

SPP-reader

The bi-annual newsletter of the DFG Priority Program SPP 1144
Issue 5, August 2006

The SPP 1144 web site is at:
www.deridge.de

Fifth Edition

The SPP 1144: "From Mantle to Ocean: Energy-, Material- and Life Cycles at Spreading Axes" started on the first of October 2003, and with it this newsletter. In general, there will be two editions per year. We hope that you will find this newsletter useful. Please send any feedback you may have to Klas Lackschewitz (klackschewitz@ifm-geomar.de). This is also the address to use if you have a contribution which you would like included in the next issue.

Our bi-annual newsletter aims to bring you all the latest developments and news related to the SPP and other international activities at mid-ocean ridges.

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Summary of Meteor cruise M68/1

Following the investigations performed during previous cruises the goal of cruise M68/1 was to continue the detailed interdisciplinary work at the selected vent sites on the southern Mid-Atlantic Ridge (MAR). This included mapping and exploration for additional hydrothermal vent systems using CTD and the AUV ABE (WHOI), estimating hydrothermal fluxes of heat and chemical compounds, and sampling of hydrothermal vent fluids, associated vent fauna, host rock and sulfide samples using the ROV Quest (MARUM). The three target areas are the following:

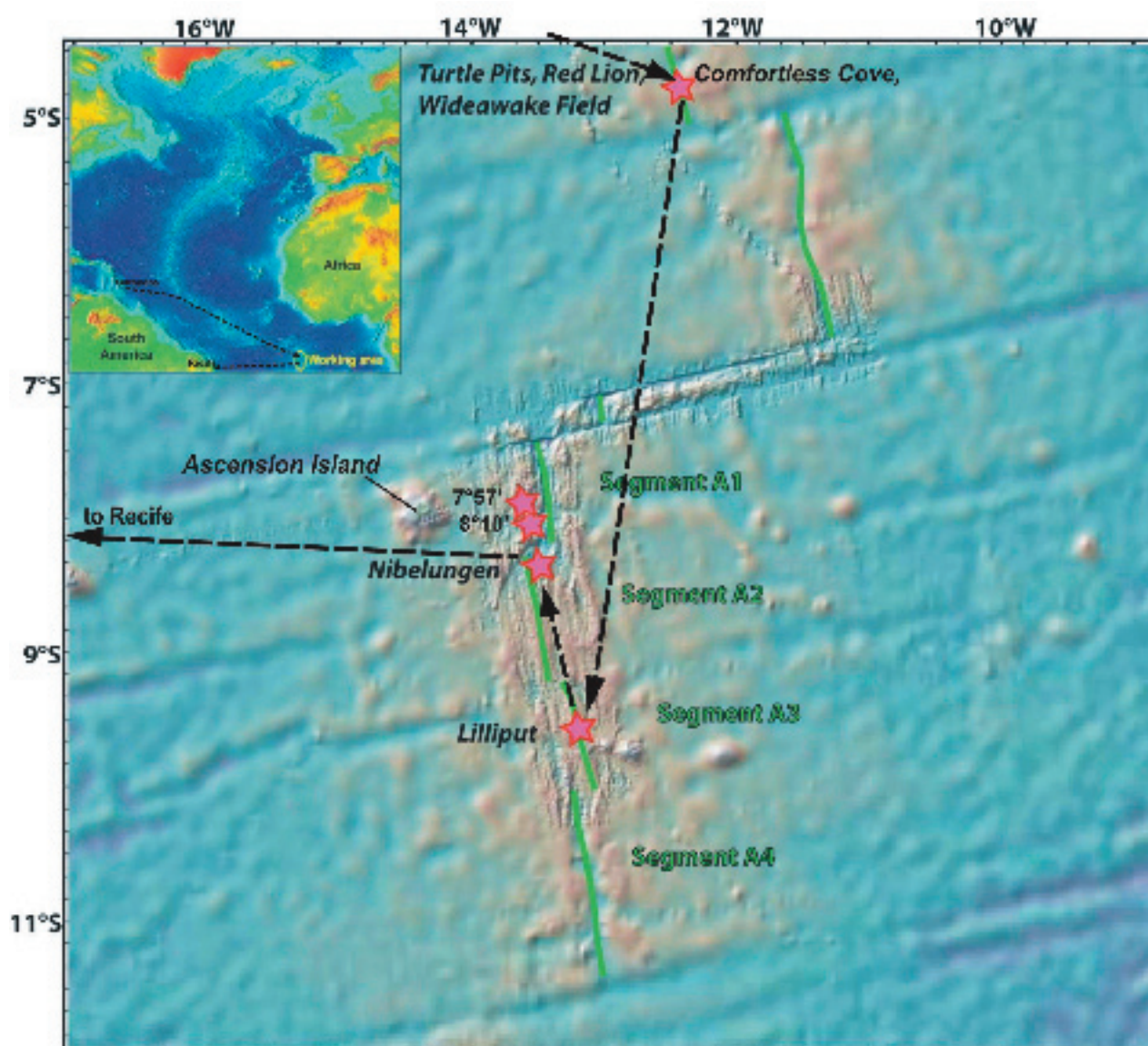
(1) 5°S, where two hot vent fields (Turtle Pits and Red Lion) and a diffuse-flow mussel field (Wideawake) had been found and sampled in 2005 (cruises CD169 and M64/1),

(2) 8°S (Nibelungen) where a hydrothermal plume had been detected during cruise M62/5 in 2004, but the hydrothermal source had not been found,

(3) 9°S where a diffuse vent field with young mussel populations named Lilliput was located during cruise M64/1.

In the 5°S area, all known vent fields were revisited and sampled for comparison with the 2005 data. The young, post-eruptive vent field at Turtle Pits was still extremely hot, and the highest temperature ever measured so far in a hydrothermal fluid (407°C) was recorded. Based on the AUV dives another field was detected (Comfortless Cove), located between Turtle Pits and Red Lion, with the hot smoker “Sisters Peak” (399°C) and two diffuse vent sites, one of them (“Golden Valley”) showing very high mussel coverage.

In the 9°S area the AUV detected signals for



several hydrothermally active sites, one of them being the known Lilliput mussel field at 9°33'S. The other sites were also all low-temperature sites with diffuse flow and populations with young mussels. This field is driven by volcanic activity, as the 5°S area, and many lava flow structures were observed. At one site lava columns and hollow lava structures had formed in a former lava lake.

In the Nibelungen field at 8°18'S, a very complex current pattern complicated the search for the source of the extensive plume, which changed its intensity and location on short time scales. Finally the AUV and ROV dives detected a large smoking crater resembling the craters observed in the Logatchev field at 15°N, which we named "Drachenschlund". Many extinct smokers were found in the vicinity, but no other hot vent field. The fluid chemistry clearly indicates reactions with mantle rocks, similar to the Logatchev field. The absence of hydrothermal fauna around the crater was striking.

In summary, seven new vent fields could be located and sampled during cruise M68/1, which was possible due to the very effective combination of CTD, AUV and ROV deployments. Further indications for hydrothermal activity at 5°S, 8°10'S and 7°57'S could not be followed up due to time constraints. Generally, the fauna at the 5°S and 9°S sites resembles the fauna from the northern MAR biogeographic province and is dominated by high abundances of the mussel *Bathymodiolus* and shrimps.

Summary of the 3rd SPP1144-Workshop in Etelsen, 4.-6.7.06

From 4.-6. July the third SPP workshop took place in Schloß Etelsen near Bremen. More than 50 participants came together to present the results from the Logatchev Hydrothermal Field and from the South Atlantic Ridge between 4° and 11° S and to coordinate the further activities in the priority program. Furthermore we have led a discussion about what we still need for the interpretation of the complex hydrothermal systems at the MAR. Three working groups have intensively discussed the following questions:

What are the factors which control the occurrence and the place of hydrothermal fields?

What do we still need to calculate fluxes of energy, material and particles?

What do we need to understand the long-term interactions between fluids, rocks and biology?

Obtaining answers to these questions requires additional experiments. Information about the composition and structure of the lithosphere should be obtained using data from OBS (ocean bottom seismographs) and from high resolution bathymetric mapping using AUV that add to the petrographic and seismic information gained during previous expeditions. The hydrothermal flux in the ocean can be acquired by measurements at individual vents (Shadowgraph), detailed plume mapping (AUV) and integrated analysis of the flow field (moorings). The investigation of trace metals, dissolved gases (including signatures of stable isotopes) and organic components for diffuse fluids should contribute significantly to understand the evolution of the hydrothermal systems.

If you would like to get the Abstract-Volume as pdf-file, please contact Klas Lackschewitz (klackschewitz@ifm-geomar.de).

Upcoming events

Merian-cruise 2006 MSM 03/2 "Rockdrill II"

The HYDROMAR IV cruise with RV Maria S. Merian will start on 9 November 2006 in Fort de France, and ends in Fort de France on 30 November 2006 (PI: S. Petersen, IFM-GEOMAR, Kiel). This project proposes to drill shallow boreholes (15 m) into the ultramafic-hosted active vent sites of the Logatchev-1 hydrothermal field located at 14°45'N on the slow-spreading MAR. The newly built Rockdrill 2 of the British Geological Survey in Edinburgh (UK) will be used as the drilling device. The subsurface samples drilled during the proposed cruise will complement surface samples gathered during the HYDROMAR I and II cruises and deep samples gathered during ODP Leg 209 (2003).

The major scientific objectives include the investigation of the depth zonations of the mineralization and alteration, their age relationships and the establishment of the variability of the subsurface biosphere. The results of these investigations will improve our understanding of the fluid chemistry and the faunal distribution found and sampled at the seabed.

Merian-cruise 2007 MSM 04/3 "Time-series measurements at LHF"

The HYDROMAR III cruise with RV Maria S. Merian to Logatchev (MAR, 14°45' N) was initially planned for January 2006, but has now been postponed till 24 January – 22 February 2007 (PI: C. Borowski, MPI-Bremen). While exact ports are not yet available, the cruise will most likely start in Las Palmas and end in Fort de France. As the Quest ROV is not available, we are currently negotiating for an alternative ROV system like Jason II or ROPOS that will be chartered by the SPP.

The main objective of this cruise is to continue time series investigations of temporal variability patterns of the physico-chemical environment that began in 2005 on the RV Meteor cruise M64/2. The recovery of monitoring devices for temperature, pressure and seismicity and also biological experiments deployed during M64/2 will provide the first continuous long-term data sets from the Logatchev field. The data sets will cover a period of more than one year.

Further investigations include organic and anorganic fluid geochemistry and sulfur isotopes, biogenicity of iron oxidation, microbial diversity and activity, metagenomics, in-situ sensor measurements and in-situ experiments to study activity patterns of hydrothermal symbiosis. For some of these investigations, long-term in-situ experiments and monitoring devices will be deployed. The new SIMRAD multi-beam echo sounder installed on RV Maria S. Merian will be used for high resolution swath bathymetry mapping, which will provide a better understanding of the MAR median valley topography around the Logatchev field and may help us locate other hydrothermal structures.

Main objectives of planned Meteor and Merian cruises 2008

Two proposals were submitted to the Senatskommission für Ozeanographie for scheduling in 2008. Both proposals received positive reviews.

The goals of the proposed 2008 *HYDROMAR VI Merian* cruise (PI Nicole Dubilier, MPI, Bremen) are investigating 1) the long-term interactions between

hydrothermalism and biology, 2) the linkage between deep structures and surficial processes, and 3) energy and material flux into the water column in the Logatchev hydrothermal field, MAR at 14°45'N.

During this cruise we wish to use an AUV to carry out microbathymetric mapping in key areas to determine their fine structure. Important questions which we wish to answer are:

- Which faults have surface breaks (active?)
- How do vents relate to the regional fracture patterns?
- Where are surface lava flows?
- How does the location of these flows relate to that of any deep magma bodies detected geophysically
- What does this tell us about heat transport through the crust?
- What role does the regional tectonics play in guiding this transport?

With the answers to these questions in 2008 we hope to be in a position to describe and possibly quantify the pathways for energy and mass movement from mantle to the ocean floor at Logatchev, achieving a major portion of one of the main goals of the SPP1144 as a whole.

The fifth cruise to the southern SPP area (*MARSÜD V*; PI Richard Seifert, IfBM, Hamburg) is scheduled for September 2008 with RV Meteor. This cruise is the last scheduled within the SPP 1144 to the major study site at 5° to 11°S, MAR. Work will focus on the first two of the 6 core cross-disciplinary questions the SPP 1144 was conceived around:

- How does the energy and mass transfer from the mantle into the ocean take place?
- What are the time scales on which processes at spreading axes occur?

Our goal for this cruise is therefore 3-fold:

- continue the fluid chemistry and fluid temperature series
- examine how the vent faunas are responding to changes in the vent fluids. The sulphide- and methane-oxidizing symbionts of vent mussels are ideal for investigating this question. Our previous studies show that these symbionts use sulphide, methane, and hydrogen as energy sources and respond to short term changes in vent fluids on the scale of minutes and hours with changes in symbiotic activity

(Pernthaler et al. Submitted, Duperron et al. 2005). Our hypothesis is that long term changes in vent fluids on the scale of years will influence the absolute and relative abundance of the two mussel symbionts with an increase in the relative concentration of an energy source leading to an increase in the biomass and productivity of the symbiont that can use the energy source and vice-versa.

- Complete the three-year study of plume dispersal on a local and regional scale (CTD box, moorings, AUV plume mapping)

Announcement:

4th SPP1144-Workshop, Etelsen, 26.- 28.6.07

This is the first announcement for the 4th SPP1144 workshop that will take place in July 2006. The workshop will be used to present the results of the Merian cruises MSM 03/2 and MSM 04/3 and the results of the funded SPP1144 DFG-projects. Furthermore, it will give us the opportunity to coordinate the evaluation of data from the Mid-Atlantic ridge segments and hydrothermal vent fields in the selected areas at 15°N and between 7 and 11°S as well as discuss how best to go about publishing these.

The workshop will bring together scientists and graduate students from all disciplines interested in both field areas. Based on our positive experience during the last years, the workshop will be held again in Etelsen (near Bremen) from 26.-28.6.07. An official invitation together with a registration form will be sent out by the DFG during spring 2007.

News from the InterRidge Office

This is the third and last year year for the InterRidge office hosted in Germany.

Office activities: A fundamental part of InterRidge office activities is to provide up-to-date ridge-related information through the annual IR News, IR info emails and the InterRidge website (www.interridge.org).

The ongoing discussion regarding the code of conduct resulted in the draft by InterRidge's biology working group "Statement of commitment to responsible research practices at deep-sea hydrothermal vents". A copy of this statement can be downloaded from the IR website.

Education Outreach activities: InterRidge has placed

a strong focus on education and outreach initiatives. InterRidge is a major partner in the Ridge 2000 "GLOBE" program. This program will bring important concepts of deep-ocean science as well as educational innovations that promote scientific inquiry to students worldwide. Two other initiatives are the publication of an issue of "Oceanography" magazine sponsored by InterRidge due for publication in March 2007 and the production of an interactive DVD based on a cruise in 2002. For all further information please contact Kristen Kusek (kristenkusek@aol.com).

Recent events: In February 2006, InterRidge held a symposium at the American Association for the Advancement of Science (AAAS) meeting in St. Louis, Missouri, USA. The symposium was entitled: Latest Ocean Ridge Research: Microbes, Mining, Management and More. The presentation on InterRidge's "Statement of commitment to responsible research practices at deep-sea hydrothermal vents" marked the unveiling of this InterRidge statement.

From 14-16 June, the InterRidge Steering Committee Meeting took place in Moscow, Russia. Apart from presenting updates of the national ridge programs and activities, the meeting outlines InterRidge activities for the upcoming year, and always presents an opportunity to establish networks amongst the different nations. The hosting nation of the InterRidge office 2007-2009 was represented by Jian Lin from Woods Hole, USA, who will be the next InterRidge chair. It was emphasized that the next few years will be particularly important in the development of public policy concerning ocean ridges.

In July 2006, InterRidge held a science symposium with six InterRidge speakers at the EuroScience Open Forum in Munich, Germany. In addition, an outreach exhibit was organized for one week, the IMAX film "Volcanoes of the Deep Sea" was shown and a press conference was held.

Upcoming events: From 20-22 September 2006 InterRidge is hosting a Polar Ridges workshop and meeting in Sestri Levante, Italy. For more information on this see the InterRidge website (www.interridge.org/SCIENCE/IRmeetings/2006PolarRidges.html).

List of submitted and accepted SPP manuscripts

- **Almeev, R., Holtz, F., Koepke, J., Haase, K. and C.W. Devey.** Depths of partial crystallization and H₂O contents of MORB inferred from glass compositions: phase equilibria simulations of basalts at the MAR near Ascension Island (7°-11°S). Submitted to Journal of Petrology.
- **Amini, M., Eisenhauer, A., Böhm, F., Fietzke, J., Bach, W., Garbe-Schönberg, D., Bock, B., Lackschewitz, K.S. and F. Hauff.** The calcium isotope systematic in fluids and precipitates along the hydrothermal pathway of the Logatchev Field. Submitted to Geochimica et Cosmochimica Acta
- **Devey, C.W., Lackschewitz, K.S. and E. Baker** (2005) Hydrothermal and volcanic activity found on the southern Mid-Atlantic Ridge. EOS, 86(22), 209, 212.
- **Duperron, S., Bergin, C., Zielinski, F., Pernthaler, A., Dando, P., McKiness, Z.P., DeChaine, E., Cavanaugh, C.M., Dubilier, N.** In press. A dual symbiosis shared by two mussel species, *Bathymodiolus azoricus* and *B. puteoserpentis* (Bivalvia: Mytilidae), from hydrothermal vents along the northern Mid-Atlantic Ridge. Environmental Microbiology. (Early Online publication date: 26-Apr-2006)
- **Fabian, M. and H. Villinger,** The Bremen Ocean Bottom Tiltmeter (OBT) - A new instrument to monitor deep sea floor deformation and seismicity level. Submitted to Marine Geophysical Research
- **Ivanenko, V.N., Arbizu, P.M. and J. Stecher,** 2006. Copepods of the family Dirivultidae (Siphonostomatoida) from deep-sea hydrothermal vent fields on the Mid-Atlantic Ridge at 14°N and 5°S. Zootaxa 1277: 1-21.
- **Perner, M., Kuever, J., Seifert, R., Pape, T., Koschinsky, A., Schmidt, K., Strauss, H. and J.F. Imhoff,** The role of hydrothermal fluids influenced by serpentinization processes on microbial communities at the Logatchev hydrothermal field, 15°N on the Mid-Atlantic Ridge. Submitted to Applied and Environmental Microbiology
- **Schmidt, K., Koschinsky, A., Garbe-Schönberg, D., de Carvalho, L.M. and R. Seifert:** Geochemistry of hydrothermal fluids from the ultramafic-hosted Logatchev hydrothermal field, 15°N on the Mid-Atlantic Ridge. Submitted to Chemical Geology
- **Sander, S.G. and A. Koschinsky, Gary Massoth, Matthew Stott and Keith A. Hunter:** Organic complexation of copper in deep-sea hydrothermal vent systems. Submitted to Geophysical Research Letters online

SPP 1144 members and cruises in the news

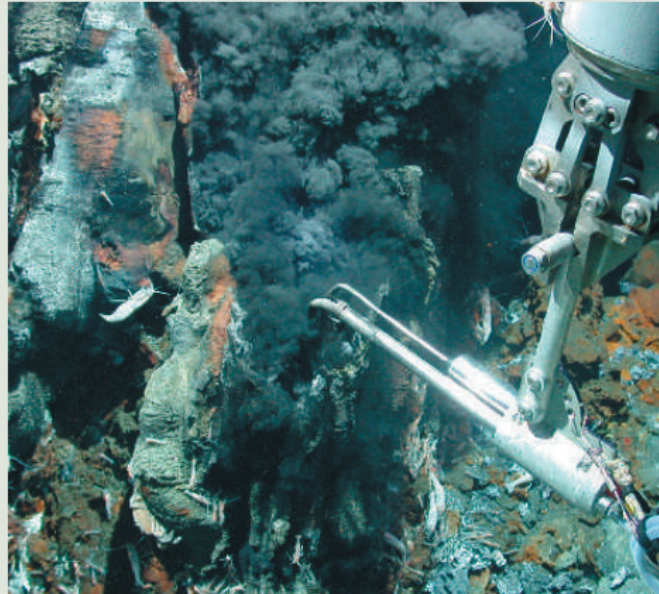
aus NATURE Vol 441, 1 June 2006

Robot delves deep to find the hottest water

German scientists have measured the hottest temperature ever found at a hydrothermal vent — a crack in the ocean floor where superheated water pours out. Using a temperature sensor on a robot submersible (pictured), the team measured a scorching 407 °C at a depth of 3,000 metres in the equatorial Atlantic.

That's just 5 °C more than the previous record, which was measured in the Pacific. But it's enough of a difference to be important, as the pressure and temperature are great enough to turn the water into a supercritical fluid — a sort of fluid-gas hybrid state. The researchers hope to learn more about the elements dissolved in the mixture.

The team, led by Andrea Koschinsky of the International University of Bremen, Germany, is continuing to probe southwards along the underwater Mid-Atlantic Ridge.



aus Spektrum der Wissenschaft August 2006

GEOLOGIE

Hitzerekord am Meeresboden

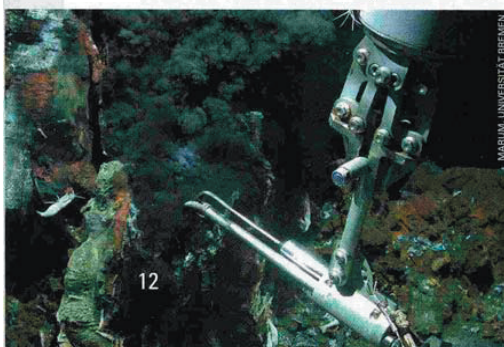
■ Heiße Quellen am Meeresgrund sind vor allem von vulkanisch aktiven Regionen im Pazifik bekannt. An ihnen tritt Meerwasser aus, das zuvor im Boden versickert und in die Nähe von Magma-körpern gelangt ist. Dort wird es aufgeheizt, bevor es wieder aufsteigt. Normalerweise haben diese Quellen eine Temperatur von etwa 350 Grad Celsius. Wegen des hohen Drucks am Meeresgrund bleibt das Wasser trotzdem flüssig.

Die heißeste bisher bekannte Tiefseequelle lag im Pazifik und erreichte 402 Grad Celsius. Nun haben Wissenschaftler um Andrea Koschinsky von der Inter-

national University Bremen bei einer Expedition mit dem Forschungsschiff Meteor 3000 Meter tief im Atlantik einen neuen Rekordhalter entdeckt. Ein Tauchroboter registrierte dort eine Temperatur von 407 Grad Celsius.

Dies entspricht genau dem »magischen« Wert, bei dem sich salzhaltiges Meerwasser unter dem hohen Druck in der Tiefsee in ein überkritisches Fluid verwandelt: ein Mittelding zwischen Flüssigkeit und Gas, das ungewöhnliche Eigenschaften aufweist. Insbesondere kann es die umliegenden Gesteine besser auslaugen als flüssiges Wasser.

»Das Ergebnis sind superheiße Lösungen ungewöhnlicher Zusammensetzung«, erklärt Koschinsky. *Pressemitteilung der International University Bremen, 22. 5. 2006*



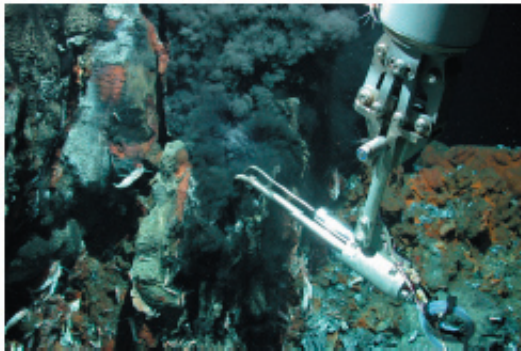
◀ Der Tauchroboter »Quest 5« misst die Temperatur an der heißesten bekannten Tiefseequelle. Dort leben Organismen, die sich von dem mineralreichen Wasser ernähren.

Spiegel online, 23.5.2006

HEISSE UNTERWASSER-QUELLE

Hitzerekord tief im Atlantik

Mitten im Atlantik hat eine deutsche Forscherin die heißeste bekannte Unterwasserquelle entdeckt. 407 Grad Celsius zeigte das Thermometer eines Tauchroboters an einem sogenannten Schwarzen Raucher – eine Insel des Lebens in der Finsternis. Per Tauchroboter hielten die Wissenschaftler an Bord des Forschungsschiffs "Meteor" ein Thermometer an den Schwarzen Raucher in 3000 Metern Tiefe. Diese Warmwasserspeier am Meeresboden interessieren Forscher wegen ihrer Rolle als Inseln des Lebens in einer denkbar lebensfeindlichen Umgebung: Extrem hoher Druck, ewige Finsternis, Eiseskälte und ein eklatanter Mangel an Nährstoffen machen den Boden der Tiefsee unwirtlich.



(MARUM, Universität Bremen)
Fieber messen: Der deutsche Tauchroboter "Quest 5" bei der Rekordmessung am heißesten bekannten Schwarzen Raucher

Doch um die Raucher herum gedeiht das Leben, weil sie

nicht nur Wärme spenden, sondern auch Nährstoffe aus dem Gestein herauslösen. Bisher galten 402 Grad als Hitzerekord für Schwarze Raucher, waren jedoch bloß im Pazifik gemessen worden, wie die International University Bremen (IUB) mitteilte. "Die Erhöhung des Temperaturweltrekords um nur fünf Grad Celsius mag auf den ersten Blick unerheblich scheinen; sie hat jedoch erhebliche Konsequenzen", sagt die Bremer Geowissenschaftlerin Andrea Koschinsky. An der Fundstelle, dem mittelatlantischen Rücken, wo die afrikanische und die südamerikanische Kontinentalplatte jährlich vier Zentimeter auseinander driften, tritt heißes Wasser normalerweise bis zu 350 Grad warm aus. 407 Grad seien aber jenseits einer besonderen Grenze, erklärte Koschinsky. Bei den in der Tiefe herrschenden Druckverhältnissen tritt Wasser mit dieser Temperatur nicht mehr als Flüssigkeit aus, sondern in einem Zwischenzustand aus flüssig und gasförmig. Dieser überkritische Dampf löst aus dem umliegenden Gestein Bestandteile ganz anders heraus, als heißes Wasser es tut. "Das Ergebnis sind superheiße Lösungen mit außergewöhnlichen Zusammensetzungen", sagte Koschinsky. Das könne Auswirkungen auf die Lebensbedingungen um besonders heiße Schwarze Raucher haben. Die Reise der "Meteor" dauert noch bis Anfang Juni. Ein internationales Forscherteam – unter anderem mit Teilnehmern aus Bremen, Hamburg, Kiel und Münster sowie des Woods Hole Oceanographic Institute in den USA – will Stoff-, Energie- und Lebenszyklen an Bruchstellen in der Tiefsee erforschen. Die Rekordmessung sei nur durch das Zusammenspiel zweier Tauchroboter aus den USA und Deutschland möglich gewesen, teilte die IUB mit.

SPP1144 Newsletter is published bi-annually by

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