



[ Research ]

## Research flights in the deep sea

Scientific investigations in extreme environments present deep-sea and space researchers with similar technological challenges. In the Helmholtz Alliance «Robotic Exploration of Extreme Environments – ROBEX» researchers from both fields tackle these together. Within this alliance, 16 research institutes throughout Germany have developed technologies designed to facilitate the study of hard-to-reach regions. Dr. Christoph Waldmann and his team at MARUM have built the underwater glider MARUM-MAPPA, whose flying-wing design borrows on experience from the field of aviation. To date, the craft can operate independently in water depths to 500 meters, and has been successfully

tested several times, including deployment from the research ship POLARSTERN. It can also, however, be launched from the coast, and can thus obtain environmental data in the ocean independently of a research vessel. Depending on the area of research, its modular format allows additional measurement devices to be installed. For example, an attached particle camera can record the distribution of microalgae in the water column. The group is now working on the development of additional scientific application scenarios. Their goals include achieving water depths of 2,000 meters and a diving duration of up to two months.

[www.marum.de/en/Infrastructure/ROBEX.html](http://www.marum.de/en/Infrastructure/ROBEX.html)

Dear readers,

The oceans are crucial for the well-being of humans – not only as a resource but also, for example, as an integral component of the climate system. The Sustainable Development Goals of the United Nations thus attach great importance to the preservation of the marine environment and to its sustainable use. But do we know and understand this environment in sufficient detail to even be able to develop meaningful sustainability concepts? For the deep sea the answer to this question is clearly «no». Satellite measurements cannot penetrate below the ocean surface, and obtaining data from the deep sea is still only possible through great effort and cost. At MARUM, therefore, we employ and develop autonomous underwater vehicles that in the future will be able to measure environmental parameters even when there is no research ship present in an area. Within the framework of a new innovation center at MARUM, engineers and natural scientists will develop new environmental observation systems for the deep sea. In this newsletter you will find more information about this, as well as other topics.

I wish you a very informative read,

*Michael Schulz*

Michael Schulz (Director)



ArcTrain members discuss their findings on climate change in the Arctic.

[ Training ]

## Climate research in the Arctic

At the annual meeting of the international DFG Research Training Group «Processes and impacts of climate change in the North Atlantic Ocean and the Canadian Arctic» (ArcTrain), more than 30 PhD students from Bremen and eight Canadian partner universities presented their research results. In addition to training courses on handling

data, presentations by guest speakers, and scientific interaction, the meeting provided an opportunity to develop future plans for the second phase of the program. Since 2013, German and Canadian early career researchers have been working in ArcTrain on the impacts of climate change on the ocean, sea ice and land ice masses in the Arctic region.

[www.marum.de/en/education-career/ArcTrain-2.html](http://www.marum.de/en/education-career/ArcTrain-2.html)

[ Training ]

## Schoollab international

The «Bremen-Durban Network of Marine Environmental Education» has been operating since the summer of 2017. The goal of this German-South African project is to enhance public awareness of the crucial need to protect the seas. The MARUM UNISchullabor (University School Laboratory) supports marine environmental education in Durban and fosters an appreciation in young people and community stakeholders for marine conservation. During the South African team's visit to Bremen in November, workshops were held in the areas of «Scientific Graffiti» and «Science Theater». Representatives of the UNISchullabor will travel to Durban in the spring of 2018. Within the network of the European Marine Science Educators Association (EMSEA) there is an ongoing and active exchange of both new and established methods of knowledge transfer in the area of seas, oceans and climate. At the EMSEA meeting on Malta, the MARUM UNISchullabor presented a workshop on the topic «Achieving results with the help of scientific graffiti» in the area of «Best Practice».



Visit from Durban, South Africa in the MARUM UNISchullabor.



On board, water samples are filled into special sample containers. The amounts of meltwater in the ocean are then determined based on noble gas content. Photo: Tilia Breckenfelder

[ Research ]

## Research cruise to Greenland's glaciers

Rising temperatures in the Arctic Ocean are presumably contributing to accelerated melting of Greenland glaciers. Three scientists from MARUM were on board the Research Icebreaker POLARSTERN in September and October to investigate interactions between the ocean and the Greenland glaciers, and to determine the amount of meltwater that is flowing into the ocean. On the Greenland continental shelf offshore of the 79° North glacier and Zachariae Isstrom glacier, they took hundreds of water samples from different depths in the ocean. The next step is to measure the content of the noble gases helium and neon

in the home laboratory, which will provide information about the location and amount of meltwater in the ocean.

The collaboration research project «Greenland Ice Sheet Ocean Interaction» is funded by the BMBF and has been in operation since May 2017. Scientists from eight German universities and research centers are participating in the project. The researchers, from the fields of oceanography, glaciology and geodetics, will also carry out coordinated air, ship, and field campaigns in northeast Greenland in 2018 and analyze their measurements with the help of computer models.

[ Research ]

## Storm waves – past and present

On the Bahamas enormous boulders weighing many tons provide evidence of past storm waves that flooded the land more than 100,000 years ago. Dr. Alessio Rovere and his colleagues have studied these in detail and determined that the intensity of modern-day storms, combined with a rise in sea level of just a few meters, would be sufficient to move the huge boulders. The team of researchers have shown that for future storms – even if the storms themselves are not stronger – the higher sea-level alone would produce more frequent strong waves during a storm, and that the current velocities, and thus the wave energy, would likewise increase. Their results were published in the journal *Proceedings of the National Academy of Sciences*.

[www.marum.de/en/Discover/Past-storm-waves.html](http://www.marum.de/en/Discover/Past-storm-waves.html)

[ Research ]

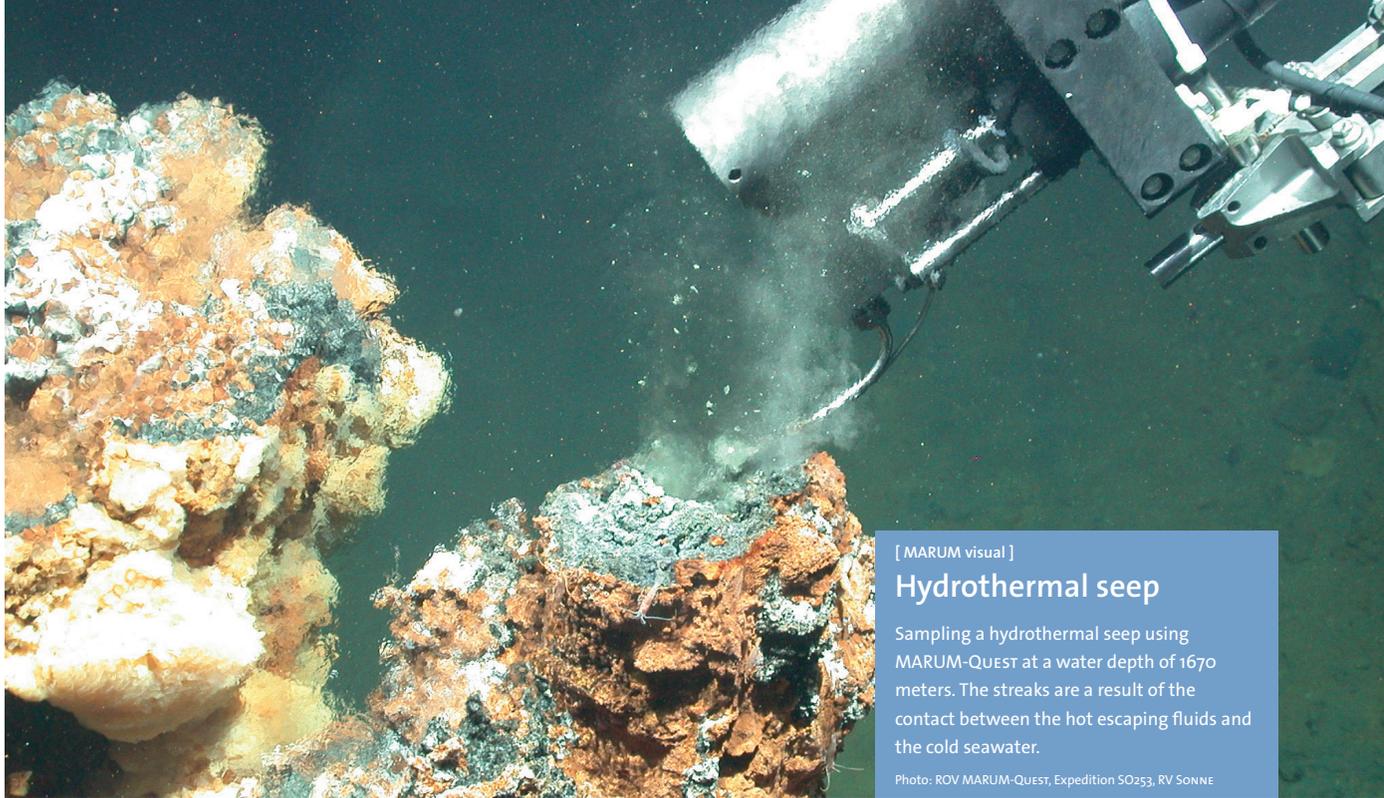
## «Oil-eating» bacteria

In the depths of the Gulf of Mexico, oil and asphalt are seeping out of the sea floor and form bizarre-looking structures with an appearance similar to that of cooled lava – these are asphalt volcanoes. It was almost 15 years ago that Bremen and US American scientists discovered this habitat. It is still full of surprises, as is now illustrated by a study published in *Nature Microbiology* by an international group of researchers working with Dr. Maxim Rubin-Blum and Prof. Dr. Nicole Dubilier of Bremen's Max Planck Institute and MARUM. With the remotely operated vehicle MARUM-QUEST, the researchers were able to collect deep-sea mussels that live in symbiosis with bacteria. These microorganisms feed on short-chain hydrocarbons in the oil. The researchers also discovered that closely related bacteria employed this ability in degrading the oil spill after the explosion of the oil platform «Deepwater Horizon».

[ Research ]

## Tropical wind systems

A global system of winds and ocean currents influences climate. The Walker Circulation, operating along the Equator, plays an important role. In a recent study published in *Nature Communications*, the scientists Dr. Mahyar Mohtadi, Dr. Matthias Prange, Dr. Enno Schefuß and Dr. Tim C. Jennerjahn have analyzed the influence of rising global temperatures on the Walker Circulation. «According to current prognoses for the future, their intensity declines with global climate warming. Weakening of the circulation will mean more rain over East Africa and less rain over Southeast Asia,» explains Mohtadi. The rain, however, could have devastating consequences because, instead of creating a more fertile climate in East Africa, it would produce more flooding. A glimpse into the past, with its alternating cold and warm periods, has corroborated the theory of the climate researchers.



[ MARUM visual ]

## Hydrothermal seep

Sampling a hydrothermal seep using MARUM-QUEST at a water depth of 1670 meters. The streaks are a result of the contact between the hot escaping fluids and the cold seawater.

Photo: ROV MARUM-QUEST, Expedition SO253, RV SONNE

[ Research ]

## Newly endowed professorship at MARUM

On July 1, Prof. Dr. Ralf Bachmayer assumed the newly established Werner Siemens endowed professorship of «Marine Environmental Technology / Deep-Sea Engineering» at MARUM. From a past research residency here, the 50-year old is already familiar with Bremen as an active center for science. In addition to the engineering science aspect of the professorship, he also appreciates the excellent technological infrastructure and networking practices at MARUM. «Both performance and competence are a given here,» says Bachmayer. In the future he plans to apply his talents not only academically but also in practice. «How can long-term observations

be achieved over many months using mobile observing systems? How can such high-grade multidisciplinary systems be designed and integrated? These are basic questions for me,» he explains. Bachmayer studied electrical engineering at the Technical University of Karlsruhe and wrote his diploma thesis at Woods Hole Oceanographic Institution (USA), he earned his M.Sc. and PhD at Johns Hopkins University (USA). At the Memorial University of Newfoundland he founded and directed the Autonomous Ocean Systems Laboratory, where he most recently worked on a system for automated measurements of icebergs, employing coordinated robots both above

and under the water surface. In Bremen he wants to continue in this direction at the newly established Innovation Center for Deep-Sea Observing Systems, with the focus now on the deep sea.



Prof. Dr. Ralf Bachmayer is establishing a new Innovation Center for Deep-Sea Observing Systems.

[ Training ]

## Training for young academics

Early career scientists who attended the ECORD Summer School 2017 occupied themselves with coral mounds and drift sediments in the deep sea. After the intro-



Participants of the ECORD Summer School describing cores in the laboratory.

ductory presentations the 29 participants from ten countries got down to their practical work: core description, taking pore-water samples, analyzing physical properties of the sediments, and interpreting seismic maps. Through a live connection with the IODP drilling ship JOIDES Resolution, they spoke with Dr. Thomas Westerhold about the work onboard during an expedition. The theme for the next ECORD Summer School in September 2018 is «Sub-seafloor fluid transport and gas hydrate dynamics». The dates for the next ECORD Training Course are 23 to 27 April 2018. Both of these programs focus on the standard procedures for work in the international ocean discovery program IODP.

[ Training ]

## Cooperation with New Zealand

New Zealand and Germany are united through a close program of scientific cooperation. Since the signing of a bilateral technical/scientific cooperative agreement in December 1977, many scientists from the two countries have worked together on research projects. This includes the DFG Research Training Group «INTERCOAST – Integrated coastal and shelf-sea research». Since November 2009, the University of Bremen, through MARUM, and the University of Waikato have been jointly training PhD students. They study interdisciplinary processes in coastal zones and the adjacent shallow seas.

## Show Your Research!

With their project «Once upon a time... short stories in science» the team of early career scientists from Bremen won the college competition «Show your research». In the competition, corresponding with the Science Year 2016\*17 – Seas and Oceans, *Wissenschaft im Dialog* (Science in Dialog) invited submissions for innovative concepts in science communications. Along with 14 other teams, the Bremen scientists reached the first round of the competition in September 2016 with their idea to communicate marine research concepts through short stories. The researchers, from MARUM

and six other scientific institutions, were given one year to carry through with their idea. They created twelve short stories for children and the young-at-heart, illustrated by artists, with themes related to the ocean and climate change and about the contributions of humans toward protecting the seas. With their creation the team won the final round of the competition. The final product is available on the internet as an E-Book at no cost, with all of the stories available in German, English and Spanish.

[www.marum.de/en/Discover/Once-upon-a-time.html](http://www.marum.de/en/Discover/Once-upon-a-time.html)



Winner team of the college competition «Show your research» in the Science Year 2016\*17.

## Exhibit at COP 23

As a part of the framework program of the UN Climate Change Conference COP 23, MARUM presented the exhibit «Virtual Deep Sea» in Bonn from 6 to 17 November. With 3D glasses visitors soared through virtual underwater landscapes in the deep sea. The high-resolution maps of the

sea bed on which the animation is based were created using special submersible vehicles diving to depths of 5,000 meters. Worldwide, these kinds of measurements only exist for a few select marine regions. The exhibit was financed by the Federal Ministry of Education and Research within the scope of the Science Year 2016\*17 – Seas and Oceans.

## Events

### MARUM stand (No. 1522) at the AGU Fall Meeting 2017

11. – 15.12.17 New Orleans, USA  
12.12., 3:30 p.m.: «Serendipity in Science» – Event and competition at the booth  
[fallmeeting.agu.org/2017/](http://fallmeeting.agu.org/2017/)

### MARUM exhibit «Ozeane im Wandel»

5.12.17 – 25.05.18 Klimahaus Bremerhaven

### 4. ECORD-Training Course

23. – 27.04.18 MARUM and IODP Core Repository, Bremen

### MARUM booth (No. 14) at the EGU General Assembly 2018

8. – 13.04.18 Vienna, Austria

## About us

### Editor

Prof. Dr. Michael Schulz  
MARUM –  
Center for Marine Environmental Sciences  
University of Bremen  
Leobener Straße 8  
D-28359 Bremen  
Germany

Compilation, Composition, and photos  
MARUM

### Printer

Universitätsdruckerei Bremen

[www.marum.de](http://www.marum.de)

## In Memoriam

Prof. PhD Dr. h.c. Wolfgang H. Berger of Scripps Institution of Oceanography (USA) was one of the most distinguished marine geoscientists in the world and a cofounder of the discipline of «paleoceanography».



In Bremen he was instrumental in the development of geosciences at the University and his contributions eventually led to the establishment of MARUM. Wolfgang Berger died unexpectedly in August 2017 at the age of 79.

## New professorship

Dr. Sabine Kasten, who leads the Marine Geochemistry Section at the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research in Bremerhaven, and has worked for many years as a project leader at MARUM, will be named as Professor of Sediment Diagenesis at the University of Bremen.



© Kerstin Rolfes

## Commendation

MARUM specimen preparation specialist Martin Krogmann has been awarded the «René Lanooy Sponsorship Award» for his work. The achievement was motivated by the question



of how the microstructures of fossils can best be exposed through mechanical and chemical methods. He developed a new technique for this.

## Taira Prize

Prof. Dr. Michael Strasser was distinguished by the American Geophysical Union (AGU) and the Japan Geoscience Union with bestowal of the «Asahiko Taira International Scientific Ocean Drilling Research Prize». Strasser is a professor of sedimentary geology at the University of Innsbruck (Austria) and is closely associated with MARUM.

