



The cold-water coral reefs off Mauritania serve as a habitat for fish, crustaceans, mussels and many other living creatures.

Photo: Tomas Lundälv

Dear readers,

New knowledge in marine research is advanced on the one hand through co-operation among different disciplines. On the other hand, lean and efficient decision-making and administrative structures are necessary today to generate creative and productive new insights. A few years ago the "Research Faculty" MARUM was established as a new model at the University of Bremen precisely for the purpose of creating these necessary conditions for research. By means of a novel governance structure MARUM has obtained very far-reaching rights. It allows us, to a large extent, to manage our staff and our budget independently, and MARUM may also enter into contracts directly with partners outside the university. At the end of last year, university panels decided by a large majority to continue their course and make MARUM a permanent organizational unit of the University of Bremen that is only accountable to the rectorate. With this landmark decision behind us, we will continue to follow our chosen path to strengthen interdisciplinary cooperation with our partners both within and outside the University of Bremen.

I wish you a very informative read,



Michael Schulz (Director)

[Research]

Submarine cold-water coral mounds

The world's so far largest known contiguous cold-water coral structure, with a length of around 400 kilometers, is situated along the coast of Mauretania. The coral mounds here can reach heights of 100 meters. MARUM scientist Dr. Claudia Wienberg was one of an international team of researchers who intensively sampled this area, making use of the research vessel MARIA S. MERIAN, in order to learn more about the development of cold-water corals. In their study, she and her colleagues trace how this development has progressed over the past 120,000 years off Mauretania. They identified phases in which the growth of the mounds stagnated, and other periods when the growth

rates reached peak values of 16 meters per 1,000 years. Their results suggest that the peak phases for the cold-water corals, when the mounds grew significantly in height, coincided with those times when oxygen-rich water masses flowed into the area from the north. When the cold-water corals were flooded by oxygen-poor water masses from the south, as is the case today, the mounds grew more slowly or not at all. Depending on the prevalent climate, the front between these water masses shifted from north to south, and vice versa, and the corals were alternately enveloped by oxygen-rich or oxygen-poor waters.

www.marum.de/en/Discover/Coral-mound.html

[Training]

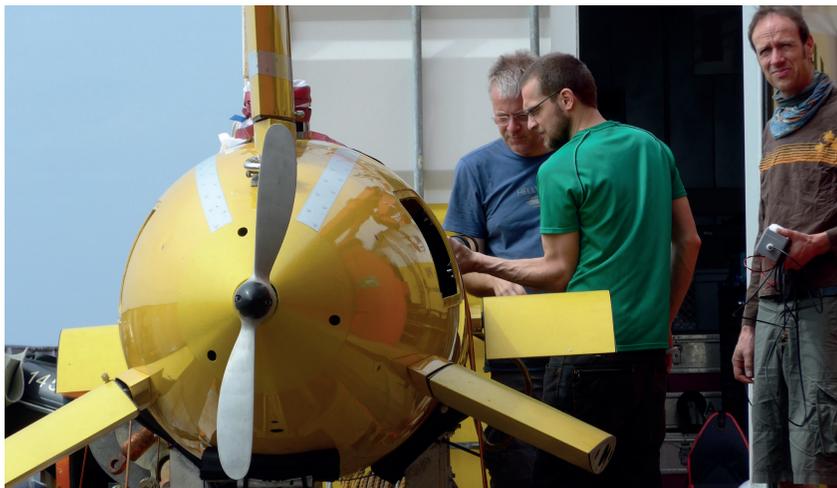
DFG extends ArcTrain

The German Research Foundation (DFG) will finance the MARUM-based International Research Training Group "Processes and impacts of climate change in the North Atlantic Ocean and the Canadian

Arctic" (ArcTrain) for another four and a half years. During the next phase until 2022 the positions and research work of 12 PhD students will be financed. Together with colleagues from Canada they will personally experience and investigate the Arctic region on land and from the sea. "The special strength of the Training Group is

its international character," says Prof. Dr. Michal Kučera, spokesperson for ArcTrain. "Through research residencies at partner universities, early career researchers acquire insights into the expertise of our Canadian partners, and strengthen their academic networks."

www.marum.de/en/education-career/ArcTrain-2.html



The autonomous underwater vehicle MARUM-SEAL is made ready for deployment. Photo: A. Klügel

[Expeditions]

Destination: Henry Seamount

An extinct submarine volcano off the Canary Islands is the focus of an expedition by MARUM scientists. On board the research vessel METEOR the team, headed by Dr. Andreas Klügel from the Department of Geosciences at the University of Bremen, is studying the Henry Seamount, a 126 million-year-old volcano southeast of the Canary Island El Hierro, at a water depth of 3,600 meters. During an earlier METEOR cruise here, mussel shells and rock samples were collected that indicated the presence of cold seeps. The autonomous underwater vehicle MARUM-SEAL, among other tools, will be deployed during the mapping.

www.marum.de/en/Research/M146.html

[Research]

North-Atlantic monitoring and modeling

When the circulation in the North Atlantic Ocean changes, it also affects the climate in Europe. How exactly, that is the focus of the joint research project Regional Atlantic Circulation and Global Change (RACE).

“In order to better understand the ocean currents, we need continuous long-term monitoring with high temporal resolution over decades, and realistic, high-resolution ocean and climate models,” says Prof. Dr. Monika Rhein from MARUM, coordinator of the joint research project.

Scientific expertise is pooled, which enables close cooperation in the development and use of complex monitoring technologies. The Federal Ministry of Education and Research has been funding the project since 2006 in order to gain reliable long-term data.

The focus of the Parliamentary Evening at the Bremen State Representation in Berlin was the successes and future tasks of German marine research in the face of climate change. The meeting was organized by the German Climate Consortium (DKK), the German Marine Research Consortium (KDM) and RACE.

Monika Rhein explained, the long-term monitoring of these realms is an important task for RACE. Networking in research is indispensable in order “to recognize the anthropogenic impact on Gulf Stream circulation at an early stage against a backdrop of immense natural fluctuations, and to substantially improve climate forecasts for Germany”. Prof. Dr. Anya Waite (AWI), Prof. Dr. Mojib Latif (GEOMAR) and Dr. Karl-Eugen Huthmacher (Federal Ministry of Education and Research) also participated in the discussions with Monika Rhein.

www.marum.de/en/Research/RACE.html

[Research]

New class of biocatalysts

Enzymes are of crucial importance for the breakdown of algal biomass in the ocean. Scientists from Bremen and Greifswald have been able to prove this for the first time in comprehensive experiments. They have discovered a completely new sub-class of biocatalysts that are involved in the breakdown of sugars by marine bacteria.

“These enzymes are very important for our understanding of the carbon cycle in the ocean. They show us how marine bacteria deal with highly stable carbon sources in order to metabolize them,” explains Dr. Jan-Hendrik Hehemann from MARUM. In the world ocean, algae store approximately the same amount of carbon each year as all land vegetation combined. In doing so, the algae produce large amounts of carbohydrates, which are subsequently broken down by bacteria and represent an important source of energy for the entire food web in the sea. The marine bacteria that are active in this breakdown were identified

in earlier investigations. However, it was previously not understood exactly how the microbial degradation takes place. The team has now been able to demonstrate the specific functions of certain bacterial enzymes for the first time. With the help of oxygen these enzymes catalyze an important chemical step in the conversion of the carbohydrates.



Bacteria living on red seaweed (picture) digest its cell walls with a newly discovered class of enzymes.

[Training]

Training for young academics

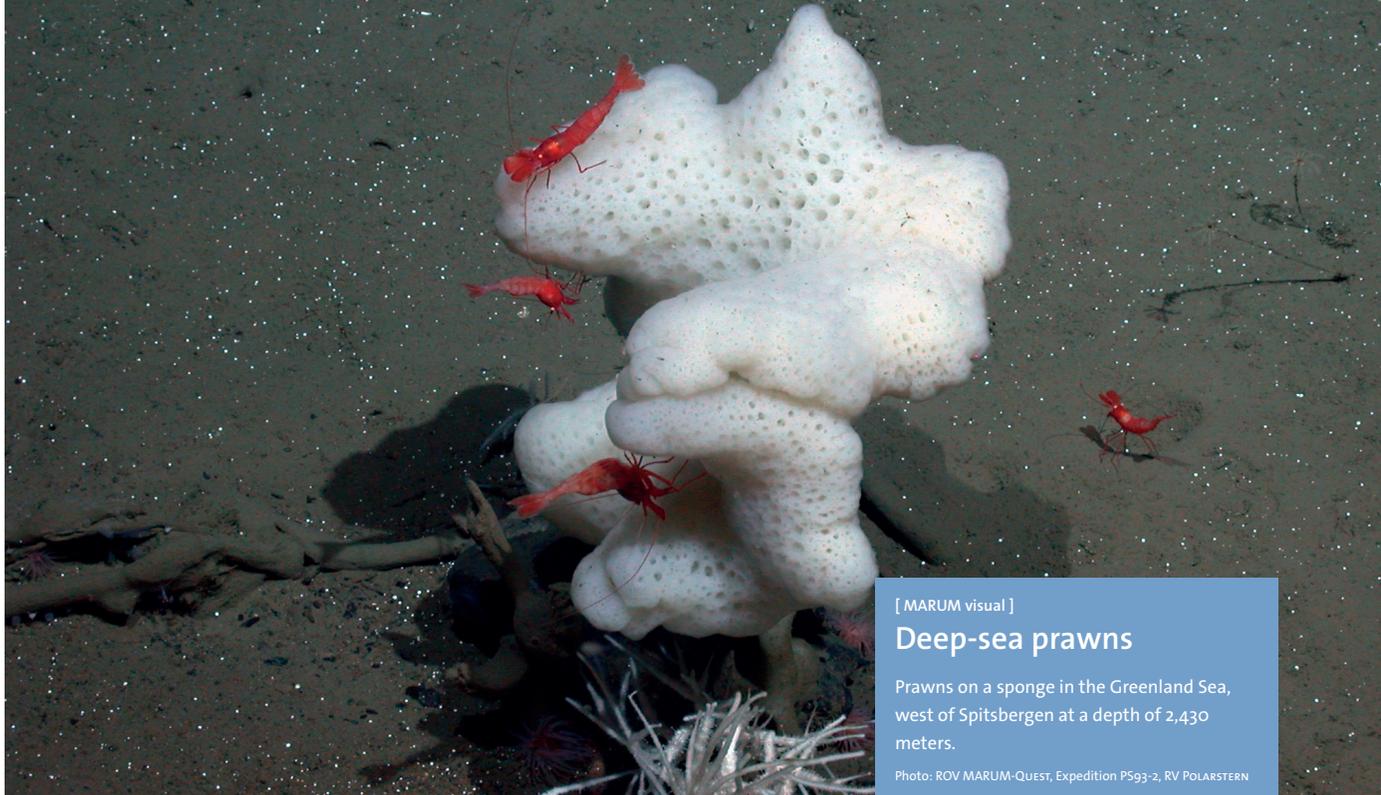
At the fourth ECORD Training Course, held at MARUM, 30 participants from 14 countries learned about the high standards of the International Ocean Discovery Program (IODP). Step by step they were taught how to sample and analyze cores. The course prepares scientists not only for participation on IODP expeditions, but for all types of offshore drilling projects. In September, interested scientists can take part in the ECORD Summer School 2018. For two weeks they will be actively learning about fluids and gas hydrates in the seafloor. Applications must be submitted no later than 4 May.

www.marum.de/ECORD-training.html

[Research]

Accurate chronologies

High-resolution age models are essential for understanding the details of how climate changes affect ecosystems. Short-term warming events 56 million years ago, during the early Eocene, are accompanied by an extraordinary increase in greenhouse gases. Dr. Thomas Westerhold and Dr. Ursula Röhl of MARUM, together with colleagues from the USA, have now produced a detailed synchronization between terrestrial drill cores from Wyoming and data from the deep sea. It revises earlier findings on exact temporal sequences, documents the processes in unprecedented detail, and for the first time documents simultaneous changes in life on the land and in the deep sea.



[MARUM visual]

Deep-sea prawns

Prawns on a sponge in the Greenland Sea, west of Spitsbergen at a depth of 2,430 meters.

Photo: ROV MARUM-QUEST, Expedition PS93-2, RV POLARSTERN

[Expeditions]

SONNE research cruise to island arcs in the South Pacific

Hot water rises from the seafloor like dark smoke. It is released by submarine volcanoes between 700 and 1,800 meters below the surface. An international group of scientists wants to investigate exactly what this water contains and how far the dissolved materials in it are distributed through the ocean. These include researchers from the University of Bremen and MARUM, who also want to know how processes deep within the volcano influence the material flux at the seafloor. Prof. Dr. Wolfgang Bach's working group presently has two study areas to the north of New Zealand, which the scientists repeatedly visit in order to collect data for their research and to fill in sample sets. These areas encompass the Kermadec Arc to the south and the Tonga Arc to the north, an underwater mountain range with

dozens of volcanoes on the ocean floor. The Kermadec Arc was also the target of Expedition SO253 in 2017. During Expedition SO263 of the research vessel SONNE the team visits the most northerly part of the Tonga Arc and the northeastern Lau Basin. The cruise is led by Prof. Dr. Karsten Haase of the Friedrich Alexander University of Erlangen-Nuremberg. As was the case on Expedition SO253, the focus of the Bremen expedition participants is on the deep processes at hydrothermal seeps. These include, for example, magma degassing and water-rock interactions. "During my PhD work I was intrigued by the chemical reactions between hydrothermal solutions and the volcanic rocks beneath the emission sites of the black smokers. These chemical reactions produce the metals and gases that are released at the

hot seeps, and change the composition of the oceans. We use special gas-tight water-samplers to recover and preserve undiluted hydrothermal water directly at the seep site," explains Alexander Diehl from MARUM. "With conventional samplers, the gases bubble out at the very latest when the container is opened, like a bottle of sparkling water. This makes quantification of the gas content absolutely impossible. The gases, however, represent a key parameter for determining the chemical reactions as well as the mobilization of metals such as copper, zinc and iron in the subsurface."

The deep-sea robot MARUM-QUEST is employed for sampling at the hydrothermal vents, and it also brings samples of rocks, ores or organisms such as mussels on board.

[Technologies]

New cooperative project

How can wind-farm piles be anchored environmentally friendly in North Sea sediments in the best and most environmentally friendly way? And how does the load capacity of the foundations change after installation? A new cooperative research project in MARUM is dedicated to answering these questions. The XL monopiles are driven into the seabed and serve as foundations for offshore wind turbines. The

new project is investigating an alternative method in which the pile is made to vibrate – called vibration ramming. "It is presently assumed that the necessary load-bearing strength for the steel piles cannot be achieved with vibration ramming. Over the next three years we want to investigate how the load capacity behaves over time with piles rammed normally and with vibration-rammed piles," explains project leader Prof. Dr. Tobias Mörz. As early as 2014, various installation methods were tested in the Altenwalde monopile test

field. The data obtained there provide a basis for comparison with the new follow-up project Restrike XL. "For the first time we can compare the two methods and quantify the so-called cumulative effect over a long time period."

In addition to MARUM, research partners include the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) and Abertay University (Great Britain). On the industry side, Innogy SE and Geo-Engineering.org are supporting the project.

Cores from the Gulf of Corinth

The Corinth Rift in Central Greece is one of the most seismically active areas in Europe. It is here that one of the Earth's tectonic plates is being ripped apart in the process of rifting, causing geological hazards including earthquakes, tsunamis and landslides. An international team of scientists from the International Ocean Discovery Program (IODP) has analyzed new cores from the Corinth Rift during the onshore science party at MARUM. The cores provide a continuous, high resolution record of complex changes in past environment and rift faulting rates over the last 1 million years. The data recently collected and to be developed over the next months will be used to calculate how fast active earthquake-generating faults are slipping within the rift. This can be used to assess the earthquake hazard potential of the region, which has a populated coastal zone around the Gulf and the city of Athens nearby that can be

impacted by future earthquakes. "The new cores are revealing exactly what we hoped: The potential to accurately calculate the activity of important faults that regularly generate earthquakes with magnitudes 6 to 7 in the area," says Co-chief scientist Prof. Dr. Lisa McNeill. Researchers have been working in the Corinth Rift region for many decades, examining sediments and active fault traces exposed on land and using marine geophysics to image the basin and its structure below the seafloor. "The missing piece of the jigsaw puzzle has been the age of the basin sediments that record the history of rifting. We know now that the core samples will enable us to complete this piece of the puzzle. This in turn can be used to calculate fault earthquake potential, and, on a longer timescale, unravel the sequence of events as the rift has evolved."

www.ecord.org/expedition381



Co-Chief scientists Prof. Dr. Lisa McNeill (left) and Prof. Dr. Donna Shillington.



Dr. Mai-Linh Doan measures the stiffness of the sediments.

Events

MARUM-booth (No 14) at the EGU General Assembly

08.04. – 13.04.2018 Vienna, Austria
11.04., 16 – 18 pm Alumni get-together
www.egu2018.eu

Explore Science

29.08.2018 ÖVB-Arena Bremen
30.08. – 01.09.2018 Bürgerpark Bremen
www.explore-science.de

ECORD Summer School

03. – 14.09.18 MARUM und IODP
Core Repository

Maritime Week

15. – 23.09.18 Bremen
22. und 23.09. Research Mile
Untere Schlachte

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“Oceans in Transition”

The special exhibition “Oceans in Transition”, which is being presented from the 5th of December 2017 through 25th of May 2018 in the Klimahaus in Bremerhaven, provides a unique insight into how oceans are created and how humankind and the sea influence each other. Its major component is the MARUM travelling exhibition “Experiencing the Sea”, with many exhibits relating to ocean and marine-research themes. Among the subjects to be encountered are primeval marine organisms, exciting current developments in deep-sea research, and an underwater robot that the visitors can operate themselves.

[Personnel]

New to our team

Katrin Stukenburg, who has been in charge of personnel matters since March 1, is new to MARUM's administrative department. Her responsibility is to function as the interface between MARUM and the central administration of the University of Bremen. The 37-year-old previously supervised the bionics program at the Hochschule Bremen, City University of Applied Sciences.



[Commendations]

Briese Research Prize

Dr. Soeren Ahmerkamp has been awarded the Briese Research Prize for his PhD dissertation, carried out within the framework of a cooperative project between MARUM and the Max Planck Institute for Marine Microbiology in Bremen. With this prize, the jury recognized his research on oxygen transport within the sandy seafloor of the North Sea and how it affects activity of the bacteria living there.



[Personnel]

Called to Kiel

Associate professor Dr. Christian Winter has accepted an offer by the Christian Albrecht University of Kiel. Since February he has been leading the working group for coastal geology and sedimentology at the Institute for Geosciences. He will continue to cooperate closely with colleagues at MARUM.

