inactive sulfides was conducted during the second cruise (RRS James Cook led by Bramley Murton, NOC Southampton) by using controlled-source electromagnetics, hyperspectral imaging, surface sampling, and drilling (British Geological Survey BGS Rockdrill-2).

**Hydrothermal vents:** Antje Boetius (AWI) together with collaborators from Bremen and Woods Hole, have made two expeditions with Germany's ice-breaker Polarstern to the Arctic ocean. Both regions they targeted were initially discovered during the InterRidge-initiated AMORE Gakkel expedition in 2001. The first expedition (PS86) aimed to study the Aurora hydrothermal field located at 6°W on the Gakkel ridge, the second expedition (PS101) targeted the Gakkel Ridge axis at 60°E and Karasik Seamount. Andrea Koschinsky (Jacobs University) and Wolfgang Bach (Univ. Bremen/MARUM) studied the hydrothermal vents along the Tonga-Kermadec arc during RV Sonne Exp. SO253.

**Icelandic Ridges:** Work led by Isobel Yeo (formerly GEOMAR, now NOC Southampton) on the north Kolbeinsey ridge culminated in an EPSL paper (Yeo et al., 2016) and a cruise with RV Poseidon in 2016. The cruise involved extensive video surveys of the ridge axis to assess the volcanology and ages of the flows described in the paper. 2018 will see research cruises to Reykjanes Ridge led by Colin Devey and to Grimsey (GrimseyEM) led by Sebastian Hölz, both from GEOMAR.

**Backarc Basins:** In recent years, the evolution of backarc basins has come into focus of several research groups in Germany. Interdisciplinary research, led by Wolfgang Bach's group, shed new light onto the volcanological-geochemical-microbiological linkages in hydrothermal vents in the Eastern Manus Basin (SO218) (e.g., Meier et al., 2016, 2017; Thal et al., 2016, Price et al., 2016). Schmidt et al. (2017) published results from vent fields in the New Hebrides backarc studied during SO229 and complemented by the studies on the local magmatic system by Lima et al. (2017) and the regional tectonics by Anderson et al. (2016). SO255 VITIAZ (led by Kaj Hoernle, GEOMAR) aimed at studying the life cycle of the Vitiaz-Kermadec Arc/Backarc system. Two research cruises related to arc rifting and backarc evolution in the Tonga Arc-Lau Basin area are scheduled for 2018.

**Red Sea volcanology and hydrothermalism:** Nico Augustin (GEOMAR) and colleagues have led a strong effort to understand the geology and hydrothermalism of the Red Sea

rift, culminating in several papers (e.g., Augustin et al., 2016; Mitchell & Augustin, 2017) and an up-coming expedition using the Dutch RV Pelagia.

**Ophiolite studies:** Karsten Haase's group at GeoZentrum Nordbayern (FAU Erlangen-Nürnberg) is continuing their successful work on the petrology of ophiolites with a focus on Troodos (Cyprus) and Myanmar. Jürgen Koepke (and his group) is involved in several field-based projects in the Semail ophiolite (Oman) and in the leadership of the ICDP Oman Drilling Project.

**Lower oceanic crust:** Jürgen Koepke's group at Leibniz-Universität Hannover follows an integrated approach of direct petrographic observations (e.g., ocean drilling), modern geochemical methods and experimental petrology to further constrain the magmatic processes in the lower oceanic crust with a focus on the cycling of volatile and chalcophile elements.

**A 3D-Virtual reconstruction of vent structures at Endeavour:** Tom Kwasnitschka (GEOMAR) and his team used the Canadian ROV ROPOS aboard the Schmidt Ocean Institute vessel "Falkor" to produce the world's first virtual video reconstruction of seafloor vents. The results can be viewed at <https://www.youtube.com/watch?v=YnBerSUqSKQ> and are 3D-navigable with the right internet browser.

#### ***Research Cruises:***

##### ***Ridge-related expeditions in 2017:***

M139: Deep Microbes & BrightFlows (Arndt, Univ. Köln & Augustin, GEOMAR)

MSM68: KNIPAS (Schlindwein, AWI)

POS509: PalinuroEM (Hölz, GEOMAR)

POS510: AEGEAN RIFTING (Hannington, GEOMAR)

SO253: HYDROTHERMADEC (Koschinsky, Jacobs University)

SO255: VITIAZ (Hoernle, GEOMAR)

SO259: INDEX 2017 (Schwarz-Schampera, BGR)

##### ***Ridge-related expeditions in 2018:***

MSM65: REYKJANES (Devey, GEOMAR)

POS524: GrimseyEM (Hölz, GEOMAR)

SO263: TongaRift (Haase, GZN, FAU Erlangen-Nürnberg)

SO267: ARCHIMEDES 1 (Hannington/Kopp, GEOMAR)

RV Pelagia: SALTAX (Augustin, GEOMAR)

##### ***Selected publications of ridge-related research in Germany (2016/17):***

Andersen, C., Theissen Krah, S., Hannington, M., Rüpke, L., Petersen, S., 2017. Faulting and off-axis submarine massive sulfide accumulation at slow spreading mid-ocean ridges: A numerical modeling perspective. *Geochemistry Geophysics Geosystems* 18, 51. doi:10.1002/2017GC006880



Anderson, M.O., Chadwick, W.W., Hannington, M.D., Merle, S.G., Resing, J.A., Baker, E.T., Butterfield, D.A., Walker, S.L., Augustin, N., 2017. Geological interpretation of volcanism and segmentation of the Mariana back-arc spreading center between 12.7°N and 18.3°N. *Geochemistry Geophysics Geosystems* 87, 4003. doi:10.1002/2017GC006813

Anderson, M.O., Hannington, M.D., Haase, K., Schwarz-Schampera, U., Augustin, N., McConachy, T.F., Allen, K., 2016. Tectonic focusing of voluminous basaltic eruptions in magma-deficient backarc rifts. *Earth and Planetary Science Letters* 440, 43–55. doi:10.1016/j.epsl.2016.02.002

Augustin, N., van der Zwan, F.M., Devey, C., Ligi, M., Kwasnitschka, T., Feldens, P., Bantan, R.A., Basaham, A.S., 2016. Geomorphology of the central Red Sea Rift: Determining spreading processes. *Geomorphology* 274, 162-179.

Berndt, C., Hensen, C., Mortera-Gutierrez, C., Sarkar, S., Geilert, S., Schmidt, M., Liebetrau, V., Kipfer, R., Scholz, F., Doll, M., Muff, S., Karstens, J., Planke, S., Petersen, S., Böttner, C., Chi, W. C., Moser, M., Behrendt, R., Fiskal, A., Lever, M. A., Su, C. C., Deng, L., Brennwald, M. S. und Lizarralde, D. (2016) Rifting under steam – how rift magmatism triggers methane venting from sedimentary basins *Geology*. DOI 10.1130/G38049.1

Brandl, P.A., Regelous, M., Beier, C., O'Neill, H.S.C., Nebel, O., Haase, K.M., 2016. The timescales of magma evolution at mid-ocean ridges. *Lithos* 240-243, 49–68. doi:10.1016/j.lithos.2015.10.020

Ciażela, J., Dick, H.J.B., Koepke, J., Pieterek, B., Muszyński, A., Botcharnikov, R., Kuhn, T. (2017): Thin crust and exposed mantle control sulfide differentiation in slow-spreading ridge magmas. *Geology*, <https://doi.org/10.1130/G39287.1>

Erdmann, M., France, L., Fischer, L.A., Deloule, E., Koepke, J. (2017): Trace elements in anatectic products at the roof of mid-ocean ridge magma chambers: an experimental study. *Chemical Geology*, 456, 43-57.

Erdmann, M., Koepke, J. (2016): Silica-rich lavas in the oceanic crust: Experimental evidence for fractional crystallization under low water activity. *Contrib. Mineral. Petrol.* 171, 83. doi:10.1007/s00410-016-1294-0.

Escartín, J., Leclerc, F., Olive, J. A., Mevel, C., Cannat, M., Petersen, S., Augustin, N., Feuillet, N., Deplus, C., Bezos, A., Bonnemains, D., Chavagnac, V., Choi, Y., Godard, M., Haaga, K. A., Hamelin, C., Ildefonse, B., Jamieson, J.W., John, B. E., Leleu, T., MacLeod, C. J., Massot-Campos, M., Nomikou, P., Paquet, M., Rommevaux-Jestin, C., Rothenbeck, M., Steinführer, A., Tominaga, M., Triebe, L., Campos, R., Gracias, N., Garcia, R., Andreani, M. und Vilaseca, G. (2016) First direct observation of coseismic slip and seafloor rupture along a submarine normal fault and implications for fault slip history *Earth and Planetary Science Letters*, 450 . pp. 96-107. DOI 10.1016/j.epsl.2016.06.024.

Escartin, J., Mevel, C., Petersen, S., Bonnemains, D., Cannat, M., Andreani, M., Augustin, N., Bezos, A. Chavagnac, V., Choi, Y., Godard, M., Haaga, K., Hamelin, C., Ildefonse, B., Jamieson, J., John, B., Leleu, T., MacLeod, C.J., Massot-Campos, M., Nomikou, P., Olive, J.A., Paquet, M., Rommevaux, C., Rothenbeck, M., Steinfuhrer, A., Tominaga, M., Triebe, L., Garcia, R. & Campos, R. (2017): Tectonic structure, evolution, and the nature of oceanic core complexes and their detachment fault zones (13°20'N and 13°30'N, Mid

Atlantic Ridge). *Geochemistry Geophysics Geosystems* 18: 1451-1482. doi:10.1002/2016GC006775

Fallon, E.K., Petersen, S., Brooker, R.A. & Scott, T.B. (2017): Oxidative dissolution of hydrothermal mixed-sulphide ore: An assessment of current knowledge in relation to seafloor massive sulphide mining. *Ore Geology Reviews* 86: 309-337. doi:10.1016/j.oregeorev.2017.02.028

Fischer, L.A., Erdmann, M., France, L., Wolff, P.E., Deloule, E., Zhang, C., Godard, M., Koepke, J. (2016): Trace element evidence for anatexis at oceanic magma chamber roofs and the role of partial melts for contamination of fresh MORB. *Lithos* 260, doi:10.1016/j.lithos.2016.05.001.

German, C.R., Petersen, S., Hannington, M.D., 2016. Hydrothermal exploration of mid-ocean ridges: Where might the largest sulfide deposits be forming? *Chemical Geology* 420, 114–126. doi:10.1016/j.chemgeo.2015.11.006

Haase, K.M., Freund, S., Beier, C., Koepke, J., Erdmann, M., Hauff, F. (2016): Constraints on the magmatic evolution of the oceanic crust from plagiogranite intrusions in the Oman ophiolite. *Contrib. Mineral. Petrol.* 171, 46. doi:10.1007/s00410-016-1261-9.

Haase, K.M., Brandl, P.A., Devey, C.W., Hauff, F., Melchert, B., Garbe-Schönberg, D., Kokfelt, T.F., Paulick, H., 2016. Compositional variation and  $^{226}\text{Ra}$ - $^{230}\text{Th}$  model ages of axial lavas from the southern Mid-Atlantic Ridge, 8°48'S. *Geochemistry Geophysics Geosystems* 17, 199–218. doi:10.1002/2015GC006016

Hannington, M., Harðardóttir, V., Garbe-Schönberg, D., Brown, K.L., 2016. Gold enrichment in active geothermal systems by accumulating colloidal suspensions. *Nature Geoscience*. doi:10.1038/ngeo2661

Ishizuka, O., Hickey-Vargas, R., Arculus, R.J., Yogodzinski, G.M., Savov, I.P., Kusano, Y., McCarthy, A., Brandl, P.A., Sudo, M., 2018. Age of Izu–Bonin–Mariana arc basement. *Earth and Planetary Science Letters* 481, 80–90. doi:10.1016/j.epsl.2017.10.023

Keith, M., Haase, K.M., Klemd, R., Schwarz-Schampera, U., Franke, H., 2016. Systematic variations in magmatic sulphide chemistry from mid-ocean ridges, back-arc basins and island arcs. *Chemical Geology*. doi:10.1016/j.chemgeo.2016.12.028

Lima, S.M., Haase, K.M., Beier, C., Regelous, M., Brandl, P.A., Hauff, F., Krumm, S., 2017. Magmatic Evolution and Source Variations at the Nifonea Ridge (New Hebrides Island Arc). *Journal of Petrology* 58, 473–494. doi:10.1093/petrology/egx023

Lin, T.J., Ver Eecke, H.C., Breves, E.A., Dyar, M.D., Jamieson, J.W., Hannington, M.D., Dahle, H., Bishop, J. L., Lane, M.D., Butterfield, D.A., Kelley, D.S., Lilley, M.D., Baross, J.A. und Holden, J.F. (2016) Linkages between mineralogy, fluid chemistry, and microbial communities within hydrothermal chimneys from the Endeavor Segment, Juan de Fuca Ridge *Geochemistry, Geophysics, Geosystems*, 17 (2). pp. 300-323. DOI 10.1002/2015GC006091.

Meier D, Pjevac P, Bach W, Hourdez S, Gurguis PR, Vidoudez C, Amann R, Meyerdierks A (2017). Niche partitioning of diverse sulfur-oxidizing bacteria at hydrothermal vents. *ISME Journal* doi: 10.1038/ismej.2017.37

- Meier D, Bach W, Girguis PR, Gruber-Vodicka H, Reeves EP, Richter M, Vidoudez C, Amann R, Meyerdierks A (2016). Heterotrophic Proteobacteria in the vicinity of active hydrothermal venting. *Environmental Microbiology* DOI: 10.1111/1462-2920.13304
- Mitchell, N. C. und Augustin, N. (2017) Halokinetics and other features of GLORIA long-range sidescan sonar data from the Red Sea. *Marine and Petroleum Geology*, 88 . pp. 724-738. DOI 10.1016/j.marpetgeo.2017.09.017.
- Mueller, T., Koepke, J., Garbe-Schoenberg, D., Dietrich, M., Bauer, U., Wolff, P.E. (2017): Anatomy of a frozen axial melt lens from a fast-spreading paleo-ridge (Wadi Gideah, Oman ophiolite). *Lithos*, 272-273, 31-45, doi: 10.1016/j.lithos.2016.11.022.
- Petersen, S., Krättschell, A., Augustin, N., Jamieson, J.W., Hein, J. R. und Hannington, M.D. (2016) News from the seabed – Geological characteristics and resource potential of deep-sea mineral resources *Marine Policy*. DOI 10.1016/j.marpol.2016.03.012.
- Pietranik, A., Storey, C., Koepke, J., Lasalle, S. (2017): Zircon record of fractionation, hydrous partial melting and thermal gradients at different depths in oceanic crust (ODP Site 735B, South-West Indian Ocean). *Contrib Mineral Petrol* 172, doi:10.1007/s00410-016-1324-y.
- Price RE, Breuer C, Reeves E, Bach W, Pichler T (2016) Arsenic bioaccumulation and biotransformation in deep-sea hydrothermal vent organisms from the PACMANUS hydrothermal field, Manus Basin, PNG. *Deep-Sea research I*, doi: 10.1016/j.dsr.2016.08.012
- Regelous, M., Weinzierl, C.G., Haase, K.M., 2016. Controls on melting at spreading ridges from correlated abyssal peridotite - mid-ocean ridge basalt compositions. *Earth Planet. Science. Let.* 449 (2016) 1-11
- Safipour, R., Hölz, S., Halbach, J., Jegen, M., Petersen, S., and Swidinski, A. (2017): A self-potential investigation of submarine massive sulfides: Palinuro Seamount, Tyrrhenian Sea. *Geophysics* 82: A51–A56. doi:10.1190/geo2017-0237.1
- Schmidt, K., Garbe-Schönberg, D., Hannington, M.D., Anderson, M.O., Bühring, B., Haase, K., Haruel, C., Lupton, J., Koschinsky, A., 2017. Boiling vapour-type fluids from the Nifonea vent field (New Hebrides Back-Arc, Vanuatu, SW Pacific): Geochemistry of an early-stage, post-eruptive hydrothermal system. *Geochimica et Cosmochimica Acta* 207, 185–209. doi:10.1016/j.gca.2017.03.016
- Szitkar, F., Tivey, M.A., Kelley, D.S., Karson, J.A., Früh-Green, G.L. & Denny, A.R. (2017): Magnetic exploration of a low-temperature ultramafic-hosted hydrothermal site (Lost City, 30°N, MAR). *Earth and Planetary Science Letters* 461, 40–45. DOI 10.1016/j.epsl.2016.12.033
- Szitkar, F., Dyment, J., Le Saout, M., Honsho, C. und Gente, P. (2016) Dyking at EPR 16°N hypermagmatic ridge segment: Insights from near-seafloor magnetics *Earth and Planetary Science Letters*, 453. pp. 288-297. DOI 10.1016/j.epsl.2016.08.020.
- Thal J, Tivey MA, Yoerger D, Jöns N, Bach W (2016). Subaqueous cryptodome eruption, hydrothermal activity and related seafloor morphologies on the andesitic North Su volcano. *Journal of Volcanological and Geothermal Research* 323, 80–96
- Toner BM, Rouxel O, Santelli CM, Bach W, Edwards KJ (2016). Iron oxidation pathways and redox micro-environments in seafloor sulfide-mineral deposits: spatially resolved Fe

XAS and d57/54Fe observations. *Frontiers in Microbiology*  
<http://dx.doi.org/10.3389/fmicb.2016.00648>

Yeo, I.A., Devey, C.W., LeBas, T.P., Augustin, N., Steinfuehrer, A., 2016. Segment-scale volcanic episodicity: Evidence from the North Kolbeinsey Ridge, Atlantic. *Earth and Planetary Science Letters* 439, 81-87.

Zhang, C., Koepke, J., France, L., Godard, M. (2017): Felsic Plutonics from IODP Hole 1256D, Eastern Pacific: Implications for the Nature of Axial Melt Lens at Fast-Spreading Mid-Ocean Ridges. *J. Petrol.*

Zhang, C., Wang, L.X., Marks, M.A.W., France, L., Koepke, J., (2017): Volatiles (CO<sub>2</sub>, S, F, Cl, Br) in the dike-gabbro transition zone at IODP Hole 1256D: Magmatic imprint versus hydrothermal influence at fast-spreading mid-ocean ridge. *Chemical Geology*, 459, 43-60.

## **India National Update**

*John Kurian*

India is a regular member in the InterRidge and was being coordinated by Dr. Kamesh Raju, National Institute of Oceanography, Goa, India. Membership coordination is now transferred to Dr. John Kurian P, National Centre for Antarctic & Ocean Research, Goa, India.

Having carried out preliminary surveys and sampling operations in the parts of Central and South West Indian ridges, close to the Rodregious Triple Junction, India filed application to International Seabed Authority for grant of license for exploration in the area. After grant of license in 2016, India carried out second round of survey and sampling operations in the area in 2017 by deploying the research vessels R/V MGS Sagar. The planned studies include hydro-dynamics, water column chemistry, Environmental baseline data collection etc. Few promising inferences have been obtained on the presence of hydrothermal plumes in three locations the area. Further study is in progress.

## **Norway National Update**

*Cédric Hamelin*

In 2016/2017, Norway continued developing a strong ridge-related scientific program.

### ***New Infrastructure:***

Early 2017, the K.G. Jebsen Centre for Deep Sea Research (KGJ CDeepSea) has officially opened in Bergen. This new research centre, funded by the Kristian Gerhard Jebsen Foundation, is based on the successes of the Centre for Geobiology, which was ending its term as a Norwegian Centre for Excellence in May 2017.

The research at the Centre incorporates: the formation of oceanic crust by magmatic and tectonic processes, heat transport from magma to the oceans by large hydrothermal convective systems, water-rock reactions and the formation of mineral deposits at the

seafloor. It also encompasses the synthesis of organic compounds and the formation of chemical energy by water-rock reactions, and the links between energy and the functioning of microbial life and higher organisms. Finally, it deals with the ecosystems inhabiting the sub-seafloor, the seafloor and the water column above. Another mission of the Centre will be to transfer knowledge from basic research and technology developments, to applied questions that will impact a sustainable “blue growth” future. The Centre will provide insights into deep sea mineral and bioprospecting resources, focusing on areas under Norwegian jurisdiction. It will also address the potential environmental impacts of industrial activity on the ocean floor.

Finally, the new Centre will have a leadership role for the NORwegian MARine Robotics facility (NORMAR), home of Ægir 6000, a work-class ROV with a Tether Management System (TMS). This will be a primary tool for exploring, sampling and deploying instruments and experiments along mid-oceanic ridges. The ROV system is specially designed for operation from RV G.O. Sars and from forthcoming research icebreaker RV Kronprins Haakon, where it will operate through a moon-pool when operating in ice-covered water.

***MARMINE project:***

The 4 years MarMine project is directed by the Norwegian University of Science and Technology (NTNU) and funded by the Research Council of Norway. The overall objectives of this project are to assess and develop new exploration and exploitation technologies for seafloor massive sulfide deposits along the Arctic Mid-Oceanic Ridges.

***Cruises:***

The yearly expeditions to the north atlantic ridge system continued during summer 2016 and 2017. New vents have been discovered along Mohns ridge and new instrumentations (temperature probes, OBSs, fluid and rock sampling) were deployed to gather data on these systems.

As a part of the MarMine project, NTNU also conducted a successful cruise along the Arctic Mid-Oceanic Ridge in the spring 2017.

***Upcoming:***

The RV Kronprins Haakon, a Polar Class 3 icebreaker, was launched on 28 February 2017. The vessel will be delivered to the Norwegian Polar Institute in the upcoming months and should be ready for scientific operations in 2018. This new research vessel will be equipped for various ridge related sciences, from deep marine biology to geology. The main deck will be dedicated to scientific activities with laboratories, refrigerated storage rooms, an A-frame, and a 3-by-4 m moon pool permitting ROV deployment operations in ice-covered seas. Detailed exploration of the ultra-slow spreading Gakkel ridge using modern underwater vehicle is one of the primary objectives of the Norwegian efforts in the upcoming years. Because of limited maneuverability in ice-covered seas, combining the

RV Kronprins Haakon capabilities with Ægir 6000 and its 1000m TMS system will play an important role to make this task achievable.

## **UK National Update**

*Richard Hobbs*

A new polar research vessel is currently being built at the Cammel Laird shipyard in Liverpool. The new 128m vessel will enter service in 2019 and will have a 60-day endurance and will accommodate up to 60 scientists. Besides a suite of laboratories and work areas the ship will have a moon-pool making it easier to deploy instrumentation especially in poor weather.

The following have been extracted from the UK Research Council Website that lists currently funded grants.

### **Over the past year completed projects:**

#### ***Characterising hydrothermal alteration across the Atlantis Massif: IODP Expedition 357*** ***Principal Investigator: Dr M Harris, University of Plymouth***

Used scientific ocean drilling of the Atlantis Massif during IODP Expedition 357 to investigate the role of hydrothermal circulation in the formation of ocean crust along long-lived detachment faults where gabbroic and mantle rocks are exposed at the sea-floor.

#### ***Investigating the influence of lithology and water depth on the composition and distribution of sulphides at the worlds deepest known vent sites.***

Investigator: Dr B J Murton, National Oceanography Centre

A study of the hydrothermal vents within the Cayman Trough, deep beneath the Caribbean Sea where supercritical fluids at nearly 500 degrees Celsius are venting into the abyssal ocean. This unique opportunity used this natural laboratory to test predictions about the formation, distribution and composition of ore deposits formed from such high-temperature supercritical fluids.

### **Currently funded projects include:**

#### ***OSCAR - Oceanographic and Seismic Characterisation of heat dissipation and alteration by hydrothermal fluids at an Axial Ridge***

Investigators: Professor R W Hobbs, Professor Christine Peirce, Durham University; Dr Miguel Maqueda Morales, Newcastle University; Dr Vincent Tong, University College London; Professor Joanne Morgan, Imperial College London; Dr David Smeed, National Oceanography Centre

An international project led from the UK, based on the Panama basin, acquired an interdisciplinary dataset combining both physical oceanography, heatflow and geophysics during a series of three acquisition cruises. These data have been used to build and parameterise new integrated models that provide valuable insight and new constraints of the thermal processes close to ocean ridges that includes a permeable seabed. These

models provide new understanding of the fluid and heat fluxes at ocean ridges and how geothermal heating is a significant driver for global circulation.

### ***Crustal accretion and transform margin evolution at ultraslow spreading rates***

Investigator: Professor C Peirce, Durham University, Earth Sciences

Part of a British, German and American partnership, used sub-seabed seismic imaging to study the structure and lithology of the crust at the Mt Dent OCC in the Cayman Trough and to determine the relationship between this and the adjacent volcanic domain that also hosts hydrothermal vents. The project also investigated the deep fault geometries and the influence of the adjacent thick, cold continental lithosphere.

### ***The impact of Mid-Ocean Ridges on the Ocean's Iron cycle***

Investigators: Dr A Tagliabue, Dr A E Heath University of Liverpool; Professor M C Lohan, University of Southampton.

To measure mixing and other macronutrients over mid-ocean ridges to study the nutrient and carbon pump and the associated role for iron. The project provides state of the art observational and modelling constraints on two important aspects of the ocean iron cycle: 1) How does the ocean ridge impact physical mixing of iron to the surface and 2) what chemical processes control the large scale influence of the iron directly supplied by mid-ocean ridges. Ultimately to address the broader question of how the amount and chemical form of iron from mid-ocean ridges influences phytoplankton growth in the open ocean.

### ***The seismic signature of serpentinite in subduction zones: A rock physics approach***

Investigators: Dr N Brantut, University College London; Professor D Dobson, Dr T M Mitchell, University College London

The study provides a characterisation of the seismic signature of deformed and dehydrating serpentinites originally formed by hydrothermal reaction at mid-ocean ridges during subduction. The data contributes to a better understanding of the deformation and dehydration mechanisms that are key aspects of subduction zone dynamics.

### ***Role and extent of detachment faulting at slow-spreading mid-ocean ridges***

Investigators: Professor T J Reston, University of Birmingham; Professor C Peirce, Durham University; Professor C J MacLeod, Cardiff University.

The project aims to differentiate between two models of the role of detachment faulting at mid-ocean ridges. The data for this study comes from a comprehensive seismic and seabed topography and magnetic survey of the mid-Atlantic Ridge in the 13N region, where detachment faults are active at the ridge axis today. An array of ocean-bottom seismographs (OBSs) provide a 3D velocity image 3D velocity variations that can be related to different rock and a multi-channel reflection survey, images the sub-surface discontinuities. A subsequent passive seismology experiment recorded the locations of natural micro-earthquakes in the region to reveal the 3D geometry of the active faults.

***Passive Imaging of the Lithosphere Asthenosphere Boundary (PiLAB) – part of larger EU funded project***

Investigators: Dr C A Rychert, Dr N Harmon, Dr K A Weitemeyer, University of Southampton

The acquisition of a systematic image the entire length of an oceanic plate, from its birth at the Mid Atlantic Ridge to its oldest formation on the African margin at multiple scales of resolution and sensitivity, from a metre to kilometre scale using seismic and electromagnetic methods to determine the processes and properties that make a plate strong and define it. The project is accomplished through a large, focused international collaboration that involves EU partners (3.5 M euro) and industry (6.4M euro).

***From Ridge to Trench, MoHole to Bend-Faults***

Investigators: T Henstock, D A Teagle, University of Southampton

To test whether the plate offshore Central America is suitable for two ambitious deep drilling projects to drill into the Earth's mantle by determining the crustal thickness, and properties of the crust and upper mantle by seismic methods. A specific target is to determine where subduction related bend-faults form, how they evolve, and how the properties of the crust and mantle change as they do and search for sites along a bend-fault where hot water returns to the seafloor using AUV and detect any associated lifeforms.

***Rift volcanism: past, present and future***

Investigators: J Biggs, K V Cashman, J Gottsmann, J D Blundy, F F Whitaker, M Kendall, University of Bristol

To study the volcanic eruptions in Ethiopia associated with the Great Rift Valley by collecting samples, mapping the geology and deploying geophysical instruments. To determine the timing, size and style of past eruptions and the plumbing system feeding the volcanoes today. Finally, to model possible scenarios and create a long-range eruption forecast for Ethiopia.

***Transport of post-transition metals in hydrothermal fluids: thermodynamics from first-principles***

Investigator: D M Sherman, Bristol

By computer simulations of the chemistry of hydrothermal fluids at high temperature and pressure, determine how metals are complexed by dissolved ligands such as Cl<sup>-</sup>, HS<sup>-</sup> and derive equilibrium constants for these reactions entirely from first-principles. To provide new insights on the chemistry and role of fluids in the Earth's crust and understand how associated ore-deposits form.

***Radium in Changing Environments: A Novel Tracer of Iron Fluxes at Ocean Margins***

Fellow: Dr A L Annett, University of Southampton, School of Ocean and Earth Science



To measure Fe and Ra near hydrothermal vents along the Mid-Atlantic Ridge to determine the removal of Fe from vent fluids as they drift away from vent sites and provide vital information for evaluating the contribution of this source to the total amount of Fe in the world's oceans. These measurements will be combined with measurements of Fe and Ra from glaciers in both Antarctic and Greenland. Hence predict the impacts of changes in Fe supply on phytoplankton health, the biological pump, and global climate.

A nutrient and carbon pump over mid-ocean ridges  
The yearly expeditions to the north atlantic ridge system continued during summer 2016 and 2017. New vents have been discovered along Mohns ridge and new instrumentations (temperature probes, OBSs, fluid and rock sampling) were deployed to gather data on these systems.

As a part of the MarMine project, NTNU also conducted a successful cruise along the Arctic Mid-Oceanic Ridge in the spring 2017.

***Upcoming:***

The RV Kronprins Haakon, a Polar Class 3 icebreaker, was launched on 28 February 2017. The vessel will be delivered to the Norwegian Polar Institute in the upcoming months and should be ready for scientific operations in 2018. This new research vessel will be equipped for various ridge related sciences, from deep marine biology to geology. The main deck will be dedicated to scientific activities with laboratories, refrigerated storage rooms, an A-frame, and a 3-by-4 m moon pool permitting ROV deployment operations in ice-covered seas. Detailed exploration of the ultra-slow spreading Gakkel ridge using modern underwater vehicle is one of the primary objectives of the Norwegian efforts in the upcoming years. Because of limited maneuverability in ice-covered seas, combining the RV Kronprins Haakon capabilities with Ægir 6000 and its 1000m TMS system will play an important role to make this task achievable. (RidgeMix)

Investigators: Alberto Naveira Garabato, University of Southampton; Jonathan Sharples, University of Liverpool.

Phytoplankton growth in the mid latitude ocean is more than might initially be expected, and is globally very important as it drives about half of the oceans' biological removal of carbon out of the atmosphere. Using a combination of measurements of the turbulence and nutrient concentrations over and adjacent to the mid-Atlantic ridge together with computer models of circulation explore the wider implications and test if mixing over the mid-Atlantic ridge really does provide enough nutrients to explain the phytoplankton production in the mid-latitude N Atlantic.

***The colonisation of hydrothermal vents by complex life: a natural experiment in macroevolution.***

Investigators: Dr A G Glover, Professor R Herrington, Dr A Riesgo, The Natural History Museum; Dr J T P Copley, University of Southampton; Dr C T S Little, University of Leeds

To gain vital evolutionary insights into the colonisation of hydrothermal vents, both in the modern ocean and throughout Earth history. Primary data for this project will be from key geological localities in Norway, Canada and Tasmania, and the southern Ural Mountains. Collected fossil samples will be subjected to new detailed palaeontological investigations, and high resolution sulphur isotopic analyses. To investigate recent and ongoing adaptation at modern hydrothermal vents we will work on samples of traditional non-vent fauna that we can observe colonising new hydrothermal systems, using advanced DNA techniques.

### ***EU-funded projects (current)***

Blue Mining Breakthrough Solutions for the Sustainable Exploration and Extraction of Deep-sea Mineral Resources

Investigators: Dr B J Murton, National Oceanography Centre.

This 15 Million Euro EU-funded programme is a partnership between industry and academia. The scientific focus is on hydrothermally extinct seafloor massive sulphide deposits (eSMS) and has involved UK and German cruises (in 2016) to map the central area of the TAG segment of the Mid-Atlantic ridge with AUV's, conduct multi-resolution EM and seismic reflection and refraction surveys and drill a number of eSMS deposits with a seafloor drilling rig. The objectives include 3D imaging of the sub-seafloor mineralised sulphide body, stockwork and fluid pathways, to understand the evolution of hydrothermal mineralisation from high-temperature formation to the close of activity, to image the structural and volcanic controls on hydrothermal activity, to quantify alteration and remobilisation of metals within the deposit and to determine the processes forming metaliferous sediments and their preservation.

### **USA National Update**

After the ending of the RIDGE 2000 program in 2012, the number of investigations at the three legacy "integrated study sites" - the 9°N segment of the East Pacific Rise, the Endeavour segment of the Juan Fuca Ridge, and the Lau backarc spreading center, have significantly decreased. Nonetheless, the selection of Axial Volcano on the Juan de Fuca Ridge as one of several seafloor observatories to be cabled under the Ocean Observatories Initiative ([oceanobservatories.org](http://oceanobservatories.org)) has resulted in the deployment of a diverse array of geophysical, chemical, and biological sensors, as well as an HD camera and digital still camera, all of which provide real-time information on linkages between seismic, volcanic, and fluid flow events at that location.

US-lead expeditions to the mid-ocean ridge for 2016 to 2018 are summarized in the accompanying table. The U.S. National Science Foundation is presently funding well over 70 projects touching on mid-ocean ridges, which collectively covers a broad range of topics from geology, geophysics, biology, chemistry, to physical oceanography; a significant number of these projects do not involve any field expeditions. These past few

years, Monterey Bay Aquarium Research Institute (mbari.org), the Ocean Exploration Trust (oceanexplorationtrust.org), and the Schmidt Ocean Institute (schmidtocean.org) have also provided opportunities to visit the mid-ocean ridges with their oceanographic ships, the *R/V Western Flyer*, the *E/V Nautilus* and the *R/V Falkor*. Of special interest to the InterRidge community, the Ocean Exploration Trust offers the opportunities for “scientists ashore” from all nationalities to participate live in their expeditions via satellite telepresence: Scientists ashore can view live video and limited data feeds from the ROVs *Hercules* and *Argus*, view data from seafloor and water column mapping efforts, participate in a text dialogue with onboard scientists and other onshore scientists, and therefore directly contribute to ROV dives and mapping operations (www.oceanexplorationtrust.org/scientists-ashore). Data collected during the *E/V Nautilus* expeditions are archived at three locations based on data type (digital, geological, and biological) and are available to interested scientists upon request. The three respective databases can be queried online (oceanexplorationtrust.org/data-request; ngdc.noaa.gov/mgg/curator/curator.html; mcz.harvard.edu).

Ridge-related US expeditions, 2016-2018			
Cruise Dates	Ship / Vehicle	Location	Chief Scientist
March 7- April 2, 2016	<i>R/V Atlantis, HOV Alvin &amp; AUV Sentry</i>	Mid-Atlantic Ridge, 14°N	Mark Kurz (WHOI)
April 7- May 5, 2016	<i>R/V Falkor, ROV ROPOS</i>	Eastern Lau Spreading Center	Chuck Fisher (Penn State U.)
June 26 - Aug. 16, 2016	<i>R/V Western Flyer, ROV Doc Ricketts</i>	Juan de Fuca Ridge, Axial Volcano	David Clague (MBARI)
July 8 - Aug. 15, 2016	<i>R/V Sikuliag, ROV Jason</i>	Juan de Fuca Ridge, Axial Volcano	Deb Kelley (U. Washington)
Oct. 8-27, 2016	<i>R/V Atlantis, HOV Alvin</i>	East Pacific Rise, 9°N	Kang Ding (U. Minnesota)
Nov. 3-Dec. 3, 2016	<i>R/V Atlantis, HOV Alvin &amp; AUV Sentry</i>	EPR, 8°20'N, off-axis seamounts	Patricia Gregg (U. Illinois)
Nov. 29-Dec. 20, 2016	<i>R/V Falkor, ROV SuBastian</i>	Mariana backarc spreading center	David Butterfield (U. Washington)
Dec. 8-27, 2016	<i>R/V Atlantis, HOV Alvin, AUV Sentry</i>	Gulf of California, Guaymas Basin	Andreas Teske (U. North Carolina)
Jan. 14-Feb. 20, 2017	<i>R/V Atlantis, ROV Jason, AUV Sentry</i>	Easter microplate, Pito deep	Michael Cheadle (U. Wyoming)
March 27-Apr. 19, 2017	<i>R/V Atlantis, HOV Alvin</i>	East Pacific Rise, 9°50'N	George Luther (U. Delaware)
April 24-May 14, 2017	<i>R/V Atlantis, HOV Alvin</i>	East Pacific Rise, 9°50'N	Stefan Sievert (WHOI)
July 13-23, 2017	<i>R/V Revelle, ROV Jason, AUV Sentry</i>	Juan de Fuca Ridge, Axial Volcano	Bill Chadwick (Oregon State U.)
July 25 - Aug. 29, 2017	<i>R/V Revelle, ROV Jason</i>	Juan de Fuca Ridge, Axial Volcano	Deb Kelley (U. Washington)
Sept. 13-23, 2017	<i>R/V Revelle</i>	Juan de Fuca Ridge, Axial Volcano	William Wilcock (U. Washington)
Oct. 2 - Nov. 1, 2017	<i>R/V Atlantis, ROV Jason</i>	Mid-Atlantic Ridge, 23°N, North Pond	Geoffrey Wheat (U. Alaska)
Oct. 3-17, 2017	<i>E/V Nautilus</i>	Revillagigedo Archipelago (Mathemat. Ridge)	Nicole Raineault (U. Rhode Island)
Oct. 20-27, 2017	<i>E/V Nautilus, ROV Hercules</i>	Gulf of California, Guaymas Basin	Adam Soule (WHOI)
Oct. 30 - Nov. 3, 2017	<i>E/V Nautilus, ROV Hercules</i>	Gulf of California, Pescadero Basin	Anna Michel (WHOI)
Nov. 8 -20, 2017	<i>E/V Nautilus, ROV Hercules</i>	Revillagigedo Archipelago (Mathemat. Ridge)	Steve Carey (U. Rhode Island)
Nov. 10-Dec. 17, 2017	<i>R/V Falkor, ROV SuBastian</i>	Northeast Lau Basin	Ken Rubin (U. Hawaii)
Dec. 16 2017 - Feb 3 2018	<i>R/V Atlantis</i>	Rio Grande Rise, south Atlantic	Anthony Koppers (Oregon St. U.)
March-April 2018	<i>R/V Sally Ride</i>	Cocos-Nazca Ridge near Galapagos T.J.	Emily Klein (Duke U.)
June 2018	<i>R/V Atlantis, HOV Alvin, AUV Sentry</i>	Mid-Atlantic Ridge, 14°N	Mark Kurz (WHOI)
August 2018	<i>R/V Kilo Moana, ROV Jason</i>	Juan de Fuca Ridge, Axial Volcano	Scott Noonon (U. North Carolina)
August 2018	<i>R/V Kilo Moana, ROV Jason</i>	Juan de Fuca Ridge	Meg Tivey (WHOI)
end June - beg. Aug. 2018	<i>R/V Revelle, ROV Jason</i>	Juan de Fuca Ridge, Axial Volcano	Deb Kelley (U. Washington)
October 2018	<i>R/V Atlantis, ROV Jason</i>	Mid-Atlantic Ridge, Lost City	Susan Lang (U. South Carolina)
November 2018	<i>R/V Atlantis, HOV Alvin</i>	Gulf of California, Guaymas Basin	Andrea Teske (U. North Carolina)
December 2018	<i>R/V Atlantis, HOV Alvin, AUV Sentry</i>	EPR near 8°20'N, off-axis seamounts	Patricia Gregg (U. Illinois)

The 6th International Symposium on Chemosynthesis-Based Ecosystems (CBE6) was held in Woods Hole (MA) on August 27 – September 1, 2017 (<http://cbe2017.org>), a meeting that highlighted the newest discoveries and developments.

The US ridge community values the objectives of the InterRidge and, thanks to the combined effort of the National Science Foundation and several research institutions and scientists, funding has been secured for the US participation as a principal member of InterRidge for 2017.

## **Chile national update**

*Luis E. Lara*

Chile has contributed with a very modest effort to the ridge research. However, interest in scientific research of active (spreading) and aseismic ridges, seamounts and oceanic islands is in good health and some projects with national funding are going on. On the other hand, SERNAGEOMIN (the Chilean Geological Survey) is setting a long-term program for research on marine geology and geophysics, where certainly spreading centers (especially the Chile Ridge) will be present. Since 2015, oceanic research in Chile is further supported by Conicyt, the science agency that provides funding for work on board of the AGS 61 Cabo de Hornos. At national scale, the government is promoting a national policy for the oceans, which will be the framework for new developments in this line and for what Earth sciences are a key component.

### **A brief summary of recent research on these topics include:**

A couple of years of geophysical survey of the Chile Ridge close to the triple junction (Nazca, South America and Antarctic plates), aimed to produce basic knowledge of the potential areas for the extended continental shelf according to the UNCLOS. Derived research about the morphology of the Chile Ridge based on high-resolution bathymetry is in progress.

More than 4 years of active research on the Juan Fernández Ridge (a chain of seamounts and oceanic islands in the Pacific SE) are producing some interesting results. With support of Conicyt (through Fondecyt grants) and IFOP (Instituto de Fomento Pesquero), new bathymetric surveys have allowed sampling of the most outstanding seamounts (e.g., O'Higgins guyot), where volcanic rocks representing rejuvenated volcanism have been recovered and dated with high-resolution  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  geochronology. Oceanic islands (especially Robinson Crusoe) have been focus of detailed geological studies and results have been published, for example about the vertical movements (e.g., Sepúlveda et al., 2015. Biogeosciences) and petrology (e.g., Reyes et al., 2017. J Volcanol Geotherm Res.). FIPA projects granted by IFOP have supported new bathymetric surveys of seamount along the Juan Fernández Ridge aimed to better constrain the biological resources and protection of these sensitive habitats. On the other hand, CONA (the National Oceanographic Committee) funded in 2016 a cruise to the Easter Seamount Chain and San Félix and San Ambrosio islands with a leg segment in Juan Fernandez Ridge. Finally, for next December 2017 a cruise is scheduled to map seamounts along the margin from the Juan Fernández Ridge (33°S) to the Copiapó Ridge (27°S) as part of a continued effort to better understand volcanism in the Nazca Plate.

## Russia National Update

Sergei Silantyev



The biennial workshop of Russian-Ridge was held in St.-Petersburg on 1-2 June 2017 in VNIIOkeangeologia, St. Petersburg. The topic of this workshop was “The Mid-Ocean Ridges - new data on geology, mineral deposits and ecology of hydrothermal systems”. Workshop brought up for discussion most important results of multidisciplinary investigations of the Mid-Oceanic Ridges obtained by Russian scientists during last two years, R-Ridge activities as well as upgrade of the R-Ridge web-site: <http://intranet.geokhi.ru/russianridge>

Among the most important results of investigations of ridge processes carried out by Russian scientists during 2015 - 2017 and presented on Russian Ridge Workshop'17 it should be to highlight the following:

### 1. Mid-Atlantic Ridge Hydrothermal ore deposits

Most important achievement of 37-th Cruise of R/V “Professor Logachev” (Shipowner: PMGE, St. Petersburg) that was conducted in MAR crest zone during Spring time, 2015, is finding a few new active hydrothermal fields those belong to single large hydrothermal cluster “Pobeda”: “Pobeda-1” (17°08,7’N, 46° 23,44’W, depth 2200m); Pobeda-2”, 4 km to SW of “Pobeda-1” (17°07,4’N, 46° 24,5’W, depth 2900m. ); “Pobeda-3”, 2 km to SW of “Pobeda-1” (17°08,3’N, 46° 24,2’W, depth 2700-2500m.. Massive sulfides were dredged here. Until now this segment of MAR has been unexplored and information about structure of basement rock was absent. Judging from the data obtained in 37-th Cruise of R/V “Professor Logachev”, characteristic sign the considered MAR segment is wide distribution of plutonic rock, often with features of syntectonic recrystallization. MAR segment between 17°30’ and 17°35’ N, is characteristic the most submerged section of the rift valley (4500-4700 m) with low magmatic budget. – *Polar Marine Geosurvey Expedition, St.Petersburg*, [www.pmge.ru](http://www.pmge.ru), [www.vniio.org](http://www.vniio.org)

### 2. Petrology and Geochemistry: different aspects of petrogenesis in the Mid-Oceanic Ridges

#### New data on composition of primary magmatic melts originated in Bouvet Triple Junction

- New evidence for heterogeneity of Bouvet Triple Junction (BTJ) primary melts revealed by volatile components systematic was obtained. Data on the presence and

concentrations of volatile components in the gas phase and dissolved in the quenched glasses of the BTJ melts allow assume the geochemical heterogeneity of the primary melts which might be caused by the involvement of the different substances in melting of primary BTJ magma source and/or the influence of the Bouvet hot spot activity. – *N.A. Migdisova., A.I. Buikin., T.A. Shishkina. Vernadsky Institute PAS, Moscow, [www.geokhi.ru](http://www.geokhi.ru)*

- The complex study of major, trace, chalcophile elements and volatile components of BTJ magmas evidenced for the long-lasting development of BTJ region in conditions of complex geological setting has resulted in formation of heterogeneous metasomatized enriched suboceanic mantle. *T.A. Shishkina., M.V. Portnyagin, N.A. Migdisova., N.M. Sushchevskaya Vernadsky Institute RAS, Moscow, [www.geokhi.ru](http://www.geokhi.ru)*

### **Geochemical and Petrological peculiarities of plutonic rocks composing Oceanic Core Complexes**

- Data on distribution of siderophile and chalcophile elements in abyssal peridotites has been used as reflection of interaction of endogenous and exogenous processes in the Mid-Ocean Ridges. Significant Sr influx into ocean peridotites was determined to be associated with both carbonation of these rocks and their serpentinization (Silantyev, 2003). Hence, the level of the Sr concentration is an informative geochemical indicator of the degree of alteration of abyssal peridotites. This parameter makes it possible to estimate the relative mobility of siderophile and chalcophile elements in the course of low-temperature metamorphism of MOR peridotites and the dependence of the distribution of these elements on the serpentinization and carbonation processes. *S.A. Silantyev, I.V. Kubrakova., O.A. Tyutyunnik. Vernadsky Institute RAS, Moscow, [www.geokhi.ru](http://www.geokhi.ru)*

- Compositional microheterogeneity of Zircon from plutonic rocks composing Oceanic Core Complex may reflect mixing of variously differentiated melt portions and mixing of diorite-plagiogranite melts from different sources. Interaction of gabbro with hydrothermal brine (30—32 wt.% NaCl) results in zircon (re)crystallization with its extremely uneven enrichment in Y, P, Th, and U in aggregates with heterogeneous amphibole.

*A.N. Pertsev, O.M. Zhilicheva, IGEM RAS, Moscow, [www.igem.ru](http://www.igem.ru)*

### **3. Geophysics data and Tectonic in the Mid-Oceanic Ridge Crest Zones**

- An interesting results from analysis of the distribution of geochemical signs of MAR peridotites along its axis and footwall position of seismic tomography anomaly are realized. Overview of these data shows, that tomography models of upper mantle of modern precision could already provide the basis for geochemical parameters interpretation and for prediction of them into the areas with no oceanic bottom sampling. *S.Yu.Sokolov., S.A. Silantyev,GIN RAS, Vernadsky Institute RAS, [www.ginras.ru](http://www.ginras.ru), [www.geokhi.ru](http://www.geokhi.ru)*

- Results of investigation of evolution of Spreading Basins based on wedge shaped pattern of anomalous magnetic fields data put allow to have new ideas on geodynamic history of Galapagos Spreading Center (GSC) and eastern segment of Southwest Indian Ridge (SWIR). The spreading systems of GSC and SWIR were formed due to the change in the

motion vector of the large lithospheric plates, which changed the configuration of the rift systems. Despite the difference in spreading rates, the GSC and the eastern part of SWIR have similar morphology, which is formed as a result of changes in the motion vectors of plates to the north or south of the wedge axis *K.O.Dobrolyubova, S.Yu. Sokolov, A.S. Abramova. GIN RAS, Moscow, [www.ginras.ru](http://www.ginras.ru)*

#### **4. New data on Structure of Gakkel Ridge**

- East of 70° E the Gakkel Ridge is still well expressed in the relief. South of 81° N the Gakkel Ridge is not observed in the relief of the Arctic Ocean floor. Analysis of isopachite maps of the various sediment layers and the bottom relief features in the zone of transition from the Eurasian Basin to the continental slope of the Laptev Sea indicates that during the Miocene time the axial spreading zone in this area was to the east of its present position

*A.L. Piskarev, S.P. Pavlov, V.A. Savin., D.V. Elkina, VNIIOkeangeologia, St. Petersburg, , [www.vniio.org](http://www.vniio.org)*

- It was established that the Rift Zone of the Eurasian basin, which is southward of the Kiseleva depression is filled with a sedimentary series with thickness up to 3 km and is completely devoid of framing uplifts, while northwardly -the thickness is reduced to 2 or less km and the rift zone is surrounded by a chain of seamounts. This implies that the conclusion about the sequence of geological events in the formation of the Mid-Oceanic Gakkel Ridge can be made. In the beginning the rift zone had been formed in sedimentary basin, then tectonomagmatic and volcano-tectonic uplifts developed around and the mid-oceanic ridge was finally formed. In the Laptev part of the Eurasian basin we are dealing with the first stage of generation and evolution of the mid-oceanic ridge

*Artemyeva D. E., Gusev E. A., Vinogradov V. A. VNIIOkeangeologia, St. Petersburg, [www.vniio.org](http://www.vniio.org)*

Listed above data are presented in more detailed design on the web-site of Russian Ridge as abstract Volume of Workshop-RR'13 (open access): <http://intranet.geokhi.ru/russianridge>.

## **6 Status of Membership and Steering Committee members**

Declarations of membership level in 2019:

China – principal member

France – host

Norway – principal member

Canada – regular member

Germany – regular member

India – regular member

Japan – regular member

Korea – regular member

United Kingdom – regular member



## 7 Working Group Updates

### **Recent activities of the InterRidge Working Group on Oceanic Transform Faults**

**Co-Chairs:** Marcia Maia (France, geophysics, tectonics), Barry Hanan (USA, isotope geochemistry), Daniele Brunelli (Italy, petrology)

The first workshop of the InterRidge Working Group on Oceanic Transforms took place from 22nd to 24th May 2018 in Brest/Plouzané (France). The workshop was attended by more than 40 international scientists from 7 specialities (geochemistry, petrology, geophysics, tectonics, structural geology, hydrothermalism, modelling). Participants dedicated the first day and a half for oral presentations and poster session discussing the state of the art on transform faults (TF) and fracture zones (FZ) concerning all aspects of the mechanics, petrology, structure, morphology and dynamics of the system. The acronym Transform Fault System (TFS) has been proposed to identify the whole tectonic system from the active part to its prolongation into the drifting plates. Afterwards, the attendants discussed all aspects necessary to identify the key questions for a comprehensive understanding of TFS. Experiments were proposed on how to answer basic questions on imaging the TF to FZ transition and thermo-mechanical, compositional alteration and stress-strain relationships to constraint physical parameters that control the TFS evolution through time. A major point was to find appropriate target regions where to apply these experimental approaches. Two major outcomes of the workshop are: the need to systematically integrate modelers to the exploratory and experimental actions and the need for high frequency investigation of TFS over long time stretches. To achieve this aim, the participants propose to launch a call for white papers addressing the different aspects putting together integrated experimental and modeling approaches to the main TFS problematic. It also appears necessary to sustain the exchange in the community by dedicated workshops and/or sessions at AGU-EGU.

The full text of the report can be found at the WG website: [http://interridge.org/files/interridge/Final\\_complete\\_report\\_OT\\_WS\\_Brest.pdf](http://interridge.org/files/interridge/Final_complete_report_OT_WS_Brest.pdf)

### **Recent activities of the InterRidge Working Group on Integrating Multidisciplinary Observations in Vent Environments (IMOVE)**

**Proponents board led by** Thibaut Barreyre, University of Bergen (Norway)

WG objectives and timeliness – IMOVE will contribute to the InterRidge research community by fostering and coordinating the integration of hydrothermal data from vent fields where observatory-style data have been acquired. A large set of temporal and spatially-variable multi-disciplinary data have been collected from deep-sea vent fields at considerable cost to the international community, but to this point the datasets have mostly been analyzed in a piecemeal fashion. Systematic efforts to integrate data from different disciplines and synthesize these products into quantitative, cross-disciplinary models relevant to hydrothermal processes on the global MOR system have the potential to produce transformative scientific results, and are clearly needed at this point in time. This WG will provide an international framework for this effort, and the relatively modest funding

required will effectively leverage all of the previous funding allocated (logistical and scientific) to gather and study this data by individual countries and organizations. We propose 1) to develop a collaborative platform to access the existing data and metadata in standardized formats, along with the available relevant analytical and modeling tools and 2) to hold two IMOVE workshops in order to synthesize data products, facilitate technology transfers and address the challenge of integrating observatory-style data at the global-scale.

The first workshop of this Working Group should be organized in late 2018.

### **Recent activities of the InterRidge Working Group on Circum-Antarctic Ridges**

**Co-Chairs:** Anne Briais (OMP Toulouse, France), Jian Lin (WHOI, USA), Sung-Hyun Park (KOPRI, Korea)

A proposal for a follow-up of this working group to continue the major, coordinated effort started in 2012 was submitted to the Steering Committee in July 2017. The Southern Ocean area is so vast that no single nation can make large scientific advances on the Circum-Antarctic Ridges. InterRidge can help with the survey of Circum-Antarctic Ridges, launch new projects, coordinate existing cruise projects, and share information. The Steering Committee recommended the proposal to be re-submitted with a more focused scientific objective, for example concerning biogeography or the link between hydrothermal systems and oceanic circulation.

The activities of the InterRidge Working Group on Circum-Antarctic Ridges in the last few years included coordinating science with one workshop, gathering new data, with cruises performed all around the Antarctic, and sharing the results. To have a new update on the results and projects regarding the southern ridges, a special session at the 2017 Fall AGU meeting have been organized. This event was included in Session T31C/T33G “From Mantle Plumes to Ocean Plumes: Mapping Heat Transfer from Mantle to Ocean” (Co-conveners: Richard W Hobbs (University of Durham, UK), Anne Briais (CNRS, France), Seung-Sep Kim (Chungnam National University, South Korea), and Ali Mashayek (Scripps Institution of Oceanography, USA). The session brought together members of the solid earth and ocean research communities to discuss interactions between the mantle, the crust and the oceans, focusing on the mid-ocean ridge and its flanks, through a holistic interdisciplinary approach. Twelve posters and 8 talks were presented during the session on 13 December 2017 (<https://agu.confex.com/agu/fm17/meetingapp.cgi/Session/34811>).

#### ***2017 Fall Meeting AGU special session***

Posters Wednesday, Dec. 13, 2017, 08:00-12:20:

T31C-0633 Mantle heterogeneity across segment at southernmost segment of Central Indian Ridge **Hiroshi Sato** et al.

T31C-0634 Segmentation and Contrasting Magma Supply Along the South-East Indian Ridge, 130°E to 140°E: Results of the STORM Cruise **Anne Briais** et al.

T31C-0635 U-Series Disequilibria Across the New Southern Ocean Mantle Province, Australian-Antarctic Ridge, **Sean R Scott** et al.

T31C-0636 Geophysical Investigation of Upper Mantle Anomalies of the Australian-Antarctic Ridge Hakkyum Choi et al.

T31C-0637 Morpho-tectonic characteristics of Australian-Antarctic Ridge. **Sung-Hyun Park** et al.

T31C-0638 Numerical Modeling of Hydrothermal Circulation at the Longqi-1 Field: Southwest Indian Ridge **Zhikui Guo** et al.

T31C-0639 Estimating the Total Heat Flux from the ASHES Hydrothermal Vent Field Using the *Sentry* Autonomous Underwater Vehicle **Timothy J Crone** et al.

T31C-0640 Axial crustal structure of the Costa Rica Rift: Implications for along-axis hydrothermal circulation **Ling Zhang** et al.

T31C-0641 Porosity, Fracturing and Alteration of Young Oceanic Crust: New Seismic Analyses at Borehole 504B **Emma P M Gregory** et al.

T31C-0642 Evolution of Heat Flow with Age on the Southern Flank of the Costa Rica Rift **Kannikha Parameswari Kolandaivelu** et al.

T31C-0643 Modelling Deep Ocean Circulation in the Panama Basin Driven by Geothermal Heating **Jowan Menhinick Barnes** et al.

T31C-0644 Geothermal heating in the Panama Basin and its impact on water mass transformation **Donata Banyte** et al.

Oral presentations Wednesday Dec. 13, 2017 13:10 to 15:40:

T33G-01 Geothermal influences on the abyssal ocean (Invited) **Julien Emile-Geay**, and Guran Madec

T33G-02 Observation and modeling of hydrothermal response to the 2015 eruption at Axial Seamount, Northeast Pacific: An OOI Cabled Observatory case study **Guangyu Xu** et al.

T33G-03 Hydrothermal and Chemosynthetic Ecosystems in the Southern Ocean: Current Knowledge on their Biology (Invited) **Katrin Linse** et al.

*T33G-04 Examining the Effect of Temperature, Pressure, Seismicity and Diffuse Fluid Flow on Floc Events at Axial Seamount* **Meethila Rahman** et al.

T33G-05 Determining the Extent of Hydrothermal Interaction on the Southern Costa Rica Rift Ridge Flank During the Past 8 Ma from Joint Inversion of Geophysical Data **Dean J Wilson** et al.

T33G-06 Complex Tectono-Magmatic Interaction along the George V Transform Fault, South-East Indian Ridge, 140°E, and Implications for Mantle Dynamics **Etienne Ruellan** et al.

T33G-07 Isotopic evidence for a large-scale plume-derived mantle domain between the Indian and Pacific mantles beneath the Southern Ocean. (Invited) **Sung-Hyun Park** et al.

T33G-08 Geochemical and Isotopic Variations Along the Southeast Indian Ridge (126°-140°E) Related to Mantle Flow Originating from Beneath Antarctica **Barry B Hanan** et al.

This activity concluded the WG in its present form.

### **Recent activities of the InterRidge Working Group on Ecological Connectivity and Resilience**

InterRidge Working Group on Ecological Connectivity and Resilience, chaired by Anna Metaxas (Dalhousie Univ., Canada) and Lauren Mullineaux (WHOI, USA), has published a review entitled "Exploring the Ecology of Deep-Sea Hydrothermal Vents in a Metacommunity Framework" in *Frontiers in Marine Science* in February 2018. This article reviews current knowledge and gaps on the mechanisms supporting the stability of vent meta-communities, of high relevance to the assessment of impacts at regional scales and design of protection plans. InterRidge financed the publication fee. This publication concluded the activity of the WG.

## **8 New Working Groups – discussions on proposals**

The InterRidge Office has received 2 resubmitted proposals for new working groups prior to the Steering Committee meeting.

During the discussion, the Steering Committee has given recommendations to improve the proposals and make them compliant with the goals and practices of IR. The Committee has decided to support the creation of two new WGs, pending minor modifications of the proposal, and has recommended some improvements. The discussions and recommendations are summarized as follows:

### **Working Group on mid-ocean ridge islands and seamounts.**

The Steering Committee has approved the creation of the Working Group on Mid-Ocean Ridge Islands and Seamounts according to the resubmitted version of their proposal. This resubmitted proposal follows the previous guidelines of the Steering Committee. However, we urge you to consider two important recommendations for the final organization of your Working Group.

1) Considering the size of the proposed working group membership and its uneven distribution in gender, country-continent and age, the Steering Committee would appreciate you to establish a core group of about 10 international scientists, balanced in genders, country-continent and ages in order to create the Scientific Board of the Working Group. It is of prime importance that this WG reflects the international dimension of InterRidge as the program promoting studies of oceanic spreading centers by creating a global research community, and planning new science programs that no single nation can achieve.

2) As the work-plan of the Working Group on mid-ocean ridge islands and seamounts has been judged as ambitious, the Steering Committee encourages the participants to look for supplementary financial support at the international level, if possible.

We hope that the novelty of the approach and the importance of the transition zone from island to mid-ocean ridge in many important processes will provide InterRidge an opportunity to include ridge interactions with on-shore processes and broaden its scientific scope, including other disciplines in ocean sciences.

### **Working Group on Resources Exploration of Seafloor Massive Sulfides along Mid-Ocean Ridges.**

The Steering Committee has approved the creation of the Working Group on Seafloor Massive Sulfides along Mid-Ocean Ridges. This resubmitted proposal follows most of the previous guidelines of the Steering Committee. However, we urge you to adopt several important recommendations of the Steering Committee for the final organization of your Working Group.

1) The Steering Committee members are convinced that the general topic of the proposed Working Group is interesting and that there is a need for a group of experts to examine the various scientific issues related to seafloor mineralization and massive sulfide formation, especially as deep-sea mining plans are progressing, but also because of the interest

these studies may have for a broad range of scientific domains (including geomicrobiology). The mandate of InterRidge is to support basic science, and therefore, the Steering Committee members recommend to concentrate the activity of the Working Group on the acquisition of fundamental knowledge about the formation of seafloor deposits and their properties. InterRidge furthermore promotes the wide dissemination of the outcomes of scientific activities to the research community and the general public, that is why all its working groups are requested to respect a 3-year life cycle, publish their conclusions/results in peer-reviewed scientific journals and share the reports from their workshops and other WGs activities with the whole community.

2) Knowing the potential economic value of the concerned knowledge in the context of deep-sea mining, the Steering Committee raises concern about the potential conflicts of interests of the WG participants. It was requested that all members of the working group certify that they have no conflicting interests and, particularly, that they are not directly contracted by mining companies to participate to the working group activities. In particular, no employee of a mining company can be endorsed as a Working Group member, and the Working Group composition should be revised accordingly. InterRidge supported activities cannot be oriented primarily on applied research activities that directly support industrial projects or that would support endorsement of exploitation projects (including environmental impact assessments) in a particular mining lease area. International balance and scientific neutrality should be ensured in order to be able to provide recommendations, contribute to statements, and/or help to achieve a consensus when it comes to potential economic, jurisdiction and environmental issues and related methodologies.

3) InterRidge relies on the work of its various groups and members to provide independent scientific expertise and, when required, can deliver scientific expertise or recommendations. Any communications or scientific recommendations in the name of InterRidge to international bodies, such as the ISA, should be issued by the Office with the endorsement of the Steering Committee in order to ensure a unified voice for ocean ridge researchers worldwide. Issuing such communications or scientific recommendations is not within the mandate of the Working Groups.

4) Several members of the Steering Committee have expressed the interest on behalf of a number of scientists wishing to join the Working Group – we hope that the list of WG participants will remain open, especially for young scientists interested in the diverse scientific aspects raised by sulfide deposits on ridges, volcanic arcs and back-arc systems. The Steering Committee still encourages you to improve, as much as possible, the gender balance and invite early-career scientists to the list of group members. Drs. Rolf Pedersen (Norway) and John Kurian (India) have already expressed interest.

The InterRidge Office expects to work in close collaboration with the new Working Groups (i.e. content of the WG's web-page on the InterRidge website) and encourages the WGs to start their activity and proceed with the organization of the first workshops, in close collaboration with the Office.

## 9 Validation of IR and IR/ISA Fellowships and Cruise Bursaries Applications

Steering Committee members have proposed reviewers upon solicitation of the Office. Applications for IR Fellowships were sent for evaluation to 3-5 experts in the field of the application. Up to 3 reviews for each proposal were received before the Steering Committee meeting. The anonymous evaluations were presented to the Steering Committee during the meeting and each application was discussed individually before taking the final decision. The Steering Committee has accepted four applications for funding. Details are provided in the table below:

Fellowship type	Level	Countries	Title of proposal	Applicant contact information:	Current advisor(s) contact information:	Proposed sponsor(s) contact information:	Project period	Funds requested
IR	PhD Student	CA → NL	Nanomeric constraints on the interface-coupled dissolution-precipitation replacement reaction of serpentine after olivine.	Title: Mr. Name: Simone Pujatti	Name(s): Benjamin Tutolo Institution: University of Calgary	Name(s): Oliver Plümper Institution: Utrecht University	February 2019 to December 2019	4778 USD
IR	PhD Student	IN → FR	Distribution of hydrothermal activity over South CIR and SWIR on Indian Ocean: Quantifying the control of tectonic and magmatic processes.	Title: Mr. Name: A. Srinivas Rao	Name(s): Dr. John Kurian Institution: National Center for Antarctica and Ocean Research	Name(s): ESCARTIN, Javier Institution: IPGP	2 months	5000 USD
IR	PhD Student	US → NO	Three-dimensional numerical assessment of mid-ocean ridge migration and its influence on mantle melting	Title: Ms Name: Loes van Dam	Kincaid Institution: The University of Rhode Island	Name(s): Clinton P. Conrad Institution: Centre for Earth Evolution and Dynamics, The University of Oslo	1 month	5000 USD
IR-ISA	PhD Student	CN → GB	Investigation of lipid biomarker compounds in deep-sea hydrothermal system of Central and Southeast Indian Ridges	Title: Mr. Name: Umoh, Unyime Udoudo	Name(s): Prof. Li Li Institution: School of Ocean and Earth Science, Tongji University China	Name(s): David Naafs Institution: University of Bristol United Kingdom	9 months	4950 USD

The applications for Cruise Bursaries of Dominik Zawadzki, Elvira Latypova, Thomas Guigère, Nicole Morgan and Gabriella Alodia have been accepted by the Office as matching all the selection criteria. After the discussion at the meeting, the Steering Committee has endorsed the choice made by the Office.

## 10 Budget 2018 and preliminary Budget 2019

The budget of InterRidge for 2018 and the preliminary budget for 2019 have been introduced by the Coordinator and are summarized in the tables below.

		2017	2018 PLANNED	At 01/06/2018	2019			
<b>Incomes [\$]</b>								
Host country	25000	25000	25000	25000	25000	<b>\$</b>		
Principal Members	25000	100000	100000	25000	100000			
Associate members	5000	25000	30000	10000	30000			
contingency fund (Japan 2015, rest from China, France 2016)		91615	91615	-	66615			
<b>TOTAL [\$]</b>		<b>241615</b>	<b>246615</b>	<b>60000</b>	<b>221615</b>			
		=	=	=	=			
<b>TOTAL [€]</b>		<b>214690</b>	<b>218940</b>	<b>51378</b>	<b>189811</b>			
<b>Expenses [€]</b>								
<b>Salaries</b>								
Salary – Coordinator		40277	57997	24166	57997	<b>€</b>		
<b>Total Salaries [€]</b>		<b>40277</b>	<b>57997</b>	<b>24166</b>	<b>57997</b>			
<b>Office</b>								
Travel expenses		15966	18000	7000	18000			
Steering Committee Meetings		1901	4000		3000			
Supplies		3066	500		500			
Telephone/communications/IR domain		155	500		500			
Printing		0	2000	50	2000			
Postage		0	1000		1000			
<b>Total Office [€]</b>		<b>21088</b>	<b>26000</b>	<b>7050</b>	<b>25000</b>			
<b>Member benefits</b>								
IR Fellowship	3	12750	9	38700	3	10200	6	25500
IR Cruise bursaries	1	1700	10	17000	4	6800	6	10200
IR Student travel award	1	4250	2	8500		0	2	8500
Workshops, working groups		0	3	24600	1	8536	2	16400
Theoretical Institute							1	17000
<b>Total Member benefits [€]</b>		<b>18700</b>		<b>88800</b>		<b>25536</b>		<b>77600</b>
<b>Others</b>								
Contingencies (to be kept for next year)		83606		83606		-		42769
Overheads		0		0		0		0
<b>Total Others [€]</b>		<b>83606</b>		<b>83606</b>		<b>0</b>		<b>42769</b>
<b>TOTAL [€]</b>		<b>163671</b>		<b>256403</b>		<b>56752</b>		<b>203366</b>
<b>BALANCE [€]</b>		<b>51019</b>		<b>13556</b>		<b>45645</b>		<b>0</b>

The presentation has been followed by the general discussion concerning the budget management. The adjusted funding plan has been accepted unanimously by the Steering Committee members.



## **11 InterRidge – ISA, participation at ISA 23 rd & 24 th Session**

Since 2012, InterRidge has been granted observer status at the ISA, allowing InterRidge to be present at public meetings of the Assembly and by invitation, to make oral statements on issues of concern, although it will not be able to participate in decision-making. This increases our links with the ISA and will strengthen our ability to engage with developing countries, which remains one of InterRidge's main challenges. Below are the summaries of the InterRidge participation at the 23rd and 24th annual sessions of the International Seabed Authority:

(1) Jérôme Dymont (IR co-chair) and Kamil Szafranski (IR coordinator) attended the 23rd annual session of the International Seabed Authority (ISA), held on 8-18 August 2017 in Kingston. The presence of InterRidge at the ISA Assembly and Council sessions gave the opportunity to introduce IR activities in extending our knowledge on mid-ocean ridges (e.g. working groups and workshops), disseminating information (e.g., vent database), and developing capacity building (e.g., fellowships and cruise-bursaries). InterRidge expressed its readiness to collaborate with the ISA through our collective scientific expertise, to ensure a proper balance between sustainable development and protection of the marine environment.

(2) Both co-chairs (Nadine Le Bris & Jérôme Dymont) attended the first part of 24th Session of the Council of the ISA on 5-9 March 2018. This time, the InterRidge observer status allowed to emphasize the importance of up-to-date knowledge bases, interdisciplinary integration and international cooperation as proposed by InterRidge in supporting best available evidence and expertise for the assessment of risks, elaboration of norms and management plans in this context. InterRidge reminded the Council "the crucial need of fundamental knowledge to answer questions on the vulnerability of ecosystems, the scales and intensity of environmental perturbations, the cumulative impacts of climate change and exploitation. This should involve all willing research teams, beyond those associated with the permit holders".

## **12 SCOR - InterRidge Meeting on "Mid-Ocean Ridges and Other Geological Features of the Indian Ocean"**

The SCOR - InterRidge Meeting on "Mid-Ocean Ridges and Other Geological Features of the Indian Ocean" will take place on 14-16 November, 2018, in Goa, India. This meeting aims to encourage involvement of the Ridge and Marine Geology and Geophysics communities in the International Indian Ocean Expedition - 2 (IIOE-2). The budget allocated by SCOR and InterRidge will mostly be used to allow students, young scientists, or other scientists to participate, with special attention given to countries bounding the Indian Ocean and potentially involved in the IIOE-2. The following seven themes cover the main peculiarities of the Indian Ocean ridges and geology:

- a) Indian Ocean mid-ocean ridges: hydrothermalism, fragile ecosystem, and deep-sea mining exploration
- b) Indian Ocean mid-ocean ridges: tectonics and magmatism in a wide range of spreading rates
- c) Evolving lithosphere of the Indian Ocean: from mid-ocean ridges to basins to active or passive margins
- d) Complex physical and geochemical aspects of the Indian Ocean mid-ocean ridge system
- e) Aseismic ridges, oceanic plateaus, micro-continents and seamounts of the Indian Ocean
- f) Implications of the collision and subduction on the complex history of the Indian Ocean
- g) Submarine fans and sedimentation history in the Indian Ocean

## **13 IR Code of Conduct**

Since the creation of the current version of the Code of Conduct in 2006, scientific research, instruments, analytical methods and potential dangers for the deep-sea have evolved. In order to adapt the limits of responsible conduct of the deep-sea research, it is high time to revise the current version of this set of recommendations. The Steering Committee has discussed the road-map for an update of the IR Code of Conduct in the context of new vents known, increased state of knowledge, developing Next-Generation Sequencing techniques and large scale disturbance experiments. Nadine Le Bris has introduced this subject at the CBE6 Symposium in September 2017 in Woods Hole and has launched the discussion via e-mail. The importance of the opinion and input of young scientists to this task, has been highlighted. The feedback from all these meetings and relevant discussions should be consulted with the authors of the current version. Further decisions and an eventual creation of the Working Group dedicated to prepare the new revision of the Code of Conduct will be taken at the next Steering Committee meeting.

#### **14 InterRidge Theoretical Institute in 2019**

The InterRidge Theoretical Institute (IRTI) will build on this momentum and aims at strengthening the cohesion and visibility of the international community working on MOR and ABA, while promoting the transfer of knowledge toward other research fields. It is now time to bring together our ideas, concepts, expertise and know-how in an effort 1) to fill the remaining gaps and develop the basic science critically needed to answer the questions raised by the global imprint of human activities on the ocean and 2) to ensure that new players have access to suitable and scientifically-robust information.

This IRTI will offer the opportunity to share emerging issues, new technologies, interdisciplinary challenges (including capacity building and methods/tools sharing across disciplines). It will be made of two parts, a set of lectures in the first two days and a workshop in the following two days.

The lectures, targeted to young scientists, will address cross methodological and theoretical advancement on key issues while the workshop sessions will be organized on a series of emerging themes or transversal hot topics in biology and geology around hydrothermalism as the main theme. The Theoretical Institute will be organized in Banyuls-sur-Mer (France) in October/November 2019.

#### **15 Bid for next InterRidge Office**

The Steering Committee has encouraged the Office to organize the call for bid for the next InterRidge Office (2020-2022) earlier than usually in order to avoid any kind of difficulties related to the transition of the office. Ideally, the bid should be announced in December 2018 with a deadline for February 2019. The next meeting of the Steering Committee should be organized earlier in 2019 to choose the next host country as quickly as possible.

#### **16 Discussion: How to improve InterRidge?**

The IR Office was in transit to France and had a limited activity during 2016 because of administrative issues. The final establishment of an operational office has been delayed until 2017. According to the bid at the last Steering Committee meeting in China in 2015, the French presidency of InterRidge has been expected for 2016-2018. This would mean that many aspects of the proposal could not be fulfilled before the end of the French chair. The first point of the discussion concerned the possibility of the extension of French presidency until 2019. Even if this option is still not sure, mainly because of necessity to get a positive feedback from funding agencies, the Steering Committee members agreed unanimously not to count the year 2016 and postpone the Office rotation to the end of 2019. In order to convince the French funding agencies, IR Office should clearly indicate the objectives of this prolongation. It has been decided to organize the Theoretical Institute, to launch the update of the Code of Conduct and to highlight the importance of Working Groups. The Steering Committee members would like to stay informed about the evolution of this proposition, to have enough time for reaction in case if it is not possible. In this case, the bid should be organized at the beginning of 2018.

## **17 Next Steering Committee meeting location and date**

Shinsuke Kawagucci has proposed to host the next IR Steering Committee meeting in Tokyo (Japan) in 2019.

## **18 List of actions**

- (1) National Updates
- (2) Reports from Working Groups
- (3) Add cruises to the database on the website – Steering Committee members shall send the relevant information from their countries
- (4) Creation of new Working Groups – summarize the decisions, ask for revisions
- (5) IR (and IR-ISA) Fellowships and Cruise Bursaries – send the decisions, prepare payments
- (6) SCOR – send report
- (7) Code of Conduct – draft to StComm
- (8) Start discussions about the sessions at the Theoretical Institute
- (9) Earlier organize call for bid for the next InterRidge Office
- (10) How to improve InterRidge:
  - i. big projects
  - ii. highlight achievements
  - iii. keep encouraging Working Groups to specific topics or locations
  - iv. deep-sea observatories
  - v. update website
- (11) Next Steering Committee meeting will take place in Tokyo (Japan).

## **19 Meeting adjourns**

Jérôme Dymont thanked for the attendance of the Steering Committee members and declared the meeting adjourn.

## APPENDIX I

### InterRidge Chairs and Coordinators – Past and Present

#### InterRidge Chairs:

Jérôme Dymont, co-chair (France)	2016 –
Nadine Le Bris, co-chair (France)	2016 –
John Chen, chair (China)	2013 – 2015
Jiabiao Li, co-chair (China)	2013 – 2015
Bramley Murton, chair (UK)	2010 – 2012
Jon Copley, co-chair (UK)	2010 – 2012
Jian Lin, chair (USA)	2007 – 2009
Chris German, co-chair (USA)	2007 – 2009
Colin Devey, chair (Germany)	2004 – 2006
Kensaku Tamaki, chair (Japan)	2000 – 2003
Mathilde Cannat, chair (France)	1997 – 1999
Roger Searle, chair (UK)	1994 – 1996
John Delaney, co-chair (USA)	1991 – 1993
H. David Needham, co-chair (France)	1991 – 1993

#### InterRidge Coordinators:

Kamil Szafranski	Apr 2017 –
Zengxi Ge	Jan 2013 – Dec 2015
Debbie Milton	Jan 2010 – Dec 2012
Stace Beaulieu	Oct 2007 – Dec 2009
Rhian Waller	Jan – Oct 2007
Sabine Lange	July – Dec 2006
Valérie Epplé	May – July 2006
Kristen Kusek (Education & Outreach)	Mar 2004 – Dec 2007
Katja Freitag	Mar 2004 – May 2006
Agnieszka M. Adamczewska	Nov 1999 – Mar 2004
Cara Wilson	Mar 1997 – Nov 1999
Ruth Williams (acting)	Oct 1996 – Mar 1997
Heather Sloan	Oct 1993 – Oct 1996
Trileigh Stroh	1991 – Oct 1993