Vol. 14 2005

InterRidge News

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INTERRIDGE NEWS

Vol. 14 October 2005

EDITOR

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LAYOUT

Katja Freitag, Kiel, Germany

INFORMATION FOR CONTRIBUTORS

Please send all items for publication via email to the InterRidge Office (coordinator@interridge.org) Text should be in Microsoft Word format. Figures should preferrably be sent in eps format for optimal printing, although other formats are accepted.

DEADLINE FOR INTERRIDGE NEWS VOL. 15 CONTRIBUTIONS

31 AUGUST 2006

LETTER FROM THE CHAIR

Dear InterRidge Scientist,

With only a few days to go ´till the deadline for InterRidge News submissions, it is time for me to put down on paper the thoughts and plans I and the Steering Committee have for the next year and reflect on what we have achieved this last year.

The year 2005 started with a bang with the Indian Ocean Ridge workshop in Goa. Thanks to the huge efforts of both the scientific and especially the local organising committees we had a tremendously interesting and productive meeting and learnt to thoroughly appreciate the Indian hospitality. I personally was also greatly impressed with the quality of posters presented at this meeting and was pleased that the award committee decided to honour three of them.

In the office we were busy revamping the website, part of a year-long effort placing a particular emphasis on getting the message about InterRidge and ridge science in general out to as many people as possible – known in the trade as Education Outreach or E&O. With Katja working hard behind the scenes on web design as well as all her other coordinator duties, our E&O coordinator Kristen Kusek was busy flying the InterRidge flag, an effort which culminated in the Science Writer-at-Sea program. For this she took a journalist student on a Norwegian cruise (led by Rolf Pedersen who kindly made the berths available to InterRidge for this) and they provided Katja with news items and interesting stories concerning the cruise. The results of this effort have received vast amounts of international praise not only within the InterRidge community but also in international marine sciences and science policy too. If you haven´t yet looked at the web-site produced I recommend you do so! As part of the preparation effort Kristen also produced a "How to..." guide for student journalists interested in learning more about science journalism.

So a busy 2005, but what is looming on the horizon? E&O continues apace in 2006 with InterRidge organising a session both at the American Association for the Advancement of Science (the producers of "Science") meeting in St Louis, Missouri in Febuary and at the Euroscience Open Forum meeting in Munich in July. The Steering Committee meeting will be held in Moscow, Russia with the aim of bringing the large and knowledgeable Russian ridge community closer to InterRidge. But we also have some thornier problems to face. A Code of Conduct for Ocean Ridge Research is long overdue and its absence is severely hurting our international credibility. I have made it a personal commitment to see this document produced during my term as InterRidge Chair and will be working on this throughout 2006. And 2006 will see the decision made on who is to be the next host of InterRidge – deadline for applications is 31 March 2006 so if you are interested, get a bid in!

COLIN DEVEY

COORDINATOR UDATE

This second year of the InterRidge office hosted in Kiel, Germany was another successful one. There were numerous InterRidge activities (international workshops and a field school and trip to Cyprus) that encouraged the exchange of ideas between scientists all around the world and gave the opportunity for future international collaborative efforts. They also allowed me to meet so many of you in person! From an office perspective a lot was achieved too, thanks to the great team I work with – the people that make up the office in particular (student helpers Swen Meyer and Tom Kwasnitschka, Kristen Kusek) and InterRidge in general (InterRidge chair Colin Devey, the steering committee, working group chairs, national correspondents, and all of you reading this!). It has also been excellent working with the Ridge 2000 office, they were amazing when it came to workshop organizing and I look forward to many more "joint ventures" with the new Ridge 2000 team when their office moves to Scripps, California in November this year – good luck with the move!

Steering Committee News

The 2005 steering committee meeting was held in Kiel, Germany, in April. Of the 17 members at the time, 15 were present, as well as both coordinators. This made the meeting the prefect occasion to exchange ideas and information on InterRidge, its activities, and its plans. The steering committee report is available to all from the downloads page on the InterRidge website.

There were a few changes to the membership of the steering committee in 2005:
Nobukazu Seama took over the Japanese representation from Kensaku Tamaki, and a second member remains to be announced. Donna Blackman, the new Ridge 2000 chair, took over USA representation from Deborah Smith. Furthermore K. A. Kamesh Raju follows Abhay Mudholkar as India's steering committee member. Other good news is that Spain joined InterRidge as an associate member after the steering committee meeting. Rosario Lunar will represent Spain on the steering committee.

InterRidge Meetings

The year was packed with meetings (see Other InterRidge News section in this newsletter), and my thanks goes again to the Ridge 2000 office that helped so much in organizing joint IR-R2K meetings as well as the Cyprus field school and trip. Thanks also to the local organizers of each meeting – the effort that goes into planning and coordinating the logistics for these smooth operations is huge and could not be done without all these dedicated background people.

- January - Indian Ridge Workshop on Indian Ridge Systems, Goa, India
- April (with Ridge 2000) – 3rd International MoMAR implementation workshop, Lisbon, Portugal
- May (with Ridge 2000) - field school and field trip led by Professsor Joe Cann (UK) to study the Troodos ophiolite, Cyprus
- September (with Ridge 2000) - 3rd International Symposium on Hydrothermal Vent and Seep Biology, La Jolla, Calfornia, USA

(Abstract volumes and workshop reports available on the downloads page of the InterRidge website.)

Two of the meetings were the third of their kind, a sure sign that although ridge science is a young field compared to other fields of science, it is reaching a matured stage fast – not surprising as it will be 30 years ago in two years time that hydrothermal vents were first discovered! And InterRidge Outstanding Student Poster Awards were presented at two of the meetings (see Other InterRidge News).

Looking towards 2006, two InterRidge meetings are currently planned, one on Arctic Ridges (involvement of InterRidge's Ultraslow Spreading working group) and the other a joint USSSP–InterRidge–Ridge2000 Workshop on the Evolution of Oceanic Lithosphere (involvement of InterRidge's Deep Earth Sampling working group - see announcement in this newsletter). Details for all InterRidge meetings will be announced in IR info emails and made available on the InterRidge website as soon as they are known.

Education Outreach

The education outreach highlight of this year was the pilot cruise for the science writer-at-sea program that was brought to life by Kristen Kusek (see her feature in this newsletter). If any of you are planning a cruise and have a berth or two available, and can give journalism graduate students the opportunity to participate in research expeditions, please contact Kristen. Not only will this enable your cruise to communicate the great stories of life and research at sea to nonscientific and scientific audiences, you will also contribute in bridging the gap that often exists between scientists and journalists through a 'real time' experience and generally encourage interest in the mysteries of the deep in diverse audiences worldwide.

The next big E&O project for InterRidge is to join groups that traditionally do not work together—scientists, writers, educators, video producers, graduate students—in a common mission: to develop an educational video package including six half-hour programs that tell the compelling stories of ridge science in an effective, accurate way. This will be done in a team effort with Future Vision:Educational Media Group who are a long-time producer of marine science educational television programs and other science organizations. A cost-effective plan to develop innovative print and video media products for formal and informal audiences is in place and only funding is pending!

InterRidge Office Projects

We successfully completed many office projects during the last year. These include:

- A redesigned and restructured InterRidge website – this went online in February 2005 and now provides you with easy access to all the information you need on InterRidge and its past, present and future activities
- An up-to-date InterRidge membership database – we merged two separate membership databases (online and the office database) into one easily maintainable InterRidge membership database and have taken steps to bring this up-to-date with current contact details of members. In order to help us maintain this database, please remember to forward any address changes to the InterRidge office
- Online membership registration form – this is back in action
- InterRidge poster – this will be used at conferences
- Science writer-at-sea website – the pilot test for this program was done on a Norwegian cruise (PI Rolf Pedersen) to the Arctic and resulted in the first InterRidge education outreach cruise website, this was translated into German as well
- Successful merge of InterRidge's biology database with ChEssBase

Office projects for 2006 include:

- Working group fact sheets – the first one for Biogeochemical Interactions at Deep Sea Vents is almost complete
- InterRidge dedicated issue in Oceanography Magazine
- Work on a collaborative effort with ChEss and Ridge 2000 and other US E&O people to put together a database of ridge images for education outreach purposes
- Support the InterRidge education outreach efforts as much as possible

And last, but not least, during the upcoming year a new "home" for the InterRidge office starting 2007 will be determined! I will do my best and set aside enough time to make sure the office is easy to hand over once it is time to move!

KATJA FREITAG

THE CURRENT INTERRIDGE WORKING GROUPS AND THEIR CHAIRS

InterRidge Working Group News

Of the seven InterRidge working groups that started off the New Decade of InterRidge, all but one have chairs and a strong membership, and an eighth working group was accepted following a proposal submitted to the steering committee last year.

- Françoise Gaill officially handed over the chair of the Mid-Ocean Ridge Ecosystem working group to Nicole Dubilier and Chuck Fisher at a working group meeting that took place in September during the Hydrothermal Vent and Seep Biology Symposium.
- The first Biogeochemical Interactions at Deep-sea Vents working group meeting was held in San Francisco at the Fall 2004 AGU meeting. This was a successful starting point for the working group, and a report is available on the outcome on the InterRidge website.

(see working group reports in this newsletter)

Planned 2006 working group meetings include:

- Ultraslow Spreading Ridges working group in conjunction with the Arctic Ridges meeting
- Deep Earth Sampling working group at the Fall 2005 AGU meeting and during the USSSP–InterRidge–Ridge2000 Workshop on the Evolution of Oceanic Lithosphere

Hotspot-Ridge Interactions	Jian Lin: jlin@whoi.edu, Jérôme Dyment: jdy@ipgp.jussieu.fr
Back-arc Spreading System/Back-arc Basins	Sang-Mook Lee: smlee@snu.ac.kr
Mid-ocean Ridge Ecosystems	Nicole Dubilier: ndubilie@mpi-bremen.de, Chuck Fisher: cfisher@psu.edu
Monitoring and Observatories	Javier Escartin: escartin@ipgp.jussieu.fr, Ricardo Santos:ricardo@notes.horta.uac.pt
Deep Earth Sampling	Benoit Ildefonse: benoit@dstu.univ-montp2.fr
Ultraslow Spreading Ridges	Jon Snow: jesnow@uh.edu
Biogeochemical Interactions at Deep-sea Vents	Nadine le Bris: Nadine.Le.Bris@ifremer.fr
Global Exploration	- still looking

Interested in becoming a working group member?
Like to know more about working group activities, meeting outcomes?
Please visit the website (www.interridge.org) or contact the working group chairs.
If you would like to propose a new working group or have any other questions, contact the IR office or Chair directly.

The Pacific-Antarctic Ridge between 41°15'S and 52°45'S: Survey and sampling during the PACANTARCTIC 2 cruise.

L. Dosso[1], H. Ondréas[2] and the PACANTARCTIC 2 Shipboard Scientific Party:
A. Briais[3], P. Fernagu[2], G. Floch[2], C. Hamelin[4], B. Hanan[5], F. Klingelhoefer[2], M. Moreira[6], A. Normand[2]

Introduction and scientific objectives

The Pacific plate is separated from the Antarctic plate by a 5000 km long spreading ridge south of the Chile Triple Junction at 35°S/110°W (Figure 1). A large portion of this plate boundary, the Pacific Antarctic Ridge, which includes major fracture zones, was surveyed by Lonsdale (1986, 1994a, 1994b), Cande et al. (1995) and Géli et al. (1997), but only the southern section has been systematically sampled (Géli et al., 1997, Castillo et al., 1998).

The Pacific-Antarctic Ridge can be divided into three main sections which define three domains from south to north (Figure 1):
- South of the Udintsev Transform Fault (TF), a domain bounded by passive margins,
- between the Udintsev and Eltanin TF, a transitional domain composed of the Eltanin TF system (Heezen and Tharp TF) and an oblique intraplate structure (Hollister Ridge).
- North of the Eltanin system, a domain delimited by subduction zones, with numerous transform faults south of the Menard TF and a domain without transform faults north of the Menard TF.

The ridge spreading rate increases from 54 mm/y at 65°S to 74 mm/y near the Udintsev TF at 55°S, and finally to 100 mm/y at 35°S (De Mets et al., 1994).

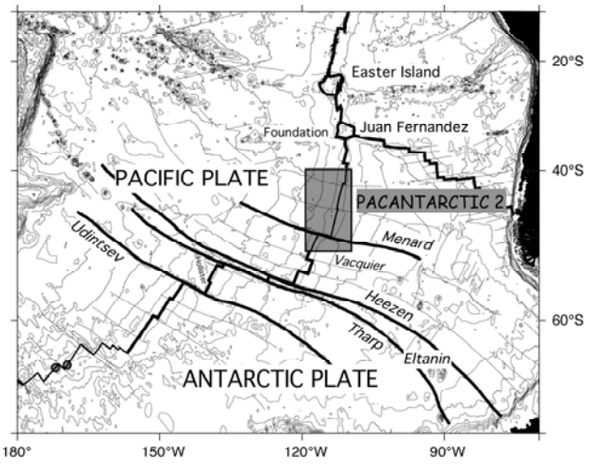

Figure 1
Location map for the PACANTARCTIC 2 cruise. The main fracture zones of the South Pacific are indicated and the two dredge sites reported in Ferguson and Klein (1993) are shown with circle symbols.

After the southernmost portion of the ridge axis was first dredged by Cande et al. in 1992 (two dredge sites at 64°S and 171°W, see Figure 1), Ferguson and Klein (1993) described the Pacific Ocean as "one of the largest chemically coherent mantle domains on the Earth". However a later cruise (PACANTARCTIC 1) which sampled the ridge between 56°S to 65°30'S (Géli et al., 1997) brought a new perspective on the properties of the South Pacific mantle as reported by Vlastélic et al. in 1999. Together with geochemical data from samples collected along the axis between 53° and 57°S (Castillo et al., 1998), the new data showed evidence of a large-scale chemical and thermal division of the Pacific mantle. The boundary was identified at the latitude of the Easter Island microplate. However those conclusions were drawn from an incomplete data set as the ridge section between 41°S and 53°S had not yet been sampled. This, therefore, became the main objective of the PACANTARCTIC 2 cruise described in this report. More samples have also been collected along the ridge near the Foundation line (Maia et al., 2000), and between 37°S and 41°30'S (Stoffers et al. 2002).

The gravity grids derived from satellite altimetry measurements show gravity highs, either isolated or aligned in ridges, between 40°S and 55°S. These are interpreted to be numerous off-axis volcanoes and volcanic ridges. The largest of these structures are located on each side of the Menard TF, forming N75° E-trending volcanic ridges, and a series of 3 ridges oriented E-W near 42°S. Another objective of the PACANTARCTIC 2 cruise was to map and dredge these off-axis structures to understand how they relate to axial magmatism, dynamics and kinematics.

Preliminary results

PACANTARCTIC 2 was a joint geophysical survey and geochemical sampling cruise to the Pacific-Antarctic Ridge between 41°15'S and 52°45'S (Figure 2). From December 17, 2004 (Talcahuano – Chile) to January 17, 2005 (Easter Island – Chile) the French research vessel *L'Atalante* surveyed 1300 kilometers of the Pacific-Antarctic Ridge axis and made 3200 km of off-axis profiles to describe the structures located on either side of the Menard transform fault and west of the axis at 42°S (Figure 2).

[1]CNRS, UMR6538, Domaines Océaniques, IFREMER, B.P.70, 29280 Plouzané, France; [2]IFREMER, B.P.70, 29280 Plouzané, France; [3]CNRS, UMR5562, 14, Avenue Edouard Belin, 31400 Toulouse, France; [4]I.U.E.M., Place Nicolas Copernic, 29280 Plouzané, France; [5]Department of Geological Sciences, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-1020, U.S.A.; [6]Laboratoire de Géochimie et Cosmochimie, I.P.G. Paris, 4 place Jussieu, 75005 Paris, France.

Bathymetry and imagery data were collected with a SIMRAD EM-12 dual multibeam echosounder system. A proton magnetometer SeaSPY (Marine Magnetics Corporation) was used to acquire magnetic data. Gravimetric measurements were made with a Lockheed Martin BGM 5 Gravimeter.

The studied ridge section is segmented by large non-transform offsets such as overlapping spreading centres (OSC) and by a major transform fault, the Menard TF located near 50°S. South of the Menard TF, the PACANTARCTIC 2 cruise imaged three 100 to 220 km long segments. North of the Menard TF, five 110 to 260 km long segments were mapped. Segment morphology varies from a robust 12 km-wide dome to a narrower 2 km wide rise. In two cases the segments are rather poorly defined, and are interpreted as transitional ridge segments. The average depth of the axis is 2400 m. The spreading rate varies between 46 mm/y at 52°S to 50mm/y at 42°S (Lonsdale 1994b).

A total of 43 dredges were carried out, 24 of these along axis and 19 off-axis. 41 were successful.

Along axis

24 dredge samples were collected at regular intervals (Figure 2). Our survey confirms Lonsdale et al. (1994) description of the ridge morphology, segment lengths and discontinuities.

From 52°45'S to 41°15'S, the axis is characterised by a dome shape typical of the East Pacific Rise. The dome, in its most robust part, reaches 8-12 km in width and 400 to 600 m in height, locally showing a small summit graben (45°S).

Basalts dredged at the axis are most often very fresh, aphyric, rarely vesicular and in many cases have a glass rim which can be a few centimetres thick. Pillow basalts are common as are tabular basalts. Ropy lavas are found occasionally.

The axis from 52°30'S to south of the Menard TF can be divided into three segments (S1 to S3), which are 220, 100 and 120 km long from south to north, respectively. They are bounded by four discontinuities: (1) the Vacquier TF, not mapped during this cruise, (2) a right-stepping discontinuity between 51°10S and 50°50'S, which shows an overlap of 40 km and an offset of 6 km, (3) a left-stepping discontinuity at 50°20'S, which shows an overlap of 25 km and an offset of 6 km, and (4) the Menard TF near 49°20'S. The southern and northernmost segments show a dome varying from 2 km to 10 km in width. The central segment may represent a transition zone between S1 and S3 as seen in cross section (Figure 2).

The axis from the north of the Menard TF to 41°15'S can be divided into five segments (N1 to N5) which deepen toward the north. The southernmost segment N1 is 160

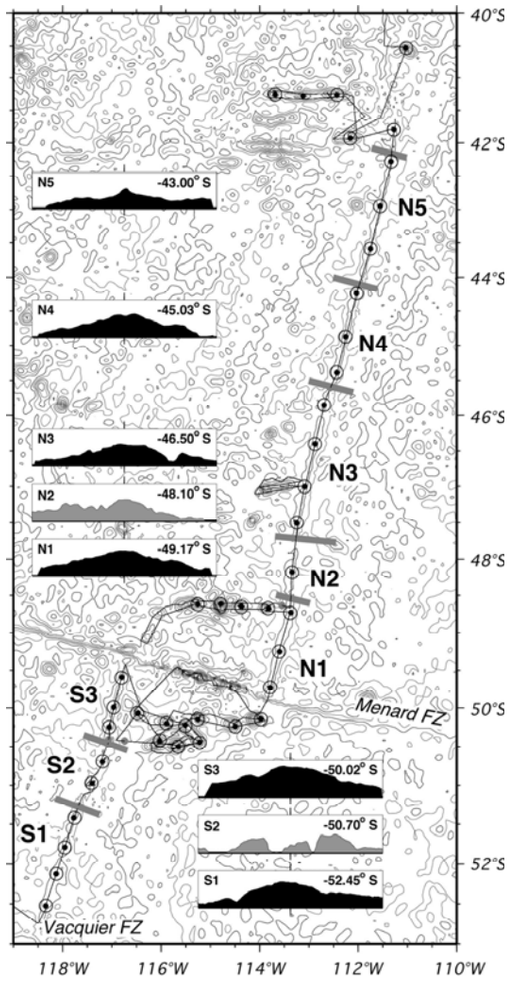

Figure 2
Path of the geophysical survey and dredge locations superimposed on seafloor predicted bathymetry. A cross section of the ridge axis is shown for each segment. It is shown in grey for transitional segments S2 and N2.

km long, and shows a 12 km-wide axial dome which lies 2300 m deep. This N15°-trending segment is separated at 48°35'S from the N2 segment by a left-stepping OSC (30 km large overlap with 8 km offset). The northern Menard volcanic ridge oriented N90° and mapped during this cruise meets the axis at this point. The 110 km long N2 segment is less robust than segments N1 or N3. A major, 20 km long discontinuity, shaped like an OSC with an 8 km-wide central basin and reaching a depth of 2650 m, is located at 47°45'S between segments N2 and N3. The longest segment, N3, is oriented N15°, and has a length of about 260 km. Along this segment, the dome is 6 km wide. The next discontinuity, located at 45°35'S, is a right-stepping OSC creating 14 km overlap and 6 km offset between segments N3 and N4. A 600 to 800 m wide and 50 m deep summit graben is found at the axis of the N15°-trending, 160 km-long N4 segment. Northward, the dome gets narrower, becoming only 2 km wide at 44°40'S. The 44°05'S discontinuity shifts the axis by 2 km to the east and forms the boundary to the 230 km

long N5 segment. The discontinuity is a small left-stepping OSC with 8 km overlap and 2 km offset.

Preliminary geochemical analyses of ridge axis samples (Figure 3) indicate, as was expected, that a majority of samples are depleted as shown by their (Nb/Zr)N ratios of less than 0.5. It is worth noting that the more enriched samples are found in ridge segments that are not clearly defined by the ridge morphology (such as S2 and N2) and within segment S3, which is clearly influenced by the proximal seamount activity. The most depleted sample with (Nb/Zr)N < 0.2 is located at the northern end of the N4 segment. Within each segment, the most depleted sample is found at the northern end of the segment where the ridge dome becomes narrower.

At the ridge section scale, a decrease in bathymetry is observed toward the north. It is accompanied by an increase in the depleted character of the samples as shown here by the general decrease of (Nb/Zr)N toward the north.

Off-axis

The major off-axis volcanic structures were mapped and dredged during this cruise: 9 dredges sampled the ridge south of the Menard TF, 4 dredges sampled the ridge north of it, and 4 dredges sampled the 42°S ridges.

Preliminary analysis of the structure of the volcanoes is based on multibeam bathymetry maps. The backscatter images also help determine the relative ages of the volcanoes. A more complete analysis of the off-axis volcanic structures will be performed using the gravity data combined with the geochemistry of the samples and their absolute ages.

The volcanic ridges south and north of the Menard TF

South of the Menard TF

Nine large (average diameter is 12 km) off-axis volcanic structures were surveyed near the major 51°S discontinuity (Figure 4).

Two types of structures coexist:

- (I) typical volcanoes, exhibiting conical shapes with a summit caldera. These structures are not associated with strong backscattering in the EM12 imagery, probably due to the presence of sediments. They are located on older lithosphere and are elongated in a N90° direction. Dredge samples taken near the top recovered altered and porphyric basalts, as well as coarse-grained rocks.
- (II) highly structured and deformed volcanoes. They are elongated in a N90° or N70° direction and are associated with narrow, N90°-trending volcanic ridges, some of them show strong backscattering in the EM12 imagery. Plagioclase-bearing pillows as well as aphyric fresh and altered pillows were dredged near their tops.

North of the Menard TF

The volcanic ridge is located along the latitude of the large 48°40'S OSC. The ridge was surveyed up to 220 km off axis. The volcanoes are smaller than those described south of the Menard TF, with an average diameter of only 6 km. They are structured and connected by N100° to N90°-trending narrow ridges.

The volcano 'line' can be divided into two groups: a first group of six volcanoes near the axis, and a second group of four volcanoes, starting 130 km off-axis. All volcanoes show single or double calderas opened towards the east. The westernmost part of the survey covered two small structures, 8 km in diameter, and deeper than the other parts of the ridge. Toward the south western end of the map, the N15° to N20° fabric of the abyssal hills reappears, and is aligned parallel to the axis.

The volcanoes closest to the axis show the strongest EM12 backscattering. Four dredge samples were taken on these volcanoes. These brought back altered basalts, various pillows and some signs of life (corals, galatheas, mussels) closer to the ridge axis.

The 42°S volcanic ridges

Two N90°-trending ridges located near 42°S were surveyed:

a) Near 41°55'S, between 111°40'W and 112°30'W

This area appears to be highly structured, linear, and narrow (7 km wide). It does not seem to have been formed

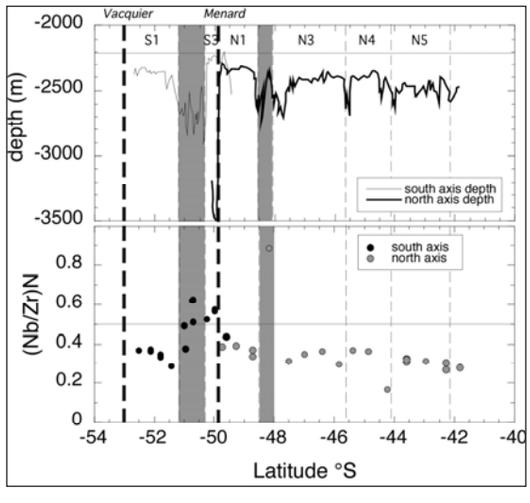

Figure 3
Bathymetry of the ridge axis with indication of the identified segments South and North of the Menard TF and (Nb/Zr)N variation along the axis (J. Etoubleau, IFREMER, analyst). Note the increasing depth of the ridge toward the north and at the same time the increasing depleted character of samples as shown by the general decrease of (Nb/Zr)N toward the north. Note also the geochemical segmentation along the ridge with a more depleted sample toward the north end of a segment. Transitional segments S2 and N2 present more enriched characteristics in relation with the proximity of the seamounts on each side of the Menard TF.

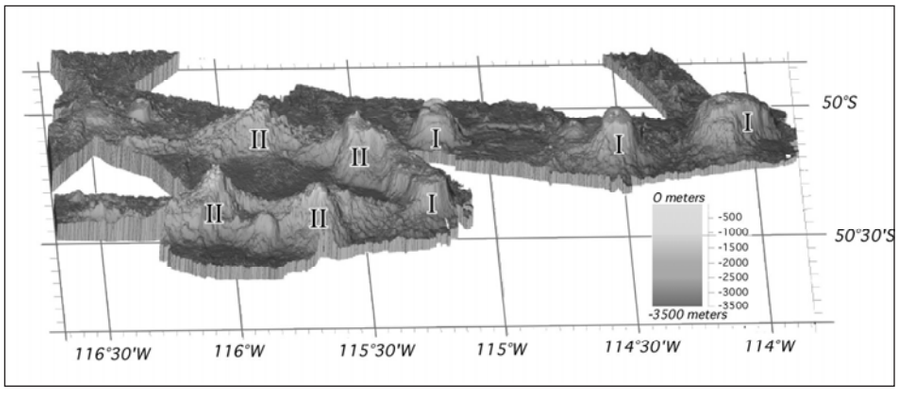

Figure 4
3-D bathymetric image of the South Menard volcanic structure with caldera-type I and younger-type II volcanoes.

by the coalescence of individual volcanoes. Fresh pillows with basaltic glass were dredged .
b) Near 41°15'S, between 112°10'W and 113°55'W
Two successful dredges sampled altered pillows from the western and vesicular basalts from the eastern part of the ridge.

Further work will test 1) the existence of two sub-Pacific mantle domains south and north of the Easter microplate (Vlastelic et al., 1999); 2) the relationship between the geochemical and morphological variations described along the ridge and the thermal structure of the underlying mantle (Vlastelic et al., 2000, Ondréas et al., 2001) and 3) the relationship between off-axis and ridge volcanism and kinematics.

Acknowledgments
We would like to thank Captain M. Houmard and the crew of the N/O *L'Atalante* for their kindness and their very efficient work at sea in the well-named roaring forties and fifties!

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Nested-Scale Investigation of Tectonic Windows into Super-Fast Spread Crust Exposed at the Pito Deep Rift, Easter Microplate, SE Pacific.

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Introduction

The walls of the Pito Deep Rift, located near the northeastern corner of the Easter microplate have >4000 m of relief and expose sections of crust created at the East Pacific Rise (EPR) at a "superfast" spreading rate of >140 mm/yr [Searle et al., 1989; Martinez et al., 1991; Naar and Hey, 1991; Naar et al., 1991; Hey et al., 1995]. The goal of our Pito Deep 2005 investigation was to map these exposures with a nested-scale survey that would define the structural geometry of upper crustal rock units as well as their igneous composition, hydrothermal alteration, and magnetic properties. To achieve these goals we used the deeply towed DSL-120 mapping system, the Jason II ROV, and the submersible Alvin to document the structure and composition of oceanic crust exposed in the walls of the Pito Deep Rift (Figures 1 and 2). The integrated results of these investigations provide a new cross-sectional perspective on processes of accretion along superfast-spreading ridges like the southern EPR.

Background

Oceanic crust exposed near Pito Deep was initially formed along a continuous segment of the EPR hundreds of kilometers to the west. Linear, continuous magnetic anomalies 2A and 3 near Pito Deep on the Pacific and Nazca plates and 12 kHz SeaMARC II side-scan data clearly show an abyssal hill fabric that is not interrupted by fracture zones. The study area has, however, been rotated about a vertical axis during the evolution of the Easter Microplate, as indicated by the abyssal hill fabric pattern (Figure 1). The main rift-bounding scarps near Pito Deep cut the abyssal hill fabric at a very high angle, creating a natural cross section of superfast spread crust with a nearly ideal orientation with respect to spreading-related structures.

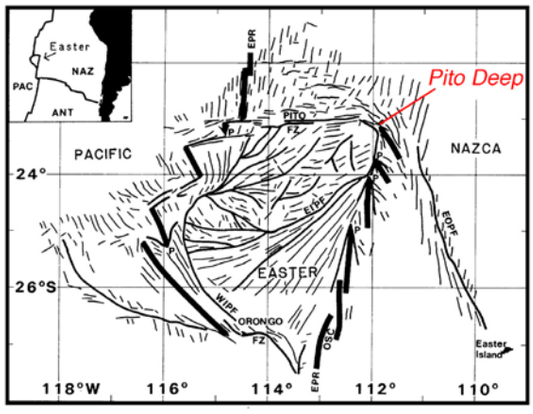

Figure 1
Tectonic setting of the Pito Deep Rift and internal structure of the Easter Microplate. The Pito Deep Rift cuts the abyssal hill of 3 m.y. old crust, initially formed at the EPR, at a high angle. Fine lines- abyssal hill lineaments; bold lines- plate boundary segments. [after Searle et al., 1989].

Prior to our cruise, nearly complete swath bathymetry data coverage (SeaBeam and SeaMARC II) was available for the study area. This included the best dive sites along the southwest-facing scarps that mark the northern side of the Pito Deep Rift and the southern edge of the Nazca plate. These scarps formed when the lithosphere was rifted open <1 m.y. ago at a rate of about 10 mm/yr. Although the present morphology is the result of slow tectonic extension, the exposed crustal structure along the scarps was formed by superfast seafloor spreading (>144 mm/yr) 3 m.y. ago at the EPR (based on a southward extrapolation of anomaly 2A from the north).

For our investigation we chose to focus on two major escarpments which were examined by Nautile dives in 1993 and that showed appropriate exposures and rock types were present in both areas (Francheteau et al., 1994). One of these areas, referred to herein as Area A (aka the "Jalapeño Ridge") was known to have excellent exposures of sheeted dikes, lavas, and hydrothermal stockwork. Area B, just to the southeast in slightly older crust, was known to have exposures of gabbro as well as shallower-level crustal units (Figure 2).

Our strategy was to conduct a nested-scale survey in which each of our investigations would be used to optimize our higher resolution mapping and sampling. Our investigation had 3 main components:

(1) DSL-120 side-scan and high-resolution bathymetric survey of both areas A and B provided morphologic maps in which we could clearly separate areas of extensive basement rock exposures from areas dominated by debris slides, talus, and pelagic sedimentary material. A magnetometer was towed behind the vehicle to collect detailed magnetic data.

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(2) Within this context, we used Jason II to make a number of long (few km) transects from the base of the escarpments (about 4000 m) to the crest (about 2600 m). Jason II allowed us to make detailed observations (documented with digital video and still cameras) and extensive sample collections with which to delineate the outcrop pattern of the major crustal rock units. We were pleased to find that Jason II was capable of collecting not only a large volume of (in some cases very large) rock samples, but could also make measurements with the Geocompass (a seafloor orientation tool) and collect oriented samples. Near-bottom magnetic data were also collected. In several places, we used the special capabilities of Jason II to make multiple overlapping traverses of large cliff outcrops in order to collect images for digital mosaics. Some of these areas are several tens of meters wide and high. We made 4 Jason II transects in Area A (Figure 3) and 5 transects in Area B (Figure 4).

(3) Specific features of interest, for example, a spectacular area of concentrated faulting, hydrothermal alteration and veining, and later dike intrusion were investigated with Alvin. We also used Alvin to make extensive collections of oriented samples for paleomagnetic studies and to define the trajectory of geological contacts between Jason II transects. Near-bottom magnetic data were collected during all dives.

In addition to our near-bottom investigations, we conducted several different kinds of shipboard studies during the evenings between Alvin dives. These included an extensive SeaBeam and magnetometer survey of the surrounding area, which has greatly enhanced the resolution of the seafloor morphology (Figure 2) and has better-defined magnetic anomaly locations. Underway surveys were conducted on both transit legs of our cruise. We also conducted a number of dredges to collect samples beyond our study areas.

Sampling

An unprecedented suite of samples was collected from the steep walls of the Pito Deep Rift. Detailed sampling traverses were conducted both laterally and vertically through the dike and lava sequences in both Areas A and B (Figures 3 and 4) and will provide information on variations in igneous compositions and hydrothermal alteration that occur at both small spatial scales (meters) and larger scales (hundreds of meters to kilometers). During our cruise, 435 individual rocks were sampled during 11 days of Jason II surveying (JII lowerings119-123) and 12 Alvin dives (dives 4075-4086). Five successful dredges were also performed. A sample suite this extensive, with known geologic context, has never before been collected in the oceans. It will allow us to test models for the generation of ocean crust developed with the previous, more limited, data set collected at the Hess Deep Rift (Karson, 2002; Stewart et al., 2005).

Preliminary Results

The major rock units mapped on the walls the Pito Deep Rift include basaltic lavas, sheeted dike complex, and gabbroic rocks as anticipated from studies of other tectonic windows into the upper ocean crust and ophiolite complexes. The contacts between these units are gradational in most places with dikes interleaved with lavas and gabbroic rocks at the top and bottom of the sheeted dike complex, respectively.

The basaltic lava unit varies substantially in thickness. It does not exceed 500 m thickness in the examined areas including the transition to underlying sheeted dikes. The typical thickness is about 400 m. Despite expectations based on surficial lavas along spreading centers, sheet flows are relatively rare in most of the lava section with pillow lavas dominating. Massive to sheeted basaltic flows with moderate dips may be tilted sheet flows, dikes or both. Sheet flows as well as flattened lobate and pillow lavas have variable dips near the top of the section but a more persistent northwesterly dip (that is toward the EPR) in the lower half of the section.

The sheeted dike complex is extremely well exposed laterally and vertically. The vertical thickness of the sheeted dike unit is 700 m to 1000 m. In most places transitions to the overlying lava and underlying gabbro units appear to occur over intervals of less than 200 m. Unlike highly shattered and complexly tilted sheeted dike complexes found in some other exposures of crust formed at fast to intermediate rates, the Pito Deep dike complex is relatively intact with only local areas of intense brecciation. The dikes dip steeply (typically 65°-80°) to the southeast (away from the EPR).

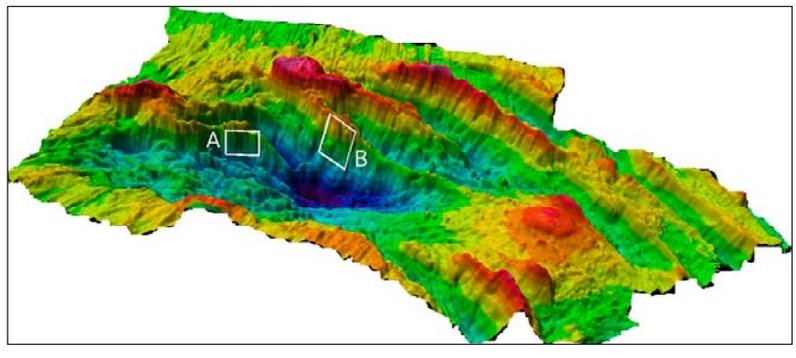

Figure 2
3-D bathymetry around Pito Deep (deep blue area in center) showing the relative locations of Areas A and B along the steep rift walls. View to NE.

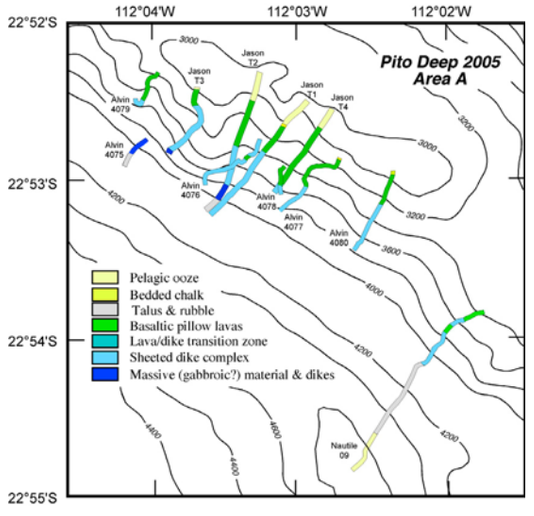

Figure 3
Summary of Pito Deep Area A submersible investigations: Jason II Transects, Alvin Dives from Pito Deep Cruise AT11-23 in 2005, and Nautile Dive (R. Hékinian and J. Francheteau, and others, unpublished data).

Extensive, rugged outcrops of gabbroic rocks occur at the base of the major scarps. Samples from these areas include a diverse suite of massive to layered olivine gabbros, troctolites, gabbronorites, and metagabbros. Microgabbro to diabase samples collected among the gabbroic outcrops indicate the presence of fine-grained margins of gabbro bodies or dikes. The maximum thickness of the gabbroic material crossed was 700 m. Subtle differences in joint patterns made it difficult to differentiate between gabbros and dikes near the contact between these two units.

Overall, the intensity of fracturing and tilting of crustal blocks is low throughout the area. However, discrete, steeply dipping, fault zones were found in a few places. These zones feature intensely altered fault gouge cut by numerous quartz veins reflecting localized hydrothermal fluid flow. Some of these fault zones are cut by later dikes and therefore probably formed near the spreading axis. Others appear to lack high-temperature mineralization and cross cutting dikes and may have formed or been reactivated during rifting in the area.

Building the Upper Oceanic Crust

Results of the Pito Deep 2005 investigation will provide an important cross sectional perspective on oceanic crust formed at a very high spreading rate. This will complement surface geological investigations, deep crustal drilling, and geophysical studies along spreading centers like the southern EPR. The results will also provide a useful comparison to drill holes and cross sections of oceanic crust formed at different spreading rates exposed in tectonic windows elsewhere. Our preliminary results indicate that superfast-spread crust at Pito Deep has a substantially thinner basaltic lava unit and a somewhat thicker sheeted dike complex compared to areas examined previously that were generated at slower spreading rates (for example, Hess Deep, Blanco Transform, Hole 504B). These relations indicate possible systematic variations in crustal structure and modes of construction that may correlate with processes that are sensitive to spreading rate.

Acknowledgements

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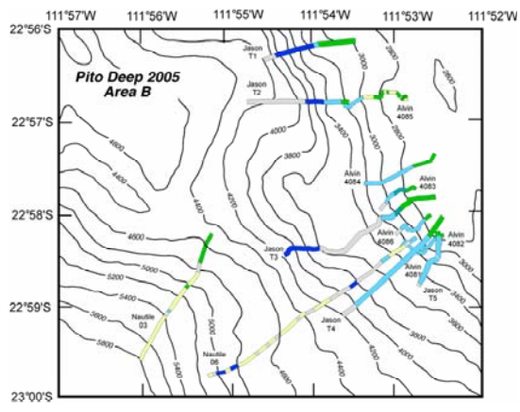

Figure 4
Summary of Pito Deep Area B submersible investigations: Jason II Transects, Alvin Dives from Pito Deep Cruise AT11-23 in 2005, and Nautile Dives (R. Hékinian and J. Francheteau, and others, unpublished data). Symbols and ornaments as in Figure 3.

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The Hard Yards: Deep basement drilling of an in situ section of oceanic crust formed at a superfast spreading rate. Recent results from IODP Expedition 309 to Hole 1256D, Eastern Equatorial Pacific.

D.A.H. Teagle[1], N.R. Banerjee[2] and the Expedition 309 Shipboard Scientific Party

Integrated Ocean Drilling Program (IODP) Expedition 309, "Superfast Spreading Rate Crust 2," successfully deepened Ocean Drilling Program (ODP) Hole 1256D (6.736°N, 91.934°W) by 503 m to a total depth of 1255.1 meters below seafloor (mbsf) or 1005.1 meters subbasement (Expedition 309 Scientists, 2005). The average rate of core recovery for the expedition was 36 %. Much higher rates of recovery were experienced in the lowermost section of the hole (~70 % average below 1200 mbsf). At the end of Expedition 309, Hole 1256D had penetrated more than 800 m of extrusive lavas and entered a region dominated by intrusive rocks. Hole 1256D is now the fourth deepest hole drilled into oceanic basement since the inception of scientific ocean drilling in 1968 and the second deepest penetration into in situ ocean crust behind ODP Hole 504B. At 1255 mbsf, Hole 1256D is tantalizingly close to the predicted minimum depth estimated for the frozen axial magma chambers (1275 mbsf). Following the completion of a comprehensive wireline logging program, the hole was successfully exited and left clear of equipment with only minor unconsolidated fill at the bottom of the hole. Hole 1256D is in excellent condition and ready for further deepening.

Expedition 309 is the second scientific ocean drilling cruise in a multiphase mission to Site 1256 designed to recover, for the first time, a complete section of the upper oceanic crust from extrusive lavas down through the dikes and into the uppermost gabbros. Hole 1256D in the eastern equatorial Pacific (Figure 1a) was initiated during ODP Leg 206 and is drilled into 15-Ma crust that formed at the East Pacific Rise during a period of superfast spreading (>200 mm/a). This site was chosen to exploit the inverse relationship observed from seismic experiments between spreading rate and the depth to axial low velocity zones (Figure 1b), thought to be magma chambers now frozen as gabbros. Hole 1256D is the first basement borehole prepared with the infrastructure desirable for drilling a moderately deep (~1.5–2 km) hole into the oceanic crust (Wilson, Teagle, Acton et al., 2003; Teagle et al., 2004).

Description of cores recovered during Expedition 309 coupled with Leg 206 observations have led to a preliminary subdivision of the upper oceanic crust at Site 1256 (Figure 2). The uppermost basement consists of a massive ponded lava flow >74 m thick. The lava pond (250–350 mbsf) overlies an interval of massive sheet and pillow flows with flow inflation structures (350– 534 mbsf)

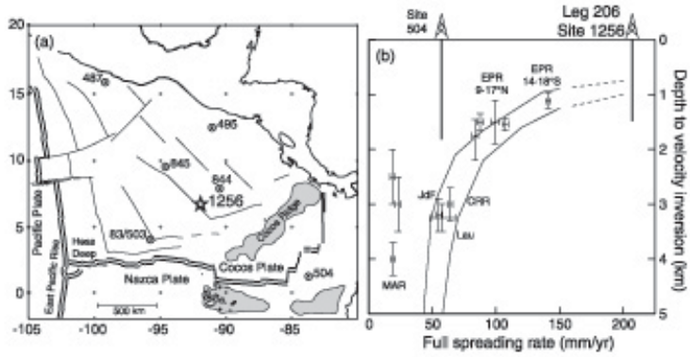

Figure 1
(a) Age map of the Cocos plate, with isochrons at 5-Myr intervals based on magnetic anomaly identifications. Selected DSDP and ODP sites that reached basement are indicated by circles. Location of ODP Site 1256 initiated during Leg 206 is shown with a star. The wide spacing of the 10 and 20-Myr isochrons to the south reflects the extremely fast (200 to 220 mm/yr) full spreading rate. (b) Depth to axial low velocity zone plotted against spreading rate modified from Purdy et al. [1992] and Carbotte et al. [1997]. Depth versus rate predictions from two models of Phipps Morgan and Chen [1993] are shown, extrapolated subjectively to 200 mm/yr. Abbreviations are: MAR, Mid-Atlantic Ridge; EPR, East Pacific Rise; JdF, Juan de Fuca Ridge; Lau, Valu Fa Ridge in: Lau Basin; and CRR, Costa Rica Rift.

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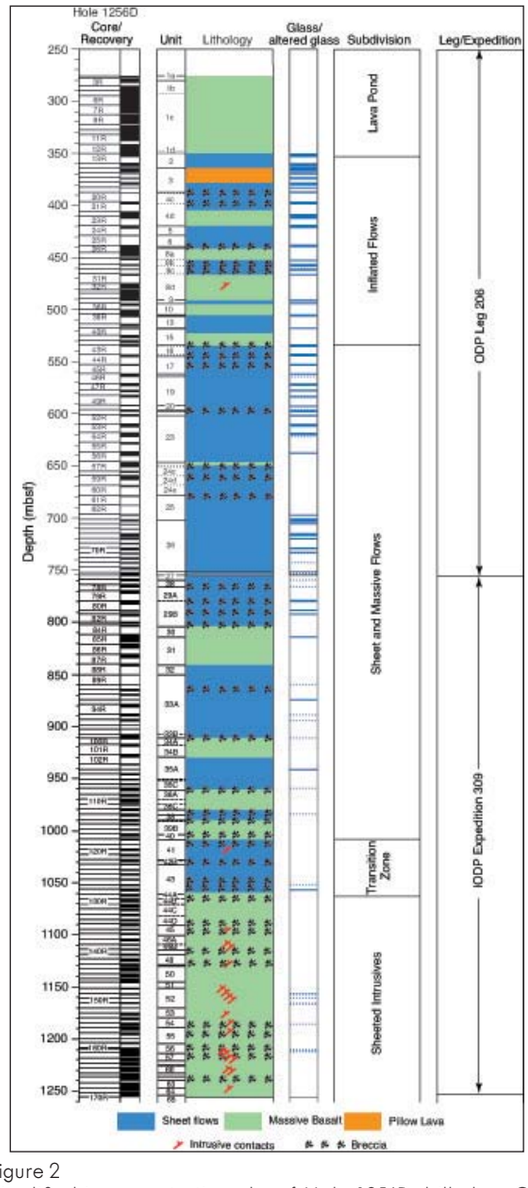

Figure 2
Simplified igneous stratigraphy of Hole 1256D drilled on ODP Leg 206 and IODP Expedition 309 showing the dominant rock types and the preliminary subdivisions of the upper crust at this site.

that suggest eruption onto a subhorizontal surface. The great thickness of the massive ponded lava required significant topography to pool the lavas, and the distinctive textures of the inflated flows suggest that these two 284 m thick lava groups formed off axis. Sheet and massive flows (534–1004 mbsf) make up the majority of the extrusive sequence in Hole 1256D. Cryptocrystalline to microcrystalline sheet flows, tens of centimeters to <3 m thick, commonly with glassy subhorizontal margins, are the dominant lava morphology. Massive fine-grained lavas become more abundant with depth. The lithologic transition zone (1004–1061 mbsf) is marked by the presence of a cataclastic massive unit with subvertically oriented cryptocrystalline basalt clasts hosted by highly altered, incipiently brecciated fine-grained basalt, crosscut by numerous fine veins and cataclastic stringers. The first subvertical intrusive contact recovered during Expedition 309 occurs at 1018 mbsf. Subvertical fracture sets possibly indicative of diking into the host rocks nearby Hole 1256D are common from ~900 mbsf. Dike chilled margins become more common downhole but extrusive textures and vesicles are still encountered down to 1061 mbsf. Breccias of various styles are common in the transition zone, including a spectacular mineralized volcanic breccia (~1028 mbsf) with hyaloclastite and basaltic clasts cemented by sulfides and subgreenschist facies minerals (Figure 3a).

A distinct change from sheet flows to massive basalts at ~1060 mbsf defines the upper boundary to the sheeted intrusives. Extrusive rocks could be present below this level, but evidence for eruption remains ambiguous. The massive basalts are most commonly aphyric and nonvesicular. Fine-grained rocks have holocrystalline or doleritic groundmass textures. Further downhole in Hole 1256D, subvertical intrusive dike contacts are common. Massive basalts are the dominant rock type in the sheeted intrusives but whether they represent dikes or sub-volcanic sills remains unproven. An unambiguous subvertical contact that grades continuously from a glassy chilled margin to microcrystalline then fine-grained massive basalt has so far eluded recovery.

The overall mineralogical and geochemical characteristics of basement drilled during Expedition 309 are similar to the cores from Leg 206 although there are some important differences. Phenocrysts are much less abundant in the Expedition 309 cores than Leg 206 cores with >80 % aphyric basalts (Leg 206 = <40 %). Olivine was the dominant phenocryst phase in the cores drilled during Leg 206 but plagioclase phenocrysts are more common in the lower 500 m of basement. The basalts show evidence

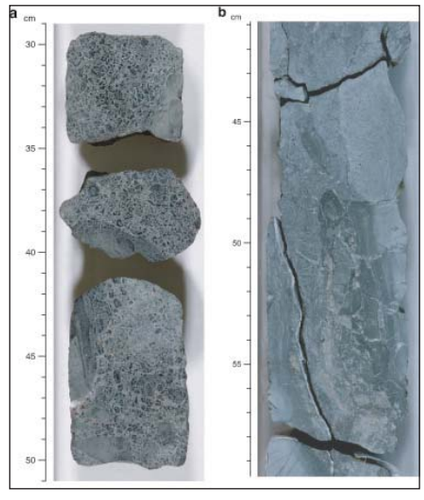

Figure 3
(a) Example of the mineralized volcanic breccia characterized by variably altered clasts of hyaloclastite in a sulfide matrix (interval 309-1256D, 122R-1, 29–51 cm). (b) Sulfide impregnated dike margin breccia (interval 309-1256D-140R-1, 42–58 cm).

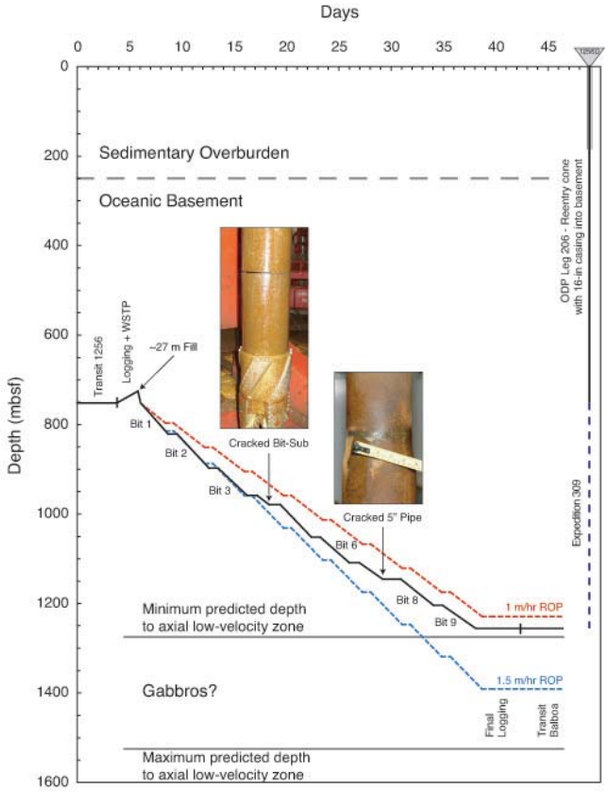

Figure 4
Drilling progress in Hole 1256D on IODP Expedition 309. The solid black line shows the actual drilling progress versus time and is compared to pre-cruise estimates of progress based on rates of penetration (ROP) of 1 and 1.5 m/hr with 54 hours rotation time per bit. Bit changes and drill string withdrawals because of equipment damage are indicated. The minimum and maximum predicted depth to gabbros is also shown.

for fractionation and replenishment downhole and trace element concentrations are within one standard deviation of average East Pacific Rise MORB, albeit on the relatively trace element depleted side.

Hole 1256D is the second drill hole to penetrate the transition from low-temperature alteration to high-temperature hydrothermal alteration in a continuous section of oceanic crust. Prior to Expedition 309, this transition had only been described in Hole 504B. Rocks that reacted with seawater at low temperatures are present down to ~965 mbsf. Black, brown, and mixed halos related to veins filled by saponite, celadonite, and iron oxyhydroxides are common in rocks from 752 to 918 mbsf. From 918 to 964 mbsf dark gray background alteration with abundant saponite and pyrite is ubiquitous.

From 964 to 1028 mbsf there is a transition in alteration characterized by the presence of pyrite-rich alteration halos and mixed-layered chlorite/smectite instead of pure saponite. Anhydrite is common from this depth to the bottom of the hole. Below ~1028 mbsf the transition to hydrothermal conditions is complete with the presence of the mineralized volcanic breccia and the first occurrences of actinolite, prehnite, titanite, and epidote. These minerals are indicative of hydrothermal alteration under subgreenschist to greenschist facies conditions. In this part of the crust, green-gray vein halos and patches are common, with 10 % – 100 % chlorite, actinolite, titanite, albite, pyrite (± minor quartz, chalcopyrite, and prehnite) replacing plagioclase and clinopyroxene and filling interstitial spaces.

The rocks at Site 1256D are less altered compared to most other basement sites (e.g., ODP Sites 417 and 418, ODP Holes 504B and 896A). Hole 1256D contains a much smaller proportion of alteration halos within the extrusive lavas, compared to Holes 504B and 896A, and the amount of calcite within Hole 1256D is very low compared to other basement penetrations. Although pyrite is abundant in the Expedition 309 cores, the black smoker fluid–derived quartz-epidote-chalcopyrite stockwork mineralization present in Hole 504B has not been penetrated in the transition from extrusive to intrusive rocks. Instead, the mineralized volcanic breccia with altered hyaloclastite fragments supported in a sulfide cement is the most sulfide-rich interval (Figure 3a). Anhydrite, which is sparse in Hole 504B, is abundant at Site 1256.

The basalts recovered during Expedition 309 predominantly exhibit brittle structures with rare brittle-ductile structures. Veins, vein networks, cataclastic zones, shear veins, microfaults, and breccia represent the main structural features. In the sheet and massive flows, structures and fracturing are heterogeneously partitioned and are most intensely developed at the top of the massive flows. Vertical sets of veins, cataclastic zones, and shear veins are present in massive units, whereas breccias are more common in sheet flows. Vertical vein sets become more common below ~900 mbsf. Most structures are related to the cooling of lava and are represented by curved, radial, Y-shaped, and irregular veins filled with secondary minerals.

Below ~1004 mbsf, numerous chilled margins were recovered and these contacts are increasingly common with depth. Where such contacts are subvertical, they are interpreted as dike margins. Chilled margins range from lobate and inter-fingered to sharp. Many chilled dike margins are associated with, or highly disrupted by, diffuse veining and brecciation (Figure 3b). Multiple dikes and banded dikes also occur. The true dips of the chilled margins range from 50° to 90° with a mode at ~70°–75°. The sheeted intrusives are also characterized by the first occurrence of systematic conjugate veins.

All rocks in Hole 1256D have been subjected to an intense drilling overprint. Rocks from the bottom of Hole 1256D have higher coercivities and there is an apparent increase in the quality of data from 970–1030 mbsf. Because of the equatorial paleolatitude of the site, polarity remains ambiguous until absolute declinations can be obtained.

The generally positive inclinations measured are not what are expected for the low paleolatitude. The most likely explanation is that a significant portion of the drilling overprint remains on nearly all of the samples. Magnetic intensities show a recurrent concave pattern with relatively high intensities at the upper and lower boundaries of igneous cooling units and lower intensities in the unit interiors suggesting an average thickness of ~1.0 ± 0.5 m for most cooling units.

P-wave velocities of Expedition 309 basalts range from 4.8 to 6.1 km/s, with an average of 5.5 ± 0.3 km/s, similar to velocities estimated from regional seismic reflection data. Below 752 mbsf, the average V_P increases ~0.05 km/s for each 50 m downhole to ~6.1 km/s at 1240 mbsf. Average V_P is slightly higher below 1060 mbsf (5.8 ± 0.1 km/s) than above (5.4 ± 0.3 km/s). Porosities range from 2 % to 14 % (average = 4 %). Porosity in the massive units decreases from 4 % ± 1 % above 1060 mbsf to 2 % ± 1 % below this level. The average thermal conductivity in the sheet and massive flows is 1.8 ± 0.2 W/m·K, but there is a significant increase in thermal conductivity starting in the transition zone and a distinct step-like increase to 2.1 ± 0.1 W/m·K at the top of the sheeted intrusives.

Following the completion of drilling in Hole 1256D, a complete suite of geophysical wireline logs was collected. Caliper readings from both the triple combo and FMS-sonic tool strings show generally good borehole conditions with a diameter typically between 11 and 14 inches. Comparison of the pre- and post drilling hole caliper measurements in the upper 500 m of basement shows an enlargement of Hole 1256D due to drilling, with a number of quite strongly eroded intervals. The borehole deviation measured at 1200 mbsf is 4.3°. Preliminary analyses of downhole geophysical measurements and images show a high degree of variation, reflecting different basement lithologies. A number of petrophysical intervals can be distinguished that closely match the subdivisions developed from core observations. Preliminary interpretation of FMS and UBI images indicate that subvertical dike margins in the sheeted intrusives have true dips towards the northeast, consistent with slight tilting of the lavas toward the paleoridge axis.

Expedition 309 (July–August 2005) will be followed closely by IODP Expedition 312 (November–December 2005). Despite our grueling pace of advance (15 m/day), progress with deepening Hole 1256D has been steady (Figure 4). Optimistically anticipating the same benign drilling conditions, good fortune, and assured of highly astute rig floor operations, Expedition 312, with more than 30 days of drilling operations, is set to deepen Hole 1256D by a further 500 m, well beyond the depths where geophysical interpretations predict gabbros to occur.

Acknowledgements

The Shipboard Scientific Party (Figure 5) would like to thank all the Expedition 309 participants for their efforts in making this expedition a highly successful scientific endeavor and an enjoyable experience. We thank Captain Alex Simpson, Drilling Superintendent Wayne Malone, the officers, and the crew of the JOIDES Resolution for all of their efforts. The IODP technical staff provided top-notch assistance throughout the cruise. Due to the superb work of the entire Transocean rig floor crew Hole 1256D is open to depth, free of junk, and ready for deepening on Expedition 312. This research used samples and data provided by the Integrated Ocean Drilling Program (IODP). IODP is managed by IODP Management International (IODP-MI), Inc.

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Figure 5: The Expedition 309 Shipboard Scientific Party: Neil Banerjee, Akram Belghoul, Carole Cordier, Laura Crispini, Florence Einaudi, Laura Galli, Yongjun Gao. Alan Gelatt, Jörg Geldmacher, Lisa Gilbert, Emilio Herrero-Bervera, Sara Holter, Christine Laverne, Haroldo Lledo, Sedelia Durand, Tetsuya Sakuyama, Takashi Sano, Christopher Smith-Duque, Paola Tartarotti, Damon Teagle, Masako Tominaga, Susumu Umino, Andres Veloso, and Douglas Wilson.

Active source electromagnetic survey of hydrothermal venting areas at the Saldanha Massif, Mid-Atlantic Ridge - the CD 167/2004 cruise.

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Introduction

The Saldanha hydrothermal field was discovered during a Portuguese-French cruise in 1998 at the Mid Atlantic Ridge and is located south of Portugal's Azores Archipelago (36°34' N; 33°26' W), between the Pico and the Oceanographer Fracture Zones (Barriga et al., 1999). One of the main morphological elements in the area is the Saldanha seamount which is 700 m high and located between the FAMOUS and AMAR second-order segments in a non-transform offset at 2200 m depth. Low temperature fluid (7-9 °C) is discharged in very few places at the top of the seamount. However, mineralogical and geochemical studies of the sediment cover suggest that temperatures deeper in the system may be much higher than those measured directly in the vents (Dias and Barriga, 2005). The lithologies found at the seamount are varied and include hydrothermally altered ultramafic rocks (serpentinites and steatites) volcanic breccias, pillow lavas and gabbros (Costa et al. 2001). All exhibit different degrees of alteration.

In terms of the ultramafic character of the host rocks, the Saldanha Massif can be compared to both the Rainbow hydrothermal site – which has the highest temperature of any known MAR hydrothermal vent fluid (up to 360°C) (Douville et al., 2002); and to the Lost City hydrothermal site (with fluid temperature up to 75°C). All three sites are located at segment boundaries rather than within segments, and so may share similar formation mechanisms. However while Lost City is located on 1 Ma old serpentinized peridotite crust (Blackman et al., 2001), both Saldanha and Rainbow are located within NTOs very close to the spreading axes of the adjacent segments. The Saldanha site offers the opportunity to investigate crustal resistivity and fluid penetration at a point on the ridge where both igneous and ultramafic rocks crop out, and where the unroofed mantle rocks of the Saldanha Massif itself host hydrothermal circulation apparently remote from the direct influence of volcanic activity.

A controlled source electromagnetic (CSEM) survey of the Saldanha site was carried out in November - December 2004 as the major objective of the RRS *Charles Darwin* cruise CD167 (Dzhatieva et al., 2005). This experiment was a joint research project between the National Oceanography Centre, Southampton, UK, the University of Lisbon, Portugal and the University of Durham, UK.

Scientific purpose of CD167

The main objective of the survey was to investigate the physical properties of the in situ rocks within the upper few kilometres of the seafloor beneath and around the Saldanha Massif. The CD167 experimental data will be analysed using 1-D and 2.5-D forward modeling and inversion (Constable et al 1987, MacGregor 1999, Flosadottir & MacGregor 1999), and geophysical effective medium modelling (Greer 2000). This should enable us to determine the 3-D distribution of porosity and hence of hydrothermal fluid penetration into the crust and uppermost mantle beneath the survey site. We shall compare our models with those determined for volcanically hosted sites elsewhere on the Mid-Atlantic and other ridges, and use these to test models of possible heat sources resulting in the Saldanha venting activity. We will also look for any differences in sub-seafloor hydrology between the volcanically- and non-volcanically-hosted sites.

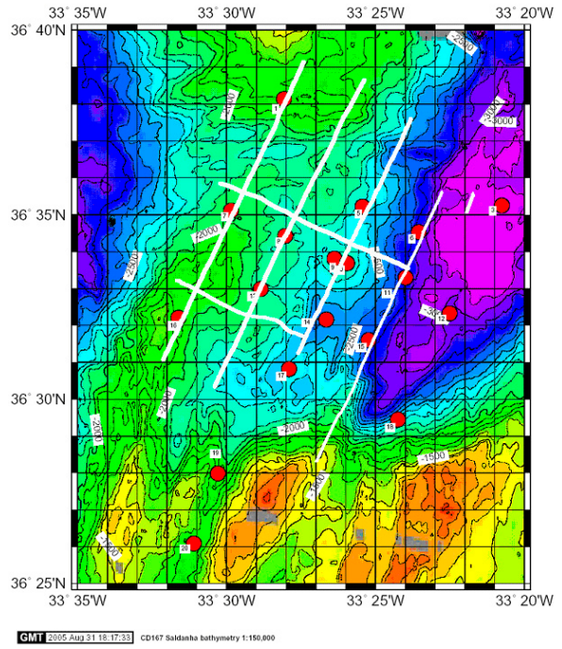

Figure 1
CD167 multibeam bathymetry with controlled-source electromagnetic survey map. Ocean bottom receivers continuously record horizontal electric field as the time series, while Deep-towed Active Source Instrument (DASI) transmits wave signal for frequency-domain sounding. Lines are DASI tows completed; signs - positions of ocean bottom receivers.

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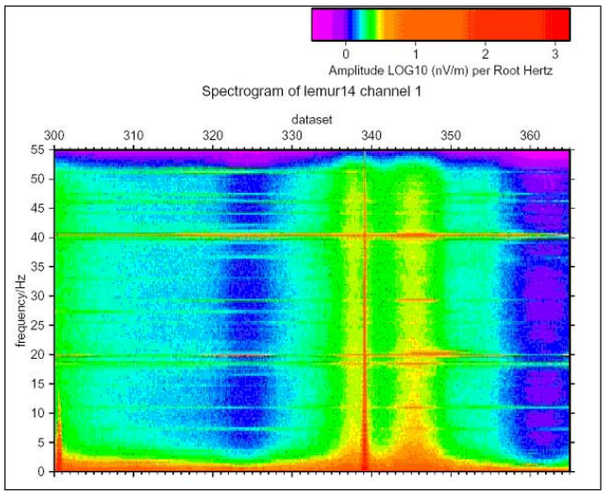

Figure 2
Spectrogram for the approx. two-day recording of one of the Low-frequency ElectroMagnetic Underwater Recorders (LEMUR) presents a good signal to noise ratio. The large peak at about 339 dataset occurred when DASI was transmitting along line AA at 0.25 Hz on 13 December. There is some background noise, believed to be caused by both internal and external noises. The scale corresponds to the electric field amplitude.

CD167 survey geometry

The survey geometry was designed to provide optimum spatial coverage of both radial and azimuthal field modes. During the survey the Deep-towed Active Source Instrument (DASI) system transmitted electromagnetic signals from a horizontal electric dipole antenna for frequency-domain sounding at 0.25 and 1 Hz. These signals were detected and measured by an array of 17 autonomous ocean-bottom geophysical recorders deployed in a 10 km^2 grid centred on the Saldanha Massif.

Eight transmission lines were towed along a set of four N-S and two E-W tow lines across the survey area (Figure 1). This survey geometry gives source - receiver ranges of up to 14 km and so should provide information on the resistivity structure to a depth of about three kilometres beneath the seafloor.

Cruise instrumentation

The DASI transmitter emits a continuous wave signal for frequency-domain sounding over a range of 0.1 - 256 Hz, with most energy at the fundamental frequency and its third and fifth harmonic (Sinha 1990). The transmitting horizontal electric dipole antenna is 100 m long, neutrally buoyant, and streams behind the DASI vehicle. The antenna is earthed into seawater at both ends using copper cable electrodes placed at 30 m and 130 m behind the vehicle. All transmissions were made with a peak-to-peak current of approximately 200 A. Transmission parameters such as frequency and current are controlled from the ship via a fibre optic cable. The tow tracks of the DASI system were determined using ship-based ultra-short baseline navigation (USBL, Sonardyne) and ship GPS.

The ocean bottom receivers used during CD167 record the horizontal electric field as the time series of two electric field components at the seafloor, using two orthogonal horizontal electric dipoles. Each dipole is 13 m long and supports low noise electrodes at the ends of the arms. The arms are weighted with glass rods to minimise motion due to water currents and also to keep the ends of the arms in contact with the seafloor. The sensors are able to measure an electric field signal of 10 picoVolts per metre over the frequency range 0.1 - 60 Hz. The receivers used were a combination of older, 'Low-frequency Electro Magnetic Underwater Recorder' (LEMUR) systems which each have a 1 Gb capacity hard disk and 128 Hz sampling rate and a new generation of LC-2000EM receivers, which have a high capacity digital data logger with a 125 Hz sampling rate. All receivers can operate at water depths of up to 6 km. The instrument positions on the seafloor were accurately determined by acoustic ranging and ship-board GPS.

Data Collected

During the CSEM survey the transmission lines were mostly towed at a frequency of 0.25 Hz to ensure deep penetration data across the entire survey area. Three profiles were made at 1 Hz, to provide a higher resolution of the resistivity structure in the upper crust. Since the source signal is a square wave, significant amounts of signal are emitted at the third and fifth harmonics. Therefore it should be possible to analyse signals at frequencies of 0.25, 0.75, 1.0, 1.25, 3, and 5 Hz.

Raw data files were initially processed by applying a Fast Fourier Transformation to obtain frequency domain representations. Plotted as a function of elapsed time, these produce spectrograms. Figure 2 shows an amplitude spectrogram for channel 2 of LEMUR 14. The spectrogram reveals distinct peaks which correspond to the DASI transmission frequencies during towing. Background noise levels at other frequencies and at times when no source transmissions are being received are low - this means that a good signal to noise ratio was obtained during the survey. After applying calibration and other corrections, we shall use the frequency domain CSEM dataset as the input to forward and inverse modelling.

Summary

During the 3-D CSEM survey the DASI system completed 66 km of electromagnetic survey, transmitting along eight tow tracks over the array of eighteen deployed receivers. Given the experiment geometry and suitable analysis, we expect to be able to construct images of the electrical structure of the Saldanha Massif area down to a depth of about 3 km.

To provide background data for the CSEM study, a set of three current meter moorings, which record current speed and direction, temperature and salinity were deployed across the survey area. Additional data on the

physical properties of the water column were obtained using 14 expendable bathythermographs (XBT) and a sound velocity meter profile. Between the start and end of the survey, gravity data were collected continuously, and total field magnetic data for part of the time, giving gravity and magnetic profiles across the ridge. During the cruise the whole survey area was remapped with Simrad EM12 swath bathymetry. To investigate the history of hydrothermal activity eleven short sediment gravity cores were collected on and around the Saldanha massif, with nine of these providing valuable material. Four dredges were attempted for hard rock samples from sites around the Massif, and two of these were retrieved with samples.

The data collected during CD167 should result in images of the electrical resistivity structure which, in turn, will be translated into constraints on pore space distribution and interconnectedness as well as pore fluid properties. We shall use these results to investigate whether the Saldanha vent site owes its existence to the presence of a deep fracture network, extending downwards into the underlying mantle rocks and to test models of possible hydrothermal heat sources.

Acknowledgements

We thank the RRS *Charles Darwin* crew members and all SOES and UKORS staff involved for their successful and highly professional contributions. Many thanks to Dr. Mathilde Cannat for helping us with the EM12 data. The work was supported by the UK Natural Environment Research Council and the SHEAMA project POCTI/MAR/15281/1999.

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New hydrothermal sites at 13°N, Mid Atlantic Ridge.

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The hydrothermal field Ashadze-1 was discovered at 12°58.4'N, 44°51.8'W on the Mid-Atlantic Ridge (MAR) in 2003 during the 24th cruise of R/V *Professor Logatchev*. The hydrothermal field is located at a depth of 4100 - 4200 m at the foot of the western slope of the MAR rift valley. Structurally, the field is related to the intersection of a deep along-axis marginal fault and a transverse sub-latitudinal tectonic dislocation. Serpentinized peridotites form the host rocks within the hydrothermal field (Bel'tenev et al., 2003).

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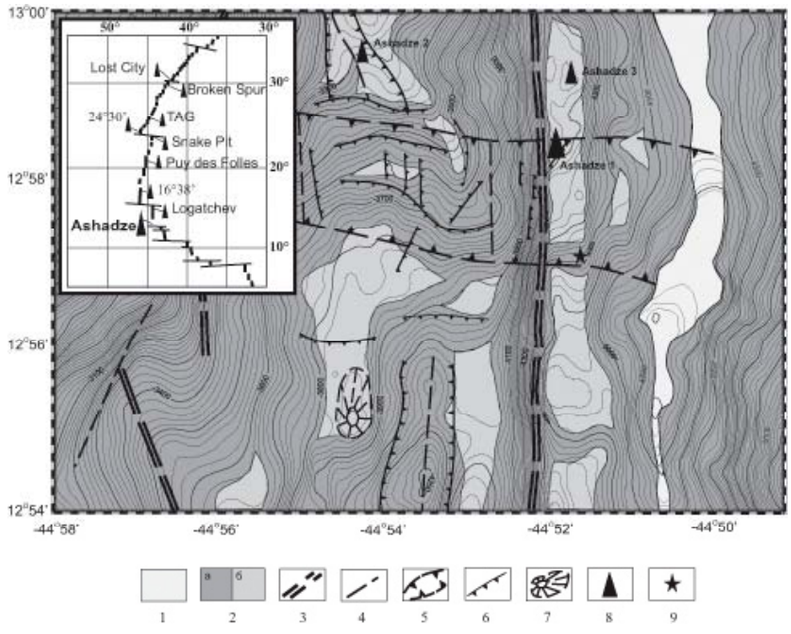

Figure 1
Bathymetric map with morphostructural elements and location of the new hydrothermal sites at 13°N, MAR.
Legend: 1 - rift valley floor; 2 - valley walls: _) - slopes, _) - terraces; 3 - major faults; 4 - minor faults; 5 - transverse zone of tectonic dislocations; 6 - small scarps; 7 - volcanic edificies; 8 - hydrothermal site locations; 9 - site with abundant sulfides in the sediments.

This field was revisited during the 26th cruise of R/V *Professor Logatchev* in January-March 2005. As a result of the investigations during this cruise, two new hydrothermal sites were discovered in the vicinity of the Ashadze-1 field (Figure 1).

We conducted the following methods of studies: geological sampling using a dredge, TV-grab, a 3 meter long rectangular sampler and a gravity corer; TV-profiling using a deep-towed system; and water-column zoning and profiling using a CTD SBE 911-plus with water samples taken in 12 bottles mounted on a SBE 32 Carousel system.

The first new site (Ashadze-2) is situated 2.5 miles to the northwest of Ashadze-1 at 12°59.5´N, 44°54.4´W. It is located in the northern part of a wide terrace of the central valley slope at depths of 3200 - 3300 m. It lies in a graben-like structure joining the la-titudinal fault zone from the north (Figure I). Fragments of sulfide chimney walls, as well as totally oxidized chimney fragments, limonite and iron-manganese crusts, hydrothermally altered gabbroids and serpentinized peridotites were dredged in this area. Chimney fragments consist of massive chalcopyrite replaced by chalcocite and covered by iron hydroxides. The limonite crusts may have resulted from complete oxidization of massive sulfides. Fault gouge, veinlets and atacamite inclusions were found in the crusts and altered rocks.

TV-profiling at the first site allowed us to recognize four ore bodies extending sub-meridionally. The largest body is about 200 x 100 m in size. The observations did not reveal recent hydrothermal fauna. Water column studies also did not indicate any turbidity anomalies in the near-bottom waters. These observations along with the high degree of sulfide oxidation suggest a long-term absence of hydrothermal activity at this site.

The second new site (Ashadze-3) is located about 1.8 km north of Ashadze-1 in the central part of the terrace. It is situated at the foot of the western slope at depths of 4100 - 4200 m. Sulfide crusts composed entirely of massive chalcopyrite and covered by an iron hydroxide crust, a large number of hydrothermally altered gabbroids and serpentinized peridotites as well as pure iron-manganese crusts were dredged in the area of 12°59.2'N and 44°51.7'W. The rocks are silicified, hematitised, and limonitised. The dominant sulfide minerals are pyrite, chalcopyrite and chalcocite. Atacamite is also common. This site is located in the marginal fracture zone as was the previous one. The recorded turbidity anomalies indicate present-day hydrothermal activity at this site. The metalliferous sediment samples are more than 140 ky old (dated by micropaleontological analysis) and may indicate there may have been hydrothermal events at the Ashadze-3 site in the past, too.

In addition to the two new sites, metalliferous sediments with high amounts of sulfide minerals (pyrite and chalcopyrite) were recovered 2.5 km south of the Ashadze-1 site at 12°57.0'N and 44°51.6'W. This suggests the presence of another hydrothermal site in the area.

The three discovered hydrothermal sites along the western slope of the rift valley which are both hydrothermally active and extinct, are copper rich and spatially associated with non-basaltic rocks (gabbroids and serpentinized peridotites) which are very common in the rift valley slopes at 13°N, MAR. This area forms a unique natural polygon which allows us to trace processes of hydrothermal activity and mineralization related to deep-seated rocks both in space and time.

Acknowledgements
We are grateful to Captain V.P. Pidenko, the crew of R/V *Professor Logatchev*, to the sampling team and it's leader S.B. Lyubimov for the well coordinated work that resulted in the success of this cruise.

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A comparative study of MAR hydrothermal fields found in different geodynamic settings: Preliminary results of the 50th cruise (August – September 2005) of R/V *Akademik Mstislav Keldysh.*

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* N. Budayeva[1], E. Chernyaev[1], V. Gagarin[1], V. Gordeev[1], O. Kamenskaya[1], V. Maslennikov[4], E. Musayeva[1], V. Nisheta[1], V. Peresypkin[1], I. Ponomarev[1], E. Rumyantseva[1], I. Rusanov[5], A. Vereshaka[1], G. Vinogradov[1], D. Zasko[1]

Known MAR hydrothermal fields (mainly Broken Spur, Lost City and Rainbow) were studied during the final stage of the 50th cruise of R/V *Akademik Msislav Keldysh*. All observations and sampling were done using the MIR-1 and MIR-2 deep manned submersibles. These submersibles had four dives at Broken Spur, five dives at Lost City and six dives at the Rainbow hydrothermal fields. This part of the expedition was funded by the Russian Academy of Sciences.

The purpose of this stage of the cruise was to conduct a comparative study of compositional and genetic peculiarities of the hydrothermal edifices and associated fluids and biota, as well as investigate the host bedrock formed along MAR segments that are characterized by different geodynamic settings.

It is accepted that the well-studied Broken Spur, Lost City and Rainbow hydrothermal fields were formed under different geodynamic regimes and are characterized by different oceanic crustal sequences. The Broken Spur field is located along an axial volcanic ridge of the rift valley (Bogdanov et al., 1995) of a normal (spreading) MAR segment which is characterized by a N-MORB magmatic suite of host rocks. Lost City is the most enigmatic hydrothermal field among those known along the MAR. This field is typical for a serpentinite-hosted hydrothermal system and is hosted in the upper part of the ultramafic Atlantis Massif (immediately above the "oceanic core complex" described by Kelley et al. (2001), Blackman et al. (2002), and Lein et al. (2004). Compared to basalt-hosted black smoker fields (e.g. Broken Spur), hydrothermal edifices at Lost City are predominantly composed of aragonite and look like cathedral domes that are up to 50 m high. Kelley et al. (2005) suggest that the Lost City hydrothermal field is a unique submarine ecosystem where geological, chemical and biological processes are intimately interlinked. The Rainbow hydrothermal field is the largest known MAR hydrothermal field and covers a surface area of 30 000 m^2. It is characterized by large spire edifices as well as hundreds of small chimneys. The ultramafic host rocks are highly carbonatized in the area of the hydrothermal field (Fouquet et al., 1997).

In this article, we compare hydrothermal systems that we separated into two main types according to which type of oceanic crustal rocks they are associated with: basalt-hosted (Penrose, canonic type) and peridotite-hosted (Hess type). Segments along the ridge axis that alter between these compositionally very different crustal substrata (basalt and peridotite) are characteristic for slow-spreading ridges. Taking into account results obtained during the previous three (41th, 42th, and 47th) cruises of R/V *Akademik Mstislav Keldysh* (1998, 1999, 2002 – Bogdanov et al., 2002) to the Rainbow hydrothermal field, this 50th cruise also allowed us to look at the changes in evolution and dynamics of hydrothermal activity in this MAR region over time.

Broken Spur Field

Representative hydrothermal ore samples from different morphologic chimney types were obtained during three dives. A large collection of extremely fresh aphyric pillow-basalt with abundant chilled glass margins was also sampled on the axial high.

Hydrothermal fauna at the Broken Spur field is associated with vent structures of various topography. During our expedition, the focus was on detailed studies of the spatial distribution of faunal assemblages at the scale of individual vent structures. For the first time, the observations and videotape recordings using laser dot

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Figure 1
Aragonite spires at Lost City.

scale methods allowed us to describe the complexity of benthic communities at hydrothermal structures of different morphologies. The video recordings and recovered samples will be used for further analysis.

Both visual observations of macroplankton (direct counting from the MIR submersibles) and mesoplankton net samples were made in order to obtain information about the interannual variability of dominant groups (similar data from our expeditions in 1994, 1996, and 2002 is available).

Lost City Field

The main goal of MIR dives in this area was to study the compositional and spatial relationships between Lost City hydrothermal domes and the hosting plutonic complex of the Atlantis Massif. Samples taken in the 1256 - 761 m depth range in the upper part of the southern slope of the Atlantis Massif were almost completely composed of spinel harzburgites that had undergone various degrees of serpentinization and depletion (estimated by the amount of pyroxene in the rocks). Minor gabbros that were strongly deformed and recrystallized were sampled from the deeper parts of this dive (1254 m). Overall, our observations fit the descriptions of the construction of the southern slope of the Atlantis Massif reported earlier in Blackman et al (2002) and Kelley et al (2005). However in contrast to these earlier observations, we established that mylonitization of peridotites along the southern slope of the Atlantis Massif is not only developed in the upper part of slope, i.e. just below the terrace characterized by active carbonate spires and a mound of spire fragments (950-850 m) and the slope at the top of the platform (830-750 m). We also recognized signs of mylonitization at deeper levels of the ultramafic massif (> 1000 m). Evidence for this is the wide distribution of serpentinite breccias here. During the same dive we found that hydrothermal carbonatization altered the peridotite host rock of the southern slope at the top of the platform where large aragonite mats and plates drape the steep serpentinite cliff outcrops at depths of 850-760 m. Small (up to a few meters) aragonite spires are also present here (Figure 1).

Hydrothermal fluids with a temperature of more than 32 °C were sampled at the terrace of the Poseidon carbonate spire (close to marker 12 "Exomar"). Onboard analyses of this fluid showed 8.1 mg/l H_2S and 75.42 mkg/l n-alkanes. The gomologs C12-C22 are dominant in these alkanes. Another fluid sample was obtained at the top of a large carbonate dome (30 m in height) to the northeast of the Poseidon spire (near marker H). H_2S concentrations in this fluid were 3.2 mg/l. Numerous samples from hydrothermal domes of the Lost City field show a compositional zonation manifested in the distribution of brucite, microbial matter, aragonite and calcite. A thick, 40 cm wide, amorphous zone (brucite + microbial biomass + minor aragonite) was identified around a fine pinnate aragonite chimney that was lined with brucite and microbial biomass. The outer zone (layer) of this chimney was composed of less porous calcite.

Endemic hydrothermal fauna at Lost City were first discovered in July 2002 during the 47th cruise of the *Akademik Mstislav Keldysh* (Gebruk et al., 2002; Vereshchaka et al, 2002). Small hydrothermal animals were observed associated with bacterial mats on tower tops and tower walls. Two subfossil mussels valves and 6 mussel fragments were sampled at the base of the chimney complex using a slurp-gun. During this 50th expedition, an enormous field (diameter of field approx. 100 m) of subfossil mussel shells was found on the slope of the Atlantis Massif. This discovery proves that "classical" hydrothermal macrofaunal communities existed in the Lost City area recently.

The horizontal heterogeneity of the plankton distribution in the near-bottom water layer above the main massif top and above the cap of the carbonate pillar was analyzed. Comparative studies of the plankton distribution were carried out using plankton nets and observations from the submersibles above and adjacent to Lost City.

Rainbow Field

Deep sea observations made during MIR-1 and MIR -2 dives showed a sharp increase of hydrothermal activity in the western part of the Rainbow field compared to observations made during previous (1998-2002) cruises of *Akademik Mstislav Keldysh* (Figure 2). A representative collection of serpentinized peridotites was also sampled in this area. Some of the samples were obtained from the western flank of the hydrothermal field close to the western slope of the rift valley; other peridotite samples were

taken from cliff outcrops located proximal to and to the east of the Rainbow field. These outcrops are therefore undoubtedly composed of ultramafic rocks that form the base of the Rainbow field. Onboard descriptions of the sampled peridotites indicate these are spinel harzburgites and dunites. Aragonite veins were present in most of the samples.

Our previous investigations (1998-2002) showed that faunal microdistribution patterns are complex and subject to temporal changes on a scale of years. During this expedition we studied the distribution of fauna at individual vent structures. For this, detailed explorations of several vent structures were carried out, principal biotopes were mapped and described using videos and commentary of dive observers. Quantitative samples were recovered from testing points. Markers were placed at the investigated sites to enable us to monitor temporal changes in vent communities during future cruises. Sample material from mussel beds was collected to study their community structure. Animals tissues were prepared for chemical, stable isotope, SEM, TEM, and DNA analyses.

The influence of the prominent hydrothermal plume on the structure of plankton communities above the vent field was analyzed. Visual observations of the plankton were made and net samples were taken and compared with our data from 1999 in order to obtain information on their interannual variability. Important data of the euphausiid and copepod distributions in the deep waters were obtained in order to trace pathways of deep-sea animal dispersals.

Qualitative and quantitative meiofauna samples were collected at the Broken Spur, Lost City and Rainbow hydrothermal fields representing areas of different hydrothermal activity and different macrofaunal assemblages. The composition and relative abundance of the main groups of small invertebrates were studied. New data were compared to data obtained during the 47th cruise of *Akademik Mstislav Keldysh*. Diverse fauna including new species from hydrothermal sites and surrounding areas were found.

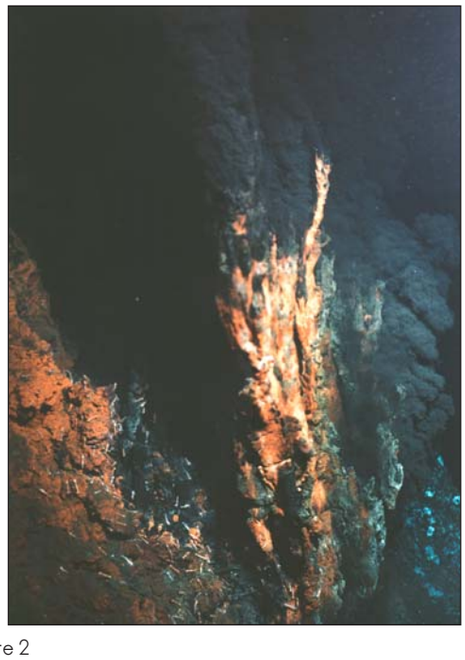

Figure 2
Western flank of the Rainbow Hydrothermal field with clear evidence for an increase of venting activity.

Acknowledgements
The scientific staff and crew of R/V *Akademik Mstislav Keldysh* are grateful to the administration and colleagues of IFM-GEOMAR for their hospitality during the last stop (September 14-15) of the vessel in Kiel on the way to Kaliningrad.

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Hydrothermal plume dynamics at MAR sites – direct observations.

D.L. Aleynik[1,2] and V.N. Lukashin[1]

From 1998 – 2003, the Russian Academy R/V *Akademik Keldysh* made repeated visits to several hydrothermal vent sites along the northern part of the Mid Atlantic Ridge (Figure 1 inset). During these cruises, geological, bio- and microbiological, chemical and hydrophysical investigations of the vent systems and their dynamics were made. The main purpose was to monitor the changes in environmental conditions around the high and low temperature vent sites. The focus was to determine the hydrophysical parameters of waters at spreading neutral plume levels.

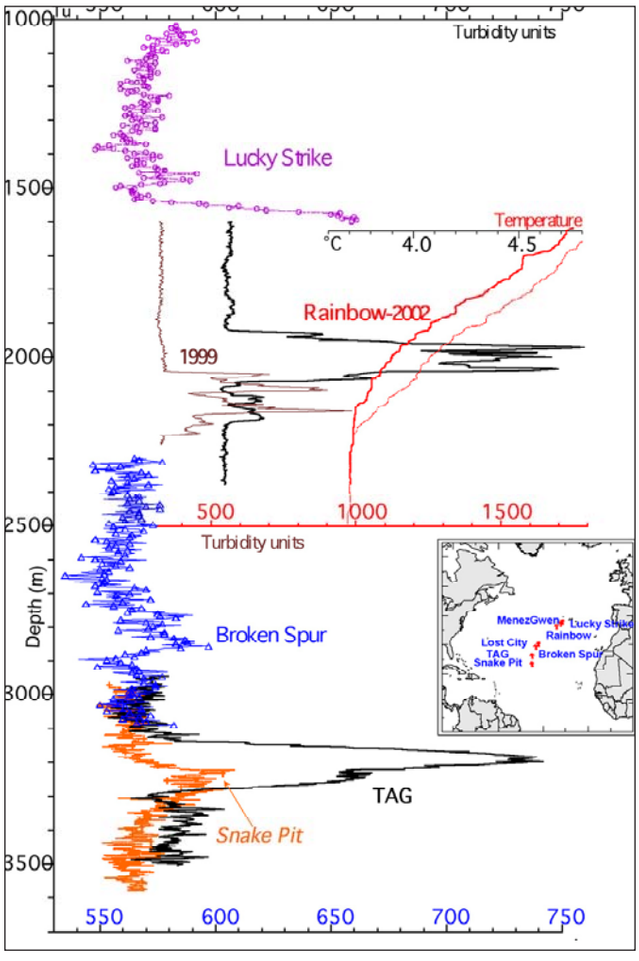

Figure 1
Nephelometric turbidity profiles from CTD stations near MAR vent sites. Scale for Rainbow turbidity profiles is three times reduced. For the Rainbow-2002 cruise two temperature profiles for plume core (st 4398) and background (st 4397) are shown in bold and dashed lines. MAR hydrothermal sites visited by R/V *Mstislav Keldysh* in 1998-2003 are mapped at the insect.

Data acquisition

Hydrophysical investigations were mainly undertaken using the CTD Mark-III system (Neil Brown Instr. Sys.) equipped with a pulse meter to measure nephelometric turbidity (SeaMarTec), 6 Niskin 30-liter bottles (General Oceanics), and an acoustic pinger (Benthos). These were packed into a single heavy Rozette unit. These main tools accompanied other equipment on board of two Mir submersibles. Apart from video and photo cameras, telemetry and navigation systems, there were also two Mark-III CTD and transmisometers and two other bottles for water sampling. The Mirs mainly worked at near bottom depths (2 – 10 meters above the sea bed) in close proximity to active vents.

The CTD's were calibrated before and after each of the cruises. Shifts in readings of the temperature sensors did not exceed 3 - $5 \cdot 10^{-3}$ °C per year. For the conductivity sensors the shifts were accounted for by comparing samples with probe analyses using the Autosal 4100. The effort that went into calibrating the sensors allowed absolute values of measured ocean water temperatures to stay within a small error range estimated at ±0.003 °C, and salinity errors to be within ±0.005 psu; the accuracy for both is approximately 0.001.

The position of the instruments through the plumes was determined by calculating the ship track, using pressure information from the CTD and measuring the cable length from the winch terminal, as well as using data from echo-sound records and an altimeter. The absolute error of the Rozette position is estimated as less than 50 – 75 m (Aleinik et al., 2001).

The collected data (Table 1) were used to calculate the vertical parameter distributions of the plumes and were presented as profiles, transects, and maps. An isopicnal analysis scheme was implemented to be able to compare the analysis results of anomaly distributions of the plume core with those of background waters at the same density levels (Koshlyakov, Panteleev, 1988).

Results

Except for at the low temperature Lost City site, the presence of hydrothermal plumes was registered at all active hydrothermal vent sites visited along the MAR from 1998-2003. Most of these plumes were located above and away from the vent mounds. This is probably due to near bottom water movements, which are generated by tides and topographic obstacles (German et al., 1998; Thurnherr et

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Table 1
Visited hydrothermal sites and statistics of the CTD data collected in the expeditions of R/V *Akademik Mstislav Keldysh.*

Polygon	Latitude ° N	Longitude ° W	Depth m	# CTD stations	# tow-yo profiles	Year	Month	Cruise #
Menez Gwen	37°51.50'	31°31.50'	850	8	4	2003	08	49
Lucky Strike	37°17.50'	32°16.50'	1700	5	52	2002	07	47
Rainbow	36°13.78'	33°54.12'	2250	1	13	1998	10	41
Rainbow	-	-	-	15	194	1999	09-10	42
Rainbow	-	-	-	10	79	2002	07	47
Lost City	30°07.45'	42°07.11'	800	2	-	2002	07	47
Lost City	-	-	-	4	-	2003	08	49
Broken Spur	29°10.08'	43°10.46'	3100	3	20	2002	06	47
TAG	26°08.00'	44°49.00'	3700	2	12	2002	06	47
Snake Pit	23°22.14'	44°57.04'	3500	6	37	2002	06	47
Snake Pit	-	-	-	3	8	2003	08	49

al., 2002). Tidally-driven effluent was previously detected at the TAG field (Kinoshita et al., 1998).

The rising plume brings the suspended particles, such as hydrothermal material enriched in sulphur, iron, methane, etc to the level of neutral buoyancy. A detailed analysis of the hydrothermal material suspended in the neutral buoyant plum above one of the MAR sites was undertaken by Lukashin (Lukashin et al., 2004). The thickness' of the neutral plumes vary at the different MAR sites. The thickness' depend mainly on the energy released at the vent as well as the temperature of the outgoing fluids and the local near bottom water stratification. The thickness' of the MAR plumes vary from 400 m (Snake Pit) and 350 m (Broken Spur) to 150 m (TAG, Lucky Strike) based on optical (turbidity) data (Table 2 and Figure 1). The difference between plume turbidity and background turbidity for these sites was 15–25 %, for the TAG neutral plume it was more than 35 %. The maximum turbidity anomalies were observed at the Rainbow site, where the difference exceeded 320 %.

At the Rainbow site the observed plume thickness changed from 200 m in autumn 1999 to 300 m in summer 2002. The plume, as determined using a nephelometer, also shifted up 150 m into higher water layers. This change was accompanied by a dramatic elongation of the neutral plume above the Rainbow ridge axis compared to an extensive CTD survey undertaken in 1999 (Figure 2 a, b). In 2002 the area of the neutral plume core that is marked by the line that is 200 % greater than background values, was 5.2 km^2. The area within the 10 % anomaly that marks the outer plume boundary was about 36 km^2. Data from British and French cruises in 1997 and 1998 show that the length of the plume then varied from 5-6 km along a south-west – north-east axis (German et. al., 1998; Thurnher et al., 2001), while in 1999 its length did not exceed 3.8 km (Aleinik et al., 1999). Plume geometry can therefore change significantly with time.

The plume that results from venting fluids, transports hydrothermal material to a level where the neutral plume spreads and forms a clearly detected (nephelometer) and visible (cameras) clouds of suspended particles. Turbulent jets from the vent sites move surrounding ocean waters from the depth of the vents to upper layers of the water column. Relatively strong stratification of

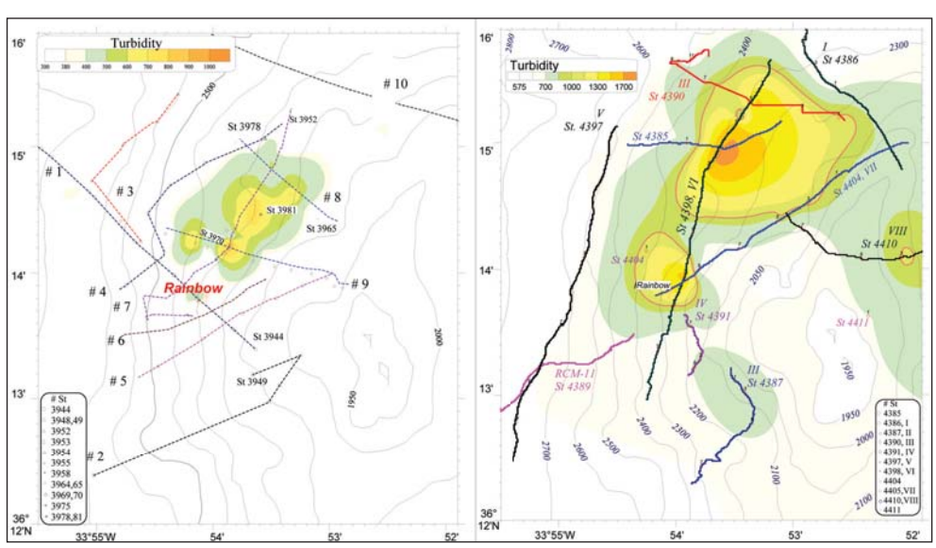

Figure 2
Rainbow plume spreading: data from September-October 1999 (a) and July 2002 (b) CTD surveys. Station locations are marked with symbols, the tow-yo pathways are shown by dashed lines.

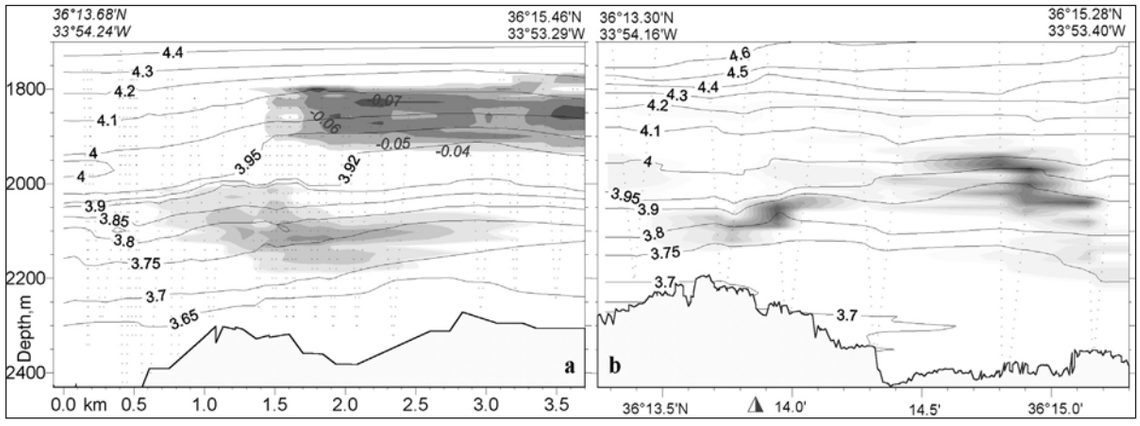

Figure 3
Cross-sections of in situ temperatures (lines, °C) through the plume core at the Rainbow site according to tow-yo stations # 3958, 02.10.1999 (a) and # 4398,19.07.2002 (b). The intensity of light consumption (turbidity) is gradually shaded. The tow-yo tracks are shown by dots. In picture (a) the isopicnic temperature anomaly (°C) over the plume is indicated by dark shading.

the water column in the Atlantic Ocean leads to partial separation of the density plume from this turbidity plume. This spatial separation can be identified when comparing vertical profiles of water characteristics with profiles of nephelometric turbidity. A good example of this turbidity (Figure 1) was recorded in data collected from two stations in July 2002. These stations were set up near the Rainbow plume, one at its core (station 4398) and the other in background waters (station 4397) within the rift valley.

Step layering of the water column in plumes is very characteristic at MAR sites. Transparent 'windows' were found in the plumes of Snake Pit, Broken Spur and Rainbow. Effects of double diffusion in the form of 'salt fingering' (Turner, 1973) can form steps with varying lengths in vertical profiles of temperature, salinity and density. The main source of uncertainty in these profiles is the layer of highly saline and warm Mediterranean water often found at depths of 800 – 1500 m. These can obscure both the hydrological impact of hydrothermal activity on the water characteristics at Menez Gwen, Lucky Strike, Lost City and can also make it more difficult to determine the upper boundary of the Rainbow 'density' plumes. The other MAR hydrothermal vent sites are located at greater depths and inside narrow rift valley segments, which are detached or semi-detached from the ocean waters. The plumes at these sites are therefore not influenced by Mediterranean water.

Conclusions

The dynamic life of neutral plumes above several MAR hydrothermal vent sites was confirmed by direct observations made during several extensive surveys over the past five years. The presence of nephelometric turbidity plumes was observed at all high temperature venting fields. Plumes at TAG, Lucky Strike and Rainbow remain the most distinct in the known part of the MAR

Table 2
Geometry of the plumes and anomalies at their cores.

Site, Year	Vent depth, m	Plume depths, m			Measurements at plume core			Anomalies		
		Top by density anomaly	Top by turbidity anomaly	Lower boundary	T in °C	S in psu	_0 in kg·m^{-3}	_T in °C	_S in psu	__0 in kg·m^{-3}
Menez Gwen	850	650	-	880	8.10–10.5	35.29–35.35	27.15–27.36	–0.20	–0.10	–0.032
Lucky Strike	1700	1370	1500	1650	4.50–5.05	35.05–35.10	27.76–27.78	–0.24	–0.02	–0.007
Rainbow, 1999	2250	1900	2050	2250	3.80–4.10	35.27–35.38	27.82–27.83	–0.06	–0.006	–0.004
Rainbow, 2002	2250	1650	1900	2200	3.75–4.70	34.95–35.08	27.79–27.82	–0.20	–0.015	–0.050
Broken Spur	3100	2450	2650	2900	2.97–3.17	34.955–34.973	27.867–27.875	–0.06	–0.003	–0.005
TAG	3700	2950	3150	3300	2.68–2.82	34.935–34.945	27.877–27.884	–0.03	–0.004	–0.002
Snake Pit	3500	3000	3100	3500	2.60–2.76	34.922–34.937	27.880–27.885	–0.13	–0.004	–0.002

system. Over time, the Rainbow neutral plume is still the most variable in geometry and physical characteristics among MAR hydrothermal sites studied to date.

Acknowledgements
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Granites in the Oceanic Lithosphere: Their Origin and Geodynamic Setting.

S. Silantyev[1], D. Cherkashin[2], Ju. Kostitsyn[1], L. Dosso[3], S. Karpenko[1], J. Casey[4]

Introduction

The most common rock type at mid ocean ridges are basalts. In this paper, we discuss the less common, but very interesting granitic rocks that have been found at the ridges. Oceanic granite samples selected for this study were obtained during the expeditions of R/V *Vitjaz, Akademik Mstislav Keldysh* (with the "MIR" submersible), *Akademik Boris Petrov, Antares* (Russian Academy of Sciences and Russian Ministry of Geology) and *Atlante* (with the French IFREMER submersible, "Nautile"). All samples were dredged or taken from submersible boards along the western slope of the MAR Rift Valley, 15°30'N, the southeastern part of King Trough (Palmer Ridge, North Atlantic), and the Carlsberg Ridge (Western Indian Ocean). New data on isotope compositions of Sr and Nd in trondhjemitic rocks and granites sampled at MAR, 15°30'N, and the King Trough Region are also presented (Figure 1).

Background

An early, simplified model for the creation of oceanic lithosphere suggested that leucocratic igneous rocks associated with mid-oceanic ridge plutonic complexes ("oceanic plagiogranites" by Coleman, 1977) are late products of the fractionation crystallization of parental melts of MORB. However, geochemical, mineralogical and petrological data for oceanic granites from MAR and SWIR crest zones obtained during the last decade (e.g. Dick et al., 1991; Silantyev, 1998) offer an alternative model of how these rock assemblages can be formed during oceanic lithosphere creation. After sampling and observations conducted by dives of submersibles "Nautile" and "MIR" in different areas along MAR as well as during deep sea drilling at SWIR (Site 735B), a Hess-type oceanic crust was observed that is widespread along the crest zone of slow spreading ridges.

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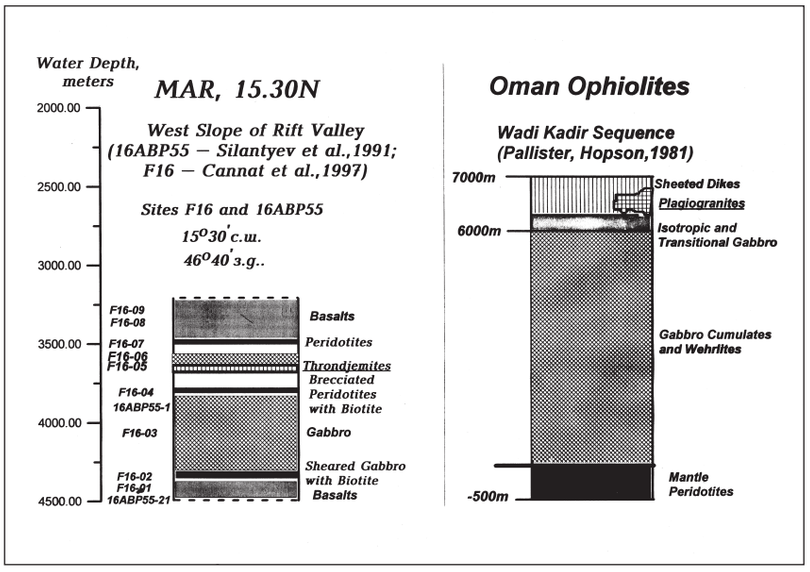

Figure 1
Comparison of position of granitic rocks in Penrose and Hess types of oceanic crustal sequences.

The Hess-type crust has a very different architecture to the normal sequence of oceanic crust found in fast spreading ridge systems (Penrose type) and classic ophiolite sequences. It is characterized by widespread outcrops of residual peridotites and gabbroic rocks that are exposed directly along both slopes of the Rift Valley. Contrary to canonic models, granitic rocks in the Hess-type crust form veins and small dikes that cross-cut the ultramafic rocks and gabbros (Figure 1). Thus, great care must be exercised when interpreting the source nature of granitic rocks sampled at slow spreading centers such as MAR and the Indian ocean ridge system.

Description

Granitic rocks discovered north of the 15°20' fault zone (MAR, 15°30'N) are associated with biotite-bearing gabbros and biotite-bearing peridotites. These rocks form thin veins in recrystallized, gneissic-textured gabbro, and consist of sodium plagioclase (An% = 7-13), biotite, quartz, secondary actinolite and small resorbed xenoliths of gabbro. Mineralogically, the granitic rocks resemble trondhjemites. Biotite is a common phase in alkaline igneous rocks but is unusual for tholeiitic plutonics. Apart from in the trondhjemitic veins, biotite is also present locally in the host gabbros and associated peridotites.

The granitic rocks sampled in the southeastern part of King Trough (Freen and Peak Deeps) represent massive granitoids consisting of albite, potassium feldspar, quartz, and amphibole. Texturally, these rocks resemble anatectic granites and are associated with basalts, diabases and gabbro-amphibolites.

Granites from Carlsberg Ridge were sampled at the ridge segment located between the Vema and Argo fault zones and are associated with basalts, dolerites, gabbros and peridotites. These rocks are composed of sodium plagioclase, amphibole, epidote, quartz, zircon and apatite. Rare fragments of granitic rocks were dredged in the axial zone of the Ninetyeast Ridge near 10°S. These granites are coarse-grained rocks that consist of plagioclase, potassium feldspar, quartz, phlogopite and ilmenite.

Table 1
Major element chemistry and Sr and Nd isotope compositions of trondhjemites from MAR at 16°30'N and granites from the southeastern part of King Trough.

Sample #	Cruise	Locality	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Total	(La/Sm)cn	$^{87}Sr/^{86}Sr$	$^{143}Nd/^{144}Nd$
2098-8	19-th, "Akademik Mstislav Keldysh"	Freen Deep, King Trough	69.22	0.27	15.55	2.38	0.10	1.32	1.80	4.63	1.55	0.06	99.58	4.95	0.718240	0.51015
2106-2	19-th, "Akademik Mstislav Keldysh"	Peak Deep, King Trough	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.705980	0.511438
FR16-05	FARANAUT "*L'Atlante*"	MAR, 16°30'N	63.70	0.39	16.93	3.70	0.04	6.78	0.58	3.25	0.23	0.1	100.39	4.18	0.703585	0.513091

Remarks: All oxides as weight %; all iron as FeO; n.d. – not determined; (La/Sm)cn – normalized by Sun and Mc Donough (1989).
The concentrations of major elements were determined at the Vernadsky Institute, Russian Academy of Sciences, by XRF on PW-1600 (Philips) analyzer (analysts I.A. Roshchina and T.V. Romashova). The REE contents were determined by G. M. Kolesov using INAA at the same institute. The isotopic study of granite from Freen Deep was carried out on a multi-channel mass spectrometer "Triton" at the Vernadsky Institute. The Sr and Nd isotopic composition of a trondhjemite sample was determined on a Finnigan MAT-261 sevencollector mass spectrometer at IFREMER, Brest, France, in compliance with the standard method adopted at this research center (Dosso et al., 1999).

In addition, tholeiitic basalts and their glasses were sampled in the same Ninetyeast Ridge area. The Ninetyeast Ridge samples will not be discussed in this paper.

Geochemistry

Granite samples from MAR and King Trough studied in this project show a clear LREE enrichment (Table 1). REE patterns in these rocks usually do not correspond to those in plutonic rocks related to the N-MORB suite. The only time a different observation was made was when biotite-bearing gneissic gabbro cross-cut by trondhjemitic veins (MAR, 15°30'N) was also enriched in LREE. This geochemical phenomenon can be interpreted as evidence for magmatic interaction between trondhjemitic melt and gabbroic host rocks.

15°20' fault zone (MAR, 15°30'N)

As suggested by Silantyev (1998), trondhjemites from MAR, 15°30'N probably originated from melts that formed by melting of gabbroic lenses and dikelets located in the mantle substratum below slow spreading ridge crest zones. During this process strongly fractionated melts enriched in incompatible elements and K_2O are incorporated in the depleted shallow mantle source (Figure 2). This would explain the apparent contradiction between isotope characteristics and REE patterns typical of MAR trondhjemites with $^{143}Nd/^{144}Nd$ and $^{87}Sr/^{86}Sr$ ratios that correspond to N-MORB mantle sources (close to depleted mantle, the source for ridge basalts) but REE

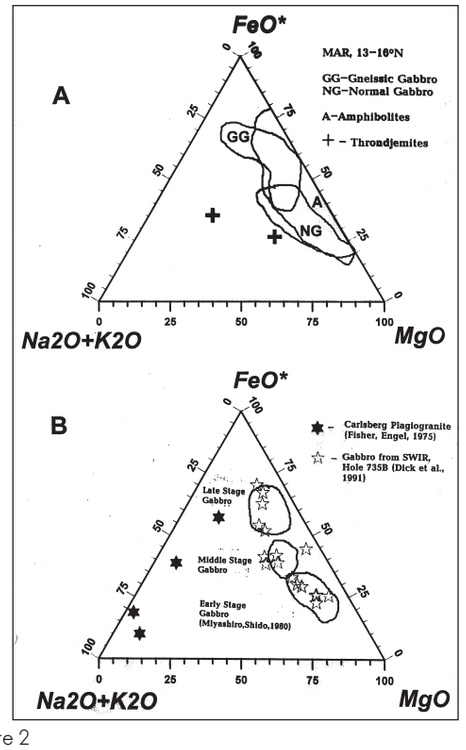

Figure 2
The variation of oceanic granite composition as compared with compositional variations in other members of plutonic complexes from slow-spreading ridges.

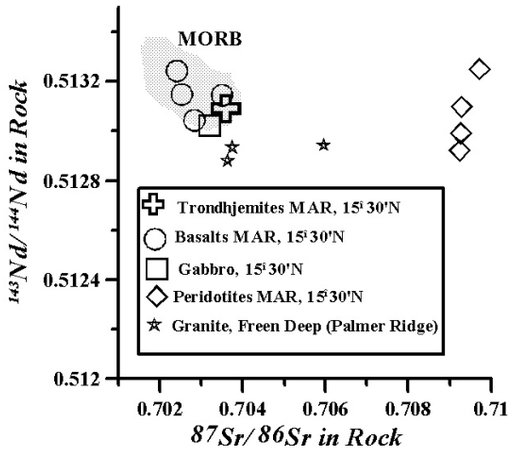

Figure 3
Sr and Nd isotope composition in different rock from plutonic complexes from MAR near 15°20' FZ and the southern part of King Trough.

patterns corresponding to the Ocean Island basalt magmatic suite (Figures 3 and 4; Table 1). It is remarkable that geochemical features of MAR trondhjemitic rocks are similar in composition to glasses in metasomatized mantle xenoliths from oceanic as well continental settings (Figure 4) presented in Coltorti et al. (2000). These glasses may have formed by alkali silicate mafic melts during mantle metasomatism (Coltorti et al., 2000). The concentrations of strongly incompatible elements in both the trondhjemitic rocks and glasses from mantle xenoliths are comparable (Figure 3).

Southeastern part of King Trough

The isotopic composition of Sr and Nd in granitic rocks from the southeastern part of King Trough in the North Atlantic (Figure 3, Table 1) shows that these rocks are unrelated to a 60 Ma magmatic event at MAR that was proposed by Ramsay (1970) and Klitgord et al. (1986). Data presented in Table 1 and shown on Figure 3 indicate that granitic rocks from this Atlantic region are much older than suggested earlier and unrelated to the MAR magmatic assemblage of MORB affinity. It is also apparent from REE patterns of these rocks that they resulted from a within-plate type parental melt.

Carlsberg Ridge

Bulk rock chemistry data suggests that only granites sampled in the central part of Carlsberg Ridge correspond to canonic oceanic plagiogranites (Figure 2).

Conclusions

This study shows that three different types of acidic plutonic rocks are present at mid-cceanic ridges:

1) a diorite-monzonite-granite suite of MORB affinity (e.g. central part of Carlsberg Ridge). These rocks are derived from melts that also produced associated gabbroic rocks. It appears that fast spreading ridges with

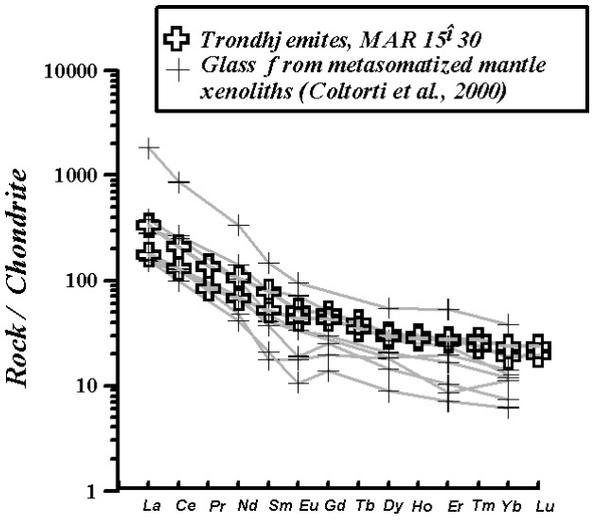

Figure 4
Geochemical features of MAR trondhjemitic rocks are similar in composition to glasses in metasomatized mantle xenoliths from oceanic as well continental settings (from Coltorti et al., 2000).

a high magmatic budget generate the most evolved and fractionated portion of MORB parental melts and are conducive to forming these granites.

2) this second type (e.g. MAR) is unrelated to gabbroic host rocks and originated from other magmatic sources characterized by anomalous geochemical features. These trondhjemitic melts then interacted with the gabbroic host and formed a "hybrid" gabbro. These recrystallized gabbros have geochemical signatures similar to those of trondhjemites. This type of oceanic granite is widespread at slow spreading ridges that have a sequence construction that corresponds to Hess-type crust. This structure of the oceanic crust is favorable for the development of zones of cold lithosphere where magmatic melts can be trapped in the crustal column.

3) a third type of granite (e. g. King Trough) represents relics of ancient continental lithospheric substratum that are preserved locally in modern oceanic basins. These are not related to contemporary magmatic complexes of the mid-ocean ridges (Figure 4).

Acknowledgements
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Current initiatives on the arc-continent convergence in Central Philippines.

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Geological background

A significant event which marked the tectonic evolution of the Philippine island arc system is the Early Miocene docking of the Palawan micro-continental block onto the Philippine Mobile Belt (Figure 1). Although this collision was established years ago, it is only now that geoscientists are looking more closely at a group of islands – Tablas, Romblon and Sibuyan - in the Romblon Province (Yumul et al., 2005) (Figure 2). These islands have been described as forming the leading edge of the colliding Palawan micro-continental block.

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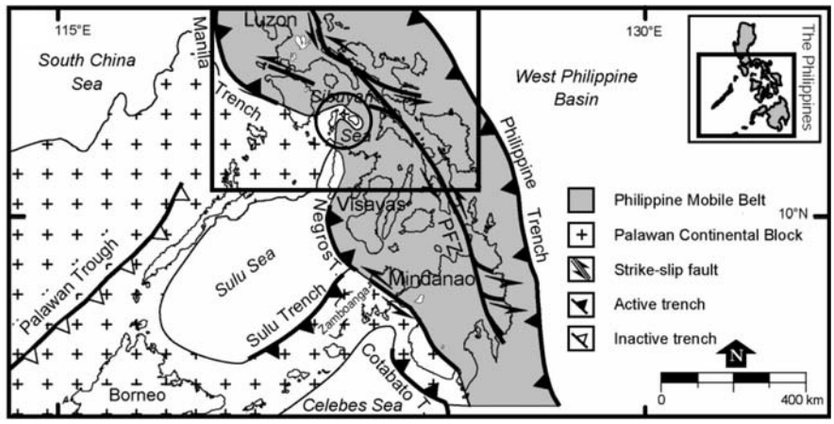

Figure 1
Map showing the major tectonic elements in the Philippine archipelago with special emphasis on the central portion (boxed region) which preserves features of the collision between the Palawan Continental Block and the Philippine Mobile Belt. Area enclosed in circle is the Romblon Island Group.

Geological and geochemical investigations

Recent field mapping on these islands revealed an oceanic crust – upper mantle sequence, the Sibuyan Ophiolte Complex (SOC). All the lithologic units comprising a complete ophiolite complex are found in the Romblon Island Group, i.e. harzburgites, layered ultramafic and mafic rocks, isotropic gabbros, diabasic dike swarms and basaltic pillow and lava flow deposits. The ophiolitic units are best exposed on Calatrava and Alcantara, Tablas Island and on Sibuyan Island. Available geochemical data from the gabbros and volcanic rocks representing the crustal section of the SOC indicate that the ophiolite probably formed in a supra-subduction zone setting. Aside from ophiolitic rocks, the basement complex in the Romblon Island Group is also made up of metamorphic rocks that include mica-bearing schists, chlorite schists, marbles and amphibolites. The schists are believed to have been derived from clastic rock protoliths as suggested by the relict bedding, granular texture and changes in grain size (Tamayo et al., 2005).

Geophysical investigations

Ground magnetic and gravity surveys were conducted on the islands of Tablas, Romblon and Sibuyan in order to determine the geophysical signatures of rocks that lie within the suture zone. The metamorphic rocks display low gravity and magnetic anomalies whereas the ophiolitic units exhibit high gravity anomalies and variable magnetic signatures (Ramos et al., 2005a). Low gravity and magnetic anomalies define the overlying Tertiary to Quaternary sedimentary rocks. Linear features were also delineated on the magnetic and gravity anomaly maps. These are interpreted to coincide with the large-scale structural boundaries which may be collision-related features located between lithologic units. The thrust faults observed on Romblon and Sibuyan islands may be the result of the collision of the Palawan micro-continental block with the Philippine Mobile Belt (Yumul et al., 2005).

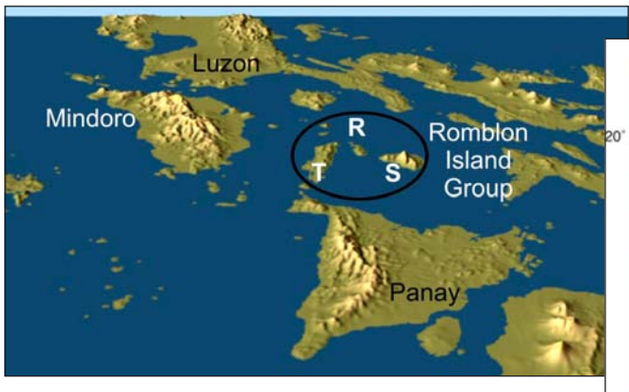

Figure 2
Close-up view of the Romblon Island Group (from west to east, T = Tablas, R = Romblon, S = Sibuyan) in Central Philippines. Figure generated using the GTOPO30 data set of Smith and Sandwell (1997).

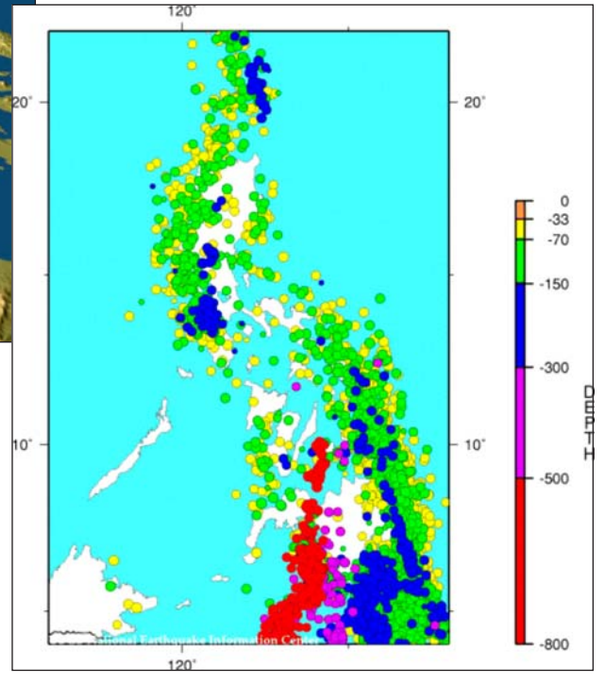

Figure 3
Plot of seismicity data showing the absence of intermediate to deep earthquakes in the western Central Philippine region (boxed area) (source: USGS-NEIC).

The inversion of seismic intensity data was also carried out in order to generate tomographic images of the central Philippine region. The tomographic images reveal a distinct low velocity seismic anomaly east of the Romblon Island Group. A significant feature in the hypocenter section plots of seismicity data is the absence of recent and intermediate to deep (>150 km) earthquakes in the central Philippine region (Figure 3). In general, strain produced by nearby tectonic features may accumulate in such seismic gaps. This gap is ascribed to the arc-continent convergence which caused the trailing edge of the colliding block to become buoyant and thereby refusing to subduct (Ramos et al., 2005b).

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Alvinella Consortium: a large scale sequencing project at the French Genoscope.

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www-alvinella.u-strasbg.fr/Alvinella/

Alvinella pompejana, the "Pompeii worm", is a Polychaete Annelid discovered in 1980 (Figure 1). This tubiculous worm colonizes hydrothermal vents where it is faced with extreme and variable physico-chemical conditions including very high temperatures (from 20 to over 80°C), anoxic conditions, low pH, and high concentrations of heavy metals and sulfides. This environment makes A. pompejana an ideal candidate for studies aimed at deciphering adaptation in general. The biologists of this consortium are interested in answering several questions to understand the physiological adaptations of this amazing worm. These questions will be addressed using transcriptomic and proteomic approaches (e.g. explain thermotolerance, thermal and oxidative defense mechanisms, gene evolution…). This consortium also wants to obtain the full cDNA sequences of interesting thermostable enzymes from an eukaryotic origin which have potential biotechnological implications. We intend to explore the biology of this exceptional animal through a massive cDNA-sequencing project. Several full-length enriched cDNA libraries have been generated at the Genoscope using whole animals as well as dissected tissues collected during the oceanographic Biospeedo cruise on the Pacific Ridge in 2004. The sequencing is on-going at Genoscope and a total of 200 000 reads will be achieved. We will select about 10 000 putatively full-length cDNA using the sequence data and the entire sequence of the selected clones will be determined.

The cDNA sequences are analyzed on the IGBMC genomic platform, Gscope, a program suite dedicated to high throughput genome and transcriptome studies. The protein function is assigned by classical homology searches and completed by the mining of specialized databases such as GO, Interpro and OMIM. A special effort is made to delineate the true set of orthologs of each

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gene on the basis of multiple alignments. This allows for reliable function prediction as well as a realistic picture of gene evolution. Comparative genomic and phylogenetic studies on Alvinella sequences will in fact fill a major gap in the sequence representation of invertebrates and enhance our understanding of animal evolution, in particular the evolution of body plans and developmental processes. Each protein is also evaluated as a potential target in functional and structural genomics (domain determination, reliability of gene and function prediction, global hydrophobicity, transmembrane regions, Codon Adaptation Index for production in E. coli, and orthology with human genes that cause diseases). For more information please contact :
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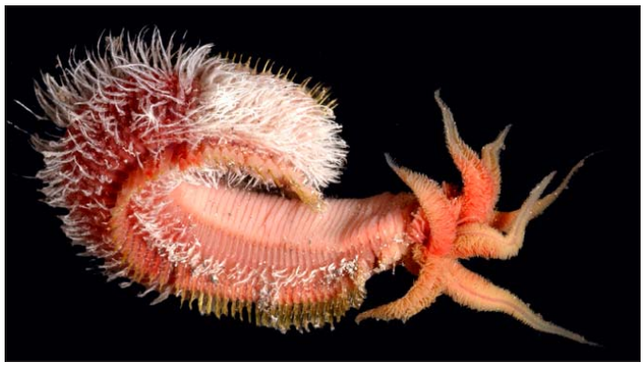

Figure 1. Alvinella pompejana
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Growing international diplomatic interest in hydrothermal vents and deep-sea genetic resources.

David Leary

In an article published in InterRidge News in 2001 I briefly outlined the then emerging interest of the international community in the regulation of activities in the deep-sea such as marine scientific research at hydrothermal vents sites (See Leary 2001). In this brief paper I intend to outline some of the main international developments since that article, with a view to alerting the scientific community to the growing diplomatic interest in their work on hydrothermal vents and deep-sea genetic resources. To date the question of the regulation of activities at hydrothermal vents has been the focus of diplomatic discussion in no less than four different international institutions. These include diplomatic discussions in meetings associated with the 1992 Convention on Biological Diversity (CBD), the International Seabed Authority, the United Nations Informal Consultative Process on the Law of the Sea, and most recently in the annual debates of the United Nations General Assembly on Oceans and the Law of the Sea. This discussion has centred on three core issues: access and benefit sharing in relation to the genetic resources of the deep-sea, the establishment of marine protected areas (MPA's) on the high seas; and the regulation of mineral prospecting operations at hydrothermal vents sites on the high seas.

The Convention on Biological Diversity

At its meeting in Jakarta in 1995 the Conference of Parties (COP) to the CBD commissioned a study on the state of international legal regulation of access and benefit sharing in relation to the genetic resources of the deep-sea beyond national jurisdiction. This study was undertaken by the Subsidiary Body on Scientific Technological and Technical Advice of the CBD (SBSTTA) which released its report on the issue in early 2003. This study confirmed the existence of a gap in international law with respect to the genetic resources of the deep-sea, and concluded that there are at least three possible options available for the future development of an international legal regime for the management of activities relating to deep-sea genetic resources beyond national jurisdiction. They are:
- maintaining the status quo;
- extension of the regime under Part XI of the 1982 United Nations Law of the Sea Convention (UNCLOS), currently limited to the management of mineral resources, to deep-sea genetic resources; and
- application of the regime of conservation and sustainable use of genetic resources under the CBD.

The SBSTTA study was presented for consideration at the eighth meeting of the SBSTTA in Montreal in 2003. The subsequent debate in relation to the report at the Montreal meeting revealed significant differences of opinion between States on this issue. (For discussion of these differences see Leary 2004a and 2004b). After considerable debate a series of recommendations

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from the Montreal meeting were then referred to the seventh meeting of the COP of the CBD in Kuala Lumpur, Malaysia in March 2004. At that meeting hydrothermal vents and deep-sea genetic resources more generally were considered in the context of the review of the programme of work of the CBD on marine and coastal biodiversity. Hydrothermal vents were considered in two parts. Firstly, in examining the issue of MPA's beyond national jurisdiction the COP endorsed continued consideration of the potential for MPA's at hydrothermal vent sites on the high seas. It was agreed that the CBD would work with other international bodies to identify ways to establish MPA's on the high seas within the framework of UNCLOS. However, the major problem with this decision is that, as most international lawyers agree, there is currently no legal basis to establish MPA's on the high seas. How to proceed is still an issue that remains to be resolved.

At the same meeting the COP also considered issues relating to hydrothermal vents under a separate agenda item headed "Conservation and sustainable use of deep seabed genetic resources beyond national jurisdiction: issues arising from the study of the relationship between the Convention on Biological Diversity and the United Nations Convention on the Law of the Sea". It considered the SBSTTA Study released in 2003. The COP resolved to request the Executive Secretary of the CBD, "in consultation with Parties and other Governments and the International Seabed Authority, and in collaboration with international organizations, such as the United Nations Division for Ocean Affairs and the Law of the Sea, the United Nations Environment Programme, and the Intergovernmental Oceanographic Commission of the United Nations Educational, Cultural and Scientific Organization, if appropriate, to compile information on the methods for the identification, assessment and monitoring of genetic resources of the seabed and ocean floor and subsoil thereof, in areas beyond the limits of national jurisdiction; compile and synthesize information on their status and trends including identification of threats to such genetic resources and the technical options for their protection; and report on the progress made to the Subsidiary Body on Scientific, Technical and Technological Advice."

The COP also invited State parties to the CBD "to raise their concerns regarding the issue of conservation and sustainable use of genetic resources of the deep seabed beyond limits of national jurisdiction at the next meeting of the [UN] General Assembly [and invited] the General Assembly to further coordinate work relating to conservation and sustainable use of genetic resources of the deep seabed beyond the limits of national jurisdiction." States were also invited "to identify activities and processes under their jurisdiction or control which may have significant adverse impact on deep seabed ecosystems and species beyond the limits of national jurisdiction".

The outcome of the deliberations of the CBD so far have thus only resulted in agreement to further study the issue.

The International Seabed Authority

As well as discussions within the forums of the CBD there have been consideration of a number of issues associated with hydrothermal vents within the meetings of the International Seabed Authority (ISA). The ISA is the main United Nations body with control over mining on the high seas.

The ISA is currently working on draft regulations for prospecting for polymetallic sulphides associated with hydrothermal vents and cobalt-rich ferromanganese crusts. The drafting of these regulations is not expected to be completed before August 2006 at the earliest. The proposed regulations relate to prospecting and exploration for polymetallic sulphides and cobalt crusts on the high seas, and will apply to a range of activities in the deep-sea marine environment just short of full scale commercial mining operations. However, it is worth noting that these regulations clearly state that they will not apply to marine scientific research. Accordingly freedom of marine scientific research on the high seas recognised by UNCLOS appears so far to be unaffected.

It is proposed that prospecting and exploration for polymetallic sulphides and cobalt crusts will be controlled through a system of notification of prospecting, and a system of contractual licences for exploration. The notification scheme under the draft regulations requires notification of all proposals to carry out prospecting to the Secretary-General of the ISA who will maintain a register of all entities authorised to carry out prospecting. Prospecting, if authorised under this procedure, must then be carried out in accordance with the provisions of the draft regulations and, in particular, some ambiguous regulations relating to protection of the marine environment.

In addition to preparation of these draft regulations the Legal and Technical Commission of the ISA has also been considering what role the ISA should play in the sustainable management of marine biodiversity on the high seas. Several states have expressed concerns that this may take the International Seabed Authority outside its existing mandate under international law. In 2003 these concerns resulted in the Secretary-General of the ISA taking the unusual step of issuing a clarification that the Authority had no intention to exceed its mandate, and in particular was not looking at trying to regulate, control or manage marine scientific research or bioprospecting on the high seas.

United Nations Informal Consultative Process on the Law of the Sea.

More recently hydrothermal vents have been subject to consideration during the work of the United Nations Informal Consultative Process on the Law of the Sea (UNICPLOS) at its fifth meeting in New York from 7 to 11 June 2004. At this meeting UNICPLOS organised its discussions around the theme of "New sustainable uses of the oceans, including the conservation and management of the biological diversity of the seabed in areas beyond national jurisdiction". Issues canvassed under this theme included hydrothermal vents.

At both recent ISA meetings and at UNICPLOS there has been some consideration of what role the ISA may potentially play in the future in the establishment of MPA's on the high seas. It has been suggested that a limited form of MPA may possibly be established by the ISA pursuant to its mandate under Articles 145 and 162(x) of UNCLOS. In a recent statement to a meeting of UNICPLOS the Secretary-General of the ISA suggested that there is no reason why, pursuant to such provisions, the ISA should not develop criteria for the identification of particularly sensitive areas to be reserved for detailed scientific study as environmental baselines or as reference areas. Logatchev in the mid-Atlantic has already been suggested as a possible candidate site by the environmental group WWF.

It is worth noting though that such action by the ISA could not restrict or control any other activities such as marine scientific research, bioprospecting or tourism.

The 2004 meeting of UNICPLOS also received presentations from a number of scientific experts including, Professor Peter Rona from the Institute of Marine and Coastal Sciences at Rutgers University and Professor Kim Juniper from the University of Quebec. The meeting also saw the recently released IMAX film on hydrothermal vents "Volcanoes of the Deep Sea".

After lengthy discussion, including taking note of recent developments at the ISA and the COP of the CBD, UNCIPLOS made a number of recommendations to the General Assembly of the United Nations. The main thrust of these recommendations was for existing international institutions such as regional fisheries institutions, the CBD and the ISA etc to continue to explore ways to sustainably manage activities at hydrothermal vent sites and other vulnerable deep-sea ecosystems such as seamounts.

United Nations General Assembly Resolutions.

The question of regulating activities at hydrothermal vents is also increasingly of interest to the United Nations General Assembly. In its annual resolution on Oceans and the Law of the Sea in 2002, Resolution 57/141 the General Assembly called on States to implement the provisions of Part XII of UNCLOS dealing with the marine environment and encouraged relevant international organisations and regional and sub-regional fisheries organisations to "consider urgently ways to integrate and improve, on a scientific basis, the management of risks to marine biodiversity of seamounts and certain other underwater features within the framework of" UNCLOS. The "other underwater features" referred to in Resolution 57/141 includes hydrothermal vents. Resolution 57/141 also reiterated the importance of the ongoing elaboration by the ISA pursuant to UNCLOS of rules, regulations and procedures to ensure the effective protection of the marine environment, the protection and conservation of the natural resources of the deep-sea on the high seas, and the prevention of damage to its flora and fauna from harmful effects that may arise from activities on the high seas.

In addition the recommendations from the UNICPLOS meetings referred to above were subsequently considered by the UN General Assembly in the course of its consideration of developments in the Law of the Sea at its 56th Meeting. At this meeting the General Assembly passed a resolution to establish an Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biodiversity beyond areas of national jurisdiction. The work of this Working Group will include questions associated with hydrothermal vents. The deliberations of this Working Group could potentially lead to a further protocol to UNCLOS to deal with regulation of activities at hydrothermal vents and or more generally with the issue of the genetic resources of the deep-sea.

Conclusion

It is clear that regulation in some form or another of activities associated hydrothermal vents is on the horizon some time in the near future. It is not yet clear what form that regulation will take or indeed which of the existing international institutions will have primary responsibility. The key focus of the international community is on the question of access and benefit sharing in relation to the genetic resources of the deep-sea. But questions are now also being raised about the environmental impact of activities such as bioprospecting, marine scientific research and mining and the ability of existing legal and intergovernmental institutions to deal with such issues.

The next few years will be an interesting time in international diplomacy and further developments in international law are likely. Science will have a role to play in guiding decisions that may ultimately be made by the international community, but science is also a stakeholder in the ongoing diplomatic initiatives in this area. Scientists with an interest in deep-sea research would be well served to pay close attention to these developments as they unfold.

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GISdeRidge
Development of a multi-scale, seamless, unified, web-based Geo Information System (WebGIS) for public accessibility through standards-compliant extensions of the WorldDataCenter MARE.

A. Schaefer[1]

This is a summary of a proposal submitted in March 2005 to form part of the German DFG special priority program 1144 (SPP1144): Vom Mantel zum Ozean: Energie-, Stoff- und Lebenszyklen an Spreizungsachsen.

Applicants:
Prof. Dr. Vikram Unnithan, Prof. Dr. Peter Baumann, Dr. Michael Diepenbroek, Dr. Angela Schäfer

Within the framework of the SPP1144, the GISdeRidge project aims to extend WDC-MARE (a World Data Centre for Marine Environmental Sciences) with a multi-scale, seamless, unified, open, interactive, web-based Geo Information System (GIS) for public accessibility, and analysis of geodata acquired by the SPP1144 community. SPP1144 is continuously gathering high-value scientific data. With this steadily growing data volume, there is a need to establish a common web-based GIS working environment to compliment existing long-term archival systems. GISdeRidge would provide the community with a framework to access homogenized, quality-monitored and visualized spatial data and research results (Figure 1). It would also provide easy, flexible access for data extraction, analysis, and strictly open, standards-based data architecture.

External interfaces will make use of international standards issued by the Open GIS Consortium and ISO. An interactive Web Map Service browser interface will be offered to casual users, while expert users will be provided with analysis and query facilities based on Web Feature Service (digital maps) and Web Coverage Service (raster data). Service implementation will use open-source software where possible, and suitable raster server technology will allow for flexible visual navigation of multi-Terabyte raster data. This project encompasses the WDC-MARE/PANGAEA operator to ensure tight integration, user orientation, and sustained service in the long run. Longer term research avenues include integration of MarineXML, Marine Data Model development, web semantics and ontology. International organisations such as CODATA and OGC have confirmed the importance of this endeavour and recommend the project gets funded.

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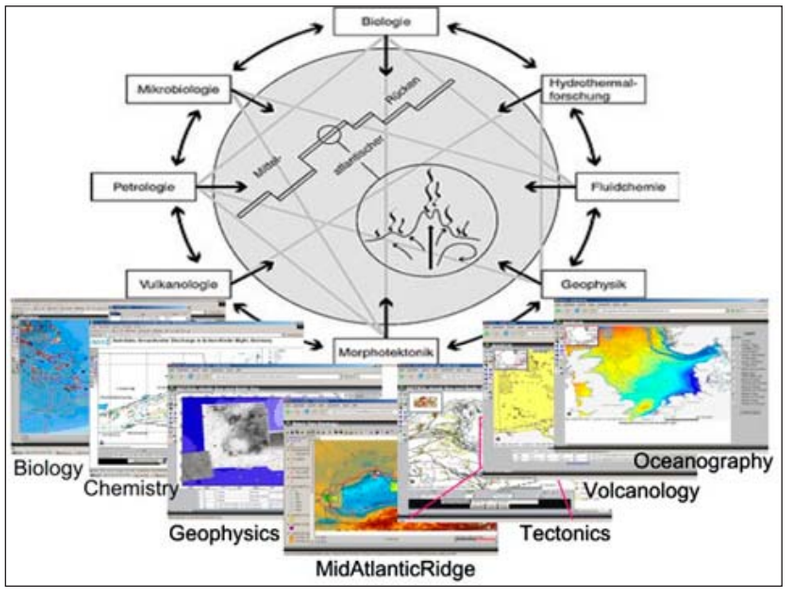

Figure 1
WebGIS portals for DeRidge

ChEssBase: a central source of information for species from deep-water chemosynthetic ecosystems – fusion with the InterRidge biological database and integration with OBIS.

E. Ramirez-Llodra[1,2], K. Freitag[3], M. Blanco[2], M. Baker[2]

Since the discovery of hydrothermal vents in 1977 and of cold seep communities in 1984, over 500 species from vents and over 200 species from seeps have been described (Van Dover et al., 2002). With the regular discovery and investigation of new vent and seep sites, as well as other reducing habitats such as whale falls, sunken wood or areas of low oxygen intersecting with the margin, samples are constantly being collected by research groups around the world, with new species often being described. The wealth of samples is rapidly increasing, however catalogues for the collections often remain within each institution or research lab. To promote and facilitate international collaboration, as well as to share information and to obtain the maximum return from the large effort devoted to the collection of these samples, it is essential that the sample and species information collected to date is freely available and searchable in a user-friendly and efficient database.

Data first started being compiled in an overarching way in 1997, after an evening discussion on biological sample exchange at the First International Symposium on Deep-Sea Hydrothermal Vent Biology in Madeira. During this discussion, it was recommended that InterRidge should establish a biological database of hydrothermal samples. This database was designed and built, and the interface to the data was via the InterRidge website. The goal was to facilitate access to information on existing biological samples collected from global vent sites encouraging international sample exchange. The 3-year rotation system of the InterRidge office as well as the lack of the necessary expertise and funds to maintain and update a large database presented a challenge for the InterRidge office and the international community.

In 2002, the Alfred P. Sloan Foundation (USA) funded ChEss (www.noc.soton.ac.uk/chess), one of the 14 field projects of the Census of Marine Life initiative (CoML, www.coml.org) investigating the diversity, abundance and distribution of marine life, past, present

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and future. The main goals of ChEss are to describe and understand the biogeography of species from deep-water chemosynthetic ecosystems and the forces driving them (Tyler et al., 2003). To this aim, ChEss is developing a long-term field programme for the exploration and investigation of new sites in key locations (see ChEss web site) and has developed a web-based database for all species from deep-water chemosynthetic ecosystems: ChEssBase.

The main objective of ChEssBase (www.noc.soton.ac.uk/chess/database/database.html) is to provide a central source of information for:
1) deep-water chemosynthetic ecosystems
2) available samples across laboratories around the globe.

To avoid duplication of effort and maximize resources and efficiency, ChEss (NOC, UK) and InterRidge (currently hosted at the Leibniz Institute of Marine Science, IFM-Geomar, DE) decided to merge their biological databases in January 2004, to create a single central source of information hosted by ChEss. In parallel, ChEssBase has been integrated into the Ocean Biogeographic Information System (OBIS), the information component of the CoML initiative. OBIS is a web-based provider of global geo-referenced information on marine species in four dimensions (the three dimensions of space plus time), offering not only access to data contents, but also to information infrastructure, and informatics tools such as maps, visualizations and models (www.iobis.org).

The first version of the database includes data on 806 species and 432 genera from 76 chemosynthetic sites that range from vents, seeps, whale falls and sunken wood. These data contain information (where available) on the taxonomy, morphology, trophic level, reproduction, endemicity, distribution and habitat type, as well as on basic geophysical characteristics of the sites. There are also 954 papers in a searchable reference list. During the second development phase of ChEssBase, specific sample data will be included in the database, with cruise information, sample location, responsible researcher and institution. A photography and video gallery linked to each species will also be created.

The links with other related databases, such as the Ridge2000 biological database that is currently being developed (http://ridge2000.bio.psu.edu, Penn State, USA), Biocean (www.ifremer.fr/isi/biocean, Ifremer, Brest), or Microbis (http://icomm.mbl.edu/microbis, MBL, USA), can be facilitated through the OBIS portal.

The collaboration of the international research community is essential to ensure ChEssBase remains up to date with the latest information such as new sites discovered, new species described or new samples collected.

For this, ChEss and InterRidge encourage researchers to send their new publications and cruise reports to Dr Eva Ramirez (ezr@icm.csic.es, ChEssBase manager). This will facilitate the task of including all new data and information in the database quickly and accurately, and therefore make this available to you, the community.

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CANADA

NEPTUNE Canada

The NEPTUNE cabled observatory for the Canadian portion of the Juan de Fuca plate, funded at $C62.4 million (~$US51 million) by the Canadian Foundation for Innovation and the British Columbia Knowledge Fund, is well along in its planning to be "wet" in 2007. An RPF for the Stage I Subsea Electro-Optical Cable Observatory System received responses from three highly qualified industrial teams. Many of the team members had made public presentations at a meeting organized by the Canadian Consulate in Los Angeles at the 2004 Fall meeting of AGU. The proponents liaised with institutions involved in the design of the US portion of the overall system to assure that the design for the Canadian Stage I will be capable of extension to complete the two-stage bi-national cabled observatory. The proposals have been evaluated and a final contract is expected to be in place in summer 2005.

The NEPTUNE Canada project includes funds for instruments for community science experiments. NEPTUNE Canada held three workshops in 2004 for the purpose of facilitating the formation of experimental teams and the development of ideas for experiments. A total of 17 proposals were received by the January 18, 2005 deadline. The 6-member international review committee met at the University of Victoria on April 1-2 to rank proposals and recommend funding levels.

A prototype data management system for NEPTUNE and VENUS is being developed by Benoît Pirenne, who was appointed in 2004 as Assistant Director for Data Management.

The University of Victoria has acquired a cable landing station in Port Alberni, British Columbia, where the first phase of NEPTUNE will be coming ashore.

ROPOS Upgrade

The Canadian ROPOS ROV (5000 m capability) is undergoing a major upgrade to its handling and data transmission systems funded by two grants from the Canadian Foundation for Innovation and the British Columbia Knowledge Fund (Ross Chapman and Verena Tunnicliffe, PIs, University of Victoria). When completed, ROPOS will be capable of transmitting live data ashore via a satellite link, will have fly-away capability for mid-depth dives without its deep water cage and winch, and will have a Kraft arm that will enhance its manipulative ability.

NSERC Major Facilities Access Grants

The Natural Sciences and Engineering Research Council of Canada made two grants to ridge-related science through its Major Facilities Access program.

- Canada IODP (K. Gillis, PI, University of Victoria) $C200,000 per year for 3 years to pay Canada's portion of its membership in ECORD.
- Canadian Scientific Submersible Facility (S. D. Scott, PI, University of Toronto) $C400,000 per year for 3 years to subsidize Canadian users of ROPOS. This is the third successful 3-year MFA grant for ROPOS and is a $50,000 per year increase over the previous two grants.

Endeavour Marine Protected Area

The implementation committee set up by Fisheries and Oceans Canada continues to develop a plan for regulating and monitoring scientific use of the Endeavour MPA.

A rapid response team investigated an earthquake swarm detected in the MPA by a SOSUS acoustic array.

Ridge-related Cruises

Canadians participated on the following ridge-related cruises:

- Pacific Ring of Fire (NOAA, R. Embly, Chief Scientist) using ROPOS to investigate hydrothermalism in the Marianna-Bonin arc.
- Keck (University of Washington, J. Delaney, PI) to the Endeavour MPA. Canadian participant was Elitsa Hrischeva, University of Toronto. CanRidge contributed two ROPOS dives.
- Easter microplate to investigate hydrothermalism and vent biology. Canadian participant was Dan Layton-Matthews, University of Toronto.

Movements of CanRidge People

Kim Juniper and Brian Bornhold were appointed co-chief scientists of NEPTUNE in 2004.

Mark Hannington has moved from the Geological Survey of Canada to Ottawa University where he holds an endowed chair.

Steve Scott stepped down as Chair of the Department of Geology at the University of Toronto on June 30, 2005.

STEVE SCOTT

FRANCE

Despite the end of the National Program of CNRS and IFREMER "Dorsales", ridge activities continue in France in three ways:

- Development of the MOMAR project, with the creation of a "MOMAR-France Steering Committee" in charge of coordinating the French activities in MOMAR
- Participation in InterRidge, with the creation of a "Bureau InterRidge France"
- Individual cruise proposals and submission of projects through other programs

MOMAR activities

The MOMAR-France Steering Committee, led by Mathilde Cannat, organized a national MOMAR workshop in late October 2004 to discuss future actions. Although the focus was initially on Lucky Strike, attending members found out that the interest was both on Lucky Strike and Rainbow, the former being the most favorable place for a permanent observatory whereas the latter would be the focus for repeated observations. Resubmission to IODP of a drilling proposal at Rainbow was strongly encouraged. The acquisition of earthquake epicenter locations in the MOMAR area through hydrophones moored in the SOFAR channel was also supported.

Cruises planned, pre-scheduled, or submitted as part of the MOMAR France effort are as follows:

- Two cruises will take place in 2005: SISMOMAR, an OBS experiment at Lucky Strike (P.I. W. Crawford), and EXOMAR, a biological cruise to various hydrothermal sites of the MAR including MOMAR sites (P.I. A. Godfroy).
- Two cruises are pre-scheduled for 2006: GRAVILUCK, a deep-sea gravity and geodesy experiment at Lucky Strike (P.I. V. Ballu), and MOMARETO, a technological cruise to test devices developed as part of the EU-funded EXOCET/D program.
- As decided during the MOMAR-France workshop, two cruise proposals have been submitted for 2007. MOMARTHYNI intends to "initiate the implementation of an integrated deep sea observatory in the Lucky Strike hydrothermal vent field" by gathering geological and biological data as part of a "zero-state" of the field (P.I. J. Escartin). MOMAR-DREAM goals are to study the role of iron in the geological, hydrological, and biological processes, and to systematically characterize the site to prepare for IODP drilling (P.I. J. Dyment & F. Gaill).
- Finally, a revised proposal for drilling at Rainbow was submitted by Yves Fouquet to IODP on March 31st.

The French interest for the MOMAR area was confirmed by the large French attendance at the 3rd International MOMAR implementation Workshop held in Lisbon in April 2005.

Bureau InterRidge France

The goals of the bureau are

- to be the correspondent of InterRidge in France, in order
  - to disseminate information from InterRidge to the relevant French programs or individual scientists and help the French Ridge community to benefit from InterRidge and the Ridge programs of other countries;
  - to pass information from the relevant French programs or individual scientists to InterRidge and improve the international visibility of the French Ridge community
- to disseminate information among the French Ridge community and support initiatives at the national level (workshops, meeting sessions) in order to maintain a community spirit among what was the "Dorsales" community.

Members of the Bureau are Jérôme Dyment, Françoise Gaill, Pascal Gente, and Yves Fouquet.

The budget in 2004 was 10 k Euro, it is 7 k Euro in 2005. This low budget, entirely paid by CNRS (together with the InterRidge contribution of 20 k$ - recently increased to 25 k$) is just sufficient to pay for the French attendance at InterRidge Steering Committee meetings and to support a limited number of participants at InterRidge workshops.

Cruises

Table 1 is a list of ridge-relevant cruise proposals that the bureau InterRidge France is aware of. Cruises relevant to the MOMAR project are in italic.

This does not take into account the quite large French participation in IODP legs on ridges, including the recent Legs 304-305 to the oceanic core complex at Atlantis Massif, on the Mid-Atlantic Ridge.

Scientific fleet

The new IFREMER ship, R/V *Pourquoi Pas?*, is near completion. Tests are scheduled for May to July 2005. The first cruise will be EXOMAR, a biological cruise to the mid-Atlantic Ridge. The ~100 m-long vessel can carry both deep sea submersible Nautile and ROV Victor, offers spacious laboratories and accommodation for ~40 scientists, and will have excellent survey capabilities. Details about the new ship can be found at
http://www.ifremer.fr/flotte/projets/nep/
and recents news at
http://www.ifremer.fr/flotte/projets/nep/nouvelles/index.htm

JÉRÔME DYMENT

Table 2
List of ridge-relevant French cruise proposals.

Cruise name	Area	Chief scientist(s)	Remarks
Completed in 2004			
BioSpeedo	EPR	D. Jollivet	
Completed or scheduled in 2005			
Pacantarctic II	PAR	L. Dosso, H. Ondreas..	Dec 04 - Jan 05, R/V *L'Atalante*
Sismomar	MOMAR	W. Crawford, S. Singh	Jun 05, R/V *L'Atalante*
Exomar	MAR	A. Godfroy	Summer 05, R/V *Pourquoi Pas?*
Submitted for 2006 and 2007			
Gala	Lau basin	E. Ruellan	
Graviluck	MOMAR	V. Ballu	(prescheduled 2005, postponed)
Pluriel	SEIR	M. Maia, C. Hémond	(prescheduled 2005, postponed)
Marche	MAR	J. Goslin	
Momareto	MOMAR	P. M. Sarradin	
Momarthini	MOMAR	J. Escartin	
Momar-Dream	MOMAR	J. Dyment, F. Gaill	
Serpentine	MAR	Y. Fouquet	
Parisub	EPR	P. Gente	(scheduled 2004, cancelled)
GeiSeir	SEIR	C. Hémond	
Mozaic	EPR	N. Le Bris	
Symbihot	EPR	F. Lallier	
AOC	Sheba R	M. Fournier	

GERMANY

DeRidge update

In October 2003 the Senate of the German Research Council (DFG) started supporting the priority program "From Mantle to Ocean: Energy-, Material- and Life cycles at Spreading Axes". The project is currently planned to continue for six years with the objective being to quantify the processes at mid-ocean ridges by undertaking detailed tectonic, geophysical, volcanological, geochemical, fluid-chemical and biological investigations. In order to attain a globally-relevant description and quantification of ridge processes it is necessary to carry out an intensive, multi-year, multi-disciplinary project at various time scales and at clearly-defined, representative regions along the mid-ocean ridge.

During the first phase (2003-2005) of the priority program, the DFG funded 20 projects. A list of these funded projects is available on the SPP1144 web site, located at IFM-GEOMAR and accessible under www.deridge.de. Continuation and/or new proposals for the next two year funding period (1.10.05-30.9.07) were submitted to the DFG on 31 March 2005 and approval of proposals is expected soon.

Summary of Meteor cruise M62/5

The R/V *METEOR* cruise M62/5 took place from 7 November – 29 December 2004, and was the second German research cruise to the South Atlantic Ridge between 7° and 11°S after cruise M62/4.

Aim - determine the volcanological and tectonic nature of the seafloor in a portion of the South-Atlantic Ridge (MAR) between 7-11°S using the British TOBI device.

Main results:

(1) Four second-order ridge segments explored south of the Ascension fracture zone, over a distance of 1000 km along-axis. Approximately 6000 km^2 of seafloor with an average depth of 3100 m imaged with TOBI.

(2) Two extensive sheet-flows identified at the northern-central end of Segment 2.

(3) A hydrothermal plume with methane concentrations of up to 115 nmol/l and a maximum turbidity of 0.1331 V was found in 2700 m water depth at the border between

segment A1 and A2.
(4) A temperature anomaly of 0.14°C found during a ROV dive on a plateau at the western flank of "Cheating Bay" is clearly related to an increase in heat transfer from a hydrothermal system below the surface. The occurrence of intense alteration of rocks and sediments around this so-called "Nibelungen field" also supports this conclusion.
(5) Most sampled microcrystalline basaltic rocks in the "Cheating Bay" area are covered by Mn-oxide.
Cruise findings were recently published in EOS (Devey, C. W., Lackschewitz, K., Baker, E. 2005: Hydrothermal and volcanic activity found on the southern Mid-Atlantic Ridge. EOS Transactions 86 (22), 209-212.).

Other Cruises

Meteor cruise M64/1

Meteor cruise M64/1 started on April 2, 2005 from Mindelo, Cape Verdes and ended in Fortaleza, Brasil on May 3. Chief scientist was K. Haase, Univ. of Kiel. The main objectives of the cruise were to find and sample active hydrothermal vents and to study recent volcanic processes along the Mid-Atlantic Ridge between 4 and 10°S.

Water column studies, fluid chemical and biological/microbiological studies were undertaken at the hydrothermal vents together with petrological sampling. The main instrument utilized for the work at the vent sites was the ROV "Quest" from Marum, Bremen.

Meteor cruise M64/2

M64/2 started on May 6, 2005 from Fortalezza (Brasil) and ended in Dakar (Senegal) on June 6. Chief scientist was K. S. Lackschewitz (IFM-GEOMAR Kiel). The overall goal of the cruise was to increase the understanding of the geochemistry, biology and microbiology of the Logatchev Hydrothermal Field (15°N at the MAR). The studies put special emphasis on the temporal variability of fluid emanations, fluid chemistry, microbial activities and associated fauna at selected vent sites in comparison to results obtained in previous Meteor-cruises to this hydrothermal field. Long-term measuring devices for temperature, pressure, microseismicity and local seafloor tilt studies were deployed for the first time in this area. Furthermore, interactions between hydrothermal and biological processes were successfully studied (geological coupling between vent fluids and symbiotic primary producers). A variety of high temperature sites were sampled and will be used to determine temporal variations in fluid composition.

SPP 1144 data management

The project web page moved from Bremen to Kiel (http://www.deridge.de). Some changes occurred with regard to the temporary presentation of non-project data. These date, previously available via the project homepage, are now on the data web page (http://www.pangaea.de/Projects/SPP1144/). These data will successively get transferred to the WDC-MARE/PANGAEA archive.

Data from Meteor cruise M60/3 were the first data provided for transfer to the SPP1144 archive at WDC-MARE/PANGAEA. Data include CTD measurements, chemical analyses of fluids and rocks, temperature measurements and seafloor images (these include: i - thumbnails representing the original images, ii - track plot (PDF file) and iii - list (ASCII text) of image name, latitude and longitude) and maps. Each document or image can be visualized and downloaded in the original size. In order to access the SPP database, please contact K. Lackschewitz to apply for a password.

The next step in data management beside continuing the transfer of M60/3 data, is to start to inspect and prepare the new data from cruise M62/5.

Upcoming events

Schedule and main objectives of planned Meteor and Merian cruises 2006

A first M.S. *Merian* cruise to the Logatchev Field is presently scheduled from 22 April to 16 May 2006 (coordinator is T. Kuhn, IFM-GEOMAR Kiel). This HYDROMAR IV project proposes to drill 15 m long boreholes into the ultramafic-hosted active vent sites of the Logatchev-1 hydrothermal field. The drilling device that will be used is the newly built Rockdrill 2 owned by the British Geological Survey in Edinburgh (UK). The major scientific objectives include the investigation of depth zonations of mineralization and alteration, their age relationships and the establishment of the variability of the subsurface biosphere.

Meteor cruise M68/1 is scheduled to depart from Barbados on 27 April 2006 and end in Recife on 2 July 2006 (coordinator is A. Koschinsky, International University Bremen). The overall goals of the investigation are (1) to investigate the petrology and geochemistry of source rocks and the geochemistry and fluxes of the respective hydrothermal fluids, temporal variations of hydrothermal activity, hydrothermal alteration of volcanic rocks, and geo-bio interactions between fluids and hydrothermal biotopes at the slow-spreading Mid-Atlantic Ridge (MAR between 7 and 11°S) and (2) to focus on the biogeographic role of the southern MAR with respect to the distribution of hydrothermal fauna and the differences between hydrothermal systems at the northern and the southern MAR.

The proposals of all three cruises are presented as pdfs on the SPP1144 web site.

The M.S. *Merian* cruise HYDROMAR III to the Logatchev Hydrothermal Field at 15°N is currently scheduled for the end of 2006 (coordinator is C. Borowski, MPI Bremen). The investigations of this cruise are a continuation of the program started at 15°N on the Mid-Atlantic Ridge in 2004 (cruise M60/3; HYDROMAR I followed by cruise M64/2; HYDROMAR II). The emphasis of this cruise is to study the temporal variability of fluid emanations, fluid temperature

and chemistry, microbial activities and associated fauna at selected hydrothermal vent sites.

2nd SPP1144-Workshop in Etelsen, 28.-30.6.05

The 2nd SPP1144 workshop to present the results of Meteor cruises M62/4, 62/5, 64/1 and 64/2 and the preliminary results of the funded SPP1144 DFG-projects took place in June 05. The meeting was well-attended by 60 German scientists. Georgy Cherkashov from VNIIOkeangeologia, St.Petersburg, Russia attended as an invited scientist. Future research activities at the Mid-Atlantic ridge segments and hydrothermal vent fields in the selected areas at 15°N and between 4 and 11°S were coordinated during this meeting. This successful workshop brought together scientists and graduate students from all disciplines interested in both areas.

COLIN DEVEY

INDIA

The Indian Ridge Program

The Indian Ridge community was active and busy during the last year. Extensive multi-parameter geophysical and water column (physical, chemical and biological) data was acquired during the two multi-disciplinary cruises that were undertaken along segments of the Carlsberg Ridge and the Central Indian Ridge. Preliminary data processing is underway.

Another important milestone of the Indian Ridge program was hosting the InterRidge workshop on Indian Ridge systems titled "Tectonic and Oceanic Processes along the Indian Ocean Ridge System". This took place at the National Institute of Oceanography, Dona Paula, Goa, India from 19 to 21 January, 2005. There were 10 special talks, 24 oral presentations and 18 poster presentations. Apart from this, a special interactive talk was devoted to the recent seismic event that occurred off Sumatra and generated a tsunami. On the second day of the workshop a film on "Volcanoes of the deep sea" was screened. Panel discussions were held during the concluding session of the workshop, which brought out opportunities for forging collaboration among the ridge researchers across the world.

The workshop was organized with financial help from the Council of Scientific and Industrial Research [CSIR], India, InterRidge and Ridge 2000, USA.

Looking towards the future, the Indian Ridge program is currently in the process of chartering a suitable research vessel to conduct Deep-Tow / ROV investigations over selected regions of the Carlsberg and Central Indian Ridges. The field program is planned for the first quarter of 2006. It is a great opportunity for international collaborative efforts to take place; interested scientists may contact the Coordinator of the Indian Ridge program Dr. K.A. Kamesh Raju, kamesh@darya.nio.org or any member of the Indian Ridge program to initiate collaboration.

K.A. KAMESH RAJU

JAPAN

InterRidge Japan Update

Japanese ridge scientists are continuing their activities with several seagoing research plans. The InterRidge-Japan program sponsored by JSPS (PI: K. Tamaki), which has supported the annual contribution to InterRidge, attendance at steering committees and workshops, as well as participation of Japanese scientists in international cruises, will end at the end of FY2005. We are trying to establish a new framework to maintain the community and to promote ridge-related studies in Japan.

Diving cruises near the Rodriguez Triple Junction

The Shinkai6500 diving cruise (PIs: K. Takai and H. Kumagai) is scheduled at the southernmost Central Indian Ridge in January to February, 2006. The area includes two completely different types of hydrothermal fields, the Kairei and the Edmond. The Kairei field is known for its extraordinarily high concentration of hydrogen in hydrothermal solutions and for its chemolithoautotrophic ecosystem, that has not been observed at the Edmond site. The unique chemistry and ecosystem are interpreted to be due to the serpentinization of ultramafic rocks at high temperature. The hyperthemophiric, lithoautotrophic subsurface microbial system is an important key as it could be a last universal common ancestral community of life. The submersible dives by geologists, geochemists and biologists at these two sites and the adjacent ridge crests including a small oceanic detachment aim to reveal the tectonic setting of the area, the details of the ecosystems, and the interaction between them. A total of 30 dives are

assigned.

Backarc Basin studies

Backarc basin studies by the Japanese community mainly target the Mariana arc. A submersible diving cruise to the southern Mariana Trough (PI: H. Masuda) was conducted from July to August, 2005 in order to understand the temporal and spatial variations of hydrothermally associated microbiological activities. A long magnetotelluric transect is planned in collaboration with U.S and Australia to provide a comprehensive structural image of the central Mariana subduction system that extends from the subducting Pacific Plate across to the Marina Trough backarc basin. An R/V *Kairei* cruise (PI: N. Seama) is scheduled in December, 2005 to deploy ocean bottom electro-magnetometers at 42 sites. In the extinct Parece Vela backarc basin, the R/V *Hakuho-maru* cruise was carried out from June to July, 2005 (PIs: K. Okino and Y. Ohara) and the intensive geophysical mapping of the southern tip of the basin and the dredging along the extinct rift system revealed the complicated evolution process of the area.

New outreach video "Direct approach to Sub-vent Biosphere, the origin of life on the Earth"

The Archean Park Project (PI: T. Urabe), an interdisciplinary research project on the interaction between the sub-vent biosphere and the geo-environment, supported by MEXT ended successfully at FY2004 (The summary papers of the project appeared in Oceanography in Japan, Vol. 14 No. 2, 2005 as a special issue of the Archean Park Project). The research team has recently released an outreach video, which summarizes their research highlights. The video is a good introduction to deep-sea hydrothermal systems and is suitable for introductory lecture courses. The file can be freely downloaded from http://www.lib.kobe-u.ac.jp/products/seimei/e-index.html

Riser drilling vessel "*Chikyu*" progress

The new riser drilling vessel *Chikyu* is continuing a series of basic operational tests and navigation training cruises around Japan this year. An open house for the general public is planned in September.

KYOKO OKINO

NEW ZEALAND

Although having a long hiatus in reporting, InterRidge science projects in the New Zealand region have continued apace since the last national news contribution, with continued work focusing on the hydrothermalism, mineralization, vent biology, magma petrogenesis, and chemical flux of the Tonga – Kermadec volcanic arc.

The major project has been EM300 multibeam mapping and hydrothermal surveying of the arc front between 30°S and 25°S during a RV *Tangaroa* voyage in October 2004. This third voyage has now completed volcano and hydrothermal plume mapping for the entire Kermadec arc. Combined with similar studies by German and Australian colleagues along the Tonga arc, it now forms a ~2500 km long inventory of volcano spacing and distribution, and frequency and intensity of venting along the entire Tonga – Kermadec arc front. The northern Kermadec arc is dominated by silicic caldera volcanism, with seven of nine larger edifices being calderas. Typically the calderas are 5-10 km in diameter, with some showing at least four phases of caldera-forming volcanism. The largest is the Monowai caldera, with the previously known and mapped Monowai cone forming a late-stage satellite construction on the southern caldera rim. The advent of near pervasive silicic caldera volcanism along the northern Kermadec arc differs from the southern Kermadec arc (where there is a mix of silicic and basaltic volcanism), and may provide insight into the temporal evolution of arc and the requisite thermal presaging and thickening of arc crust prior to generation of silicic melts.

Of the northern Kermadec arc, seven of eight volcanoes surveyed are actively venting from at least 13 different sites. The most active is Monowai caldera, where a large hydrothermal field occurs.

This recent work has included a 6-month deployment of a current meter array around the Brothers hydrothermal site as part of an experiment to establish chemical flux and process of plume dispersion from the caldera. Plume chemical intensity and size at Brothers are the greatest of the presently discovered Kermadec arc vent sites and should provide an upper limit to flux rates. The array was recovered in May 2005.

Also late in 2004 a joint Japanese – NZ project completed the first submersible dives along the Kermadec – Havre arc – back-arc system, using the Shinkai 6500 from RV *Yokosuka*. Four dives were completed at the Brothers caldera hydrothermal sites – two on the northwest caldera wall with extensive high-temperature black smoker venting and two on the resurgent dome site where fluids with lower-temperature but higher volatile content were collected. GNS and NIWA are involved with fluid chemistry and vent biology studies with Japanese colleagues from JAMSTEC and Chiba, Kyushu, and Tokyo Universities.

A recent major thrust of the Kermadec work was a 17 submersible dive programme using the PISCES IV and V manned submersibles and the RV *Ka'imikai-o-Kanaloa*

in April - May 2005. The programme is a joint NZ / US project with funding from NOAA Ocean Exploration, GNS, and NIWA. Eight volcanoes were the target sites between 25°48'S and 36°21'S that cover a range of water-depths, types of volcanoes, and vent chemistries. The major thrusts of the work are to understand the variability of hydrothermal vent chemistry, volcanic and vent field geology, and both macro- and microfaunal vent biological studies. A follow-up dive programme using Pisces by colleagues from the University of Mississippi, but also involving New Zealand scientists, conducted a further 6 dives on the southern Kermadec volcanoes, whilst researchers from the University of Kiel (Germany) dived on volcanoes along the southern Tonga arc.

Ian Wright

PHILIPPINES

The focus of Philippine ridge-related science is to continue to unravel the tectonic evolution of the Philippine island arc system. There are currently several initiatives that are being undertaken to investigate the arc-continent convergence in the western central portion of the Philippine archipelago. These include geological, geochemical and geophysical investigations of the Romblon Island Group as well as generation of mantle tomography images of Central Philippines using seismic intensity data. The international 2005 Romblon meeting was convened at the Mines and Geosciences Bureau, Quezon City, Philippines in June 2005 to allow exchange of ideas and to facilitate collaborative efforts for future research.

The main people and groups involved in this work are: G.P. Yulmul Jr, C.B. Dimalanta, R.A. Tamayo Jr., N.T. Ramos, E.G.L. Ramos, B.D. Payot and F.T. Jumawan who are part of the Tectonics and Geodynamics Group at the National Institute of Geological Sciences, College of Science, University of the Philippines in Diliman, Quezon City in conjunction with the Philippine Atmospheric, Geophysical and Astronomical Services Administration and Philippine Council for Industry and Energy Research and Development, Department of Science and Technology, Bicutan, Taguig, in Metro Manila; E.J. Marquez from the College of Arts and Sciences, University of the Philippines, Padre Faura, Manila; and T.A. Tam III, from the Faculty of Science, Okayama University in Japan.

Figure 1
Ground gravity (left) and magnetic surveys (right) were conducted on the islands of Tablas, Romblon and Sibuyan.

Figure 2
Geoscientists from the Philippines, Indonesia, Japan, France and Taiwan attended the 2-day scientific sessions held at the Mines and Geosciences Bureau, Quezon City, Philippines.

2005 Romblon International Meeting

An international meeting was convened at the Mines and Geosciences Bureau, Quezon City, Philippines from 6-12 June 2005 which was attended by around 100 geoscientists from the Philippines, France, Japan, Indonesia and Taiwan (Figure 2). The 2-day technical sessions included paper and poster presentations which highlighted the most recent geologic data and the current state of the geosciences and related disciplines in the Philippines. The meeting allowed participating geoscientists to discuss their recent results and models on regional geologic events, tectonics, magmatism, petroleum possibilities, mineralization and geohazards in the Philippines, Asia and South America.

The technical presentations were followed by a field trip that was focused on areas in the Central Philippine region: in Odiongan, Tablas, on Carabao and Boracay islands and at Caticlan, Buruanga Peninsula (Figure 3). There were twenty seven participants. The sites were chosen because they are situated within the suture zone between the Palawan micro-continental block and the Philippine Mobile Belt and gave the participants a glimpse of features believed to be related to the collision. Discussions among the geoscientists in the field led to the identification of other topics for possible research collaboration and further studies.

GRACIANO. P. YUMUL JR.

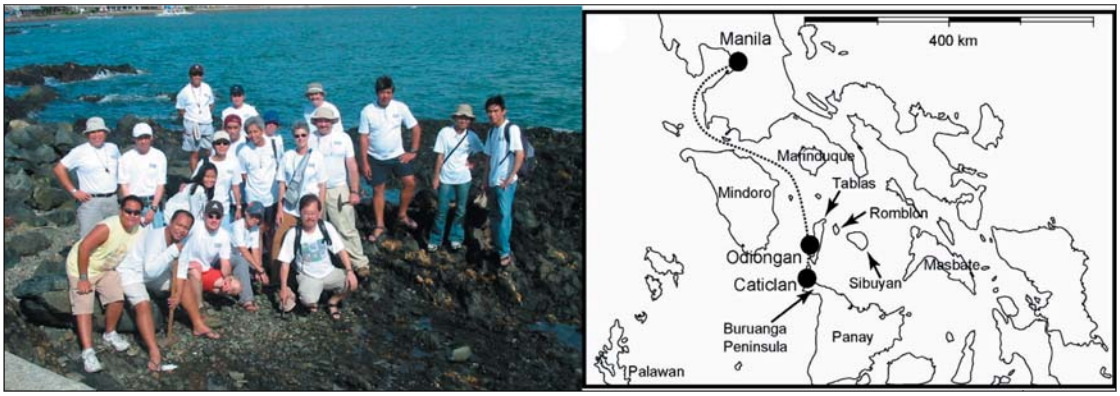

Figure 3
Participants of the post-symposium field trip examine a metamorphic outcrop in Santa Fe, Tablas Island.

SWITZERLAND

In Switzerland, research on ridge-related processes has traditionally involved comparative field, geochemical and petrologic studies of ophiolites and marine sediments with their modern analogues. Two major universities, the ETH Zürich and the University of Bern, are particularly involved in studies of the modern oceanic crust and ridge-related processes. Being a landlocked country, Switzerland has no formal oceanographic program and thus active participation in oceanographic research and cruises depends entirely on international collaborations. In addition, Switzerland has traditionally been a strong proponent of the Ocean Drilling Program and its successor IODP. Many research groups are also indirectly involved in ridge-related research through field, experimental, and analytical studies of processes at ocean/continent transition zones and in subduction zone settings. The following summarizes the activities of three groups that are working directly on InterRidge-related projects.

Mid-Ocean Ridge Hydrothermal Systems

Together with students and colleagues at the ETH-Zurich, Gretchen Früh-Green is involved in studies of hydrothermal alteration and geochemical fluxes in the oceanic lithosphere. These studies can be summarized in three main areas of research:

(1) Controls and consequences of serpentinization in different tectonic environments and understanding serpentinite-driven hydrothermal systems;
(2) Methane and hydrogen formation in mid-ocean ridge hydrothermal systems; and
(3) Fluid flow and geochemical fluxes during hydrothermal alteration.

These projects combine petrological, geochemical and stable isotope methods with microstructural and fluid inclusions studies and involve strong international collaboration.

Swiss Involvement in studies of Lost City

Most recent studies of the ETH-group focus on understanding the peridotite-hosted Lost City hydrothermal system (LCHF) and are part of the larger international, multidisciplinary investigation of the LCHF, led by Deborah Kelley (School of Oceanography, Univ. of Washington, Seattle) and funded by the RIDGE oceanographic program of the US NSF. Two research projects funded by the ETH-Zurich and the Swiss National Science Foundation (SNF) support two

Ph.D. students. G. Früh-Green and A. Delacour participated in the field campaign to Lost City in 2003. A. Delacour participated on IODP Expedition 305. Both G. Früh-Green and A. Delacour will also be involved (shore-based) in the July 2005 investigations of Lost City with co-PIs Debbie Kelley and Bob Ballard (funded by IFE, NOAA, and the Jason Foundation for Education). Public outreach of the Lost City program has been highly successful and has also received good media coverage in the Swiss press and radio. In particular, Lost City was one of the highlights in an Exposition "Worlds of Knowledge", in celebration of 150 years ETH, which took place in Zurich from 22. April – 8. May, 2005.

Hydrothermal process modeling

Christoph Heinrich and part of his group at the ETH are active in modeling hydrothermal processes. Based on developments by S. Matthai (now at Imperial College), two PhD students, S. Geiger and D. Coumou, have extended a Finite Element / Finite Volume C++ code "CSP" to model the flow of coexisting fluid phases such as low density vapour and high density brine at high temperatures, pressures and overall salinities. CSP allows the simulation of fluid processes with "realistic" geometrical detail by efficiently handling mesh resolutions varying over several orders of magnitude in a single model geometry. Similarly, fluid and rock properties varying over orders of magnitude can accurately be treated.

Transition from 'amagmatic' rifting to (ultra-) slow sea-floor spreading

Othmar Müntener and his group at the University of Bern are investigating gabbro and peridotite samples from ODP Leg 210 (Site 1277) from the Newfoundland margin, the conjugate margin of Iberia. Their studies combine petrological and microstructural studies with the aim to reconstruct the crystallization and thermal history of peridotites and gabbros. They are also conducting major and trace element studies on samples from the Galicia Margin (ODP Legs 149 and 173). The data will be used to characterize 2D-spatial compositional variations of peridotite in magma-poor passive margins to address the fundamental question whether there is a correlation between peridotite composition and increasing distance to the continent. Key questions to be solved are the importance of melt migration processes and its relations to the composition of migrating liquids during formation of 'non-volcanic' passive margins, and how 'amagmatic' rifting evolves into (ultra-) slow spreading. The combination of data from the Alps and from Iberia will ultimately show how constraints from both ancient and present-day settings can be used to extract relevant data for crust-forming processes at ridges. O. Müntener has received a special Swiss SNF professorial grant, which includes funding for students to conduct this study.

Storage of light elements (B, Be, Cl, Li) in serpentinized oceanic lithosphere

A second project of Othmar Müntener's group, in collaboration with A. Kalt (Univ. of Neuchâtel), is a systematic study of the abundance, partitioning and mobility of B, Li, Be, Cl, F, and the B isotope fractionation in rock-forming minerals from hydrothermally altered oceanic mantle from ODP Leg 209. This group is using in-situ methods and mass spectrometry to provide new mineral partitioning and isotope data to constrain the enrichment of light elements in the oceanic mantle during hydrothermal alteration and ultimately to quantify the potential input from the partially hydrated ultramafic part of the oceanic lithosphere into the subduction factory.

GRETCHEN FRÜH-GREEN

USA: Ridge 2000

R2K, now in its fourth year, is in full swing with fieldwork at each of the Integrated Studies Sites (ISS), and Time Critical Studies launching a response in record time. Further, our education and outreach activities are bearing fruit and our data management office has implemented an integrated system for cataloging and easy retrieval of ridge data.

At the EPR ISS, multidisciplinary monitoring continues with seismic, current, and temperature data being continuously recorded. Long-term fluid sampling programs for understanding temporal variations in the chemistry of high-temperature hydrothermal vents are continuing. New in situ fluid chemistry monitors have been deployed for weeks, and longer deployments are planned as the technology matures. Nested within these monitoring studies are experiments addressing larval dispersal and changes in microbial and macrobiological communities. Aspects of this work are featured as part of the R2K education outreach program, SEAS (http://www.Ridge2000.org/SEAS). In early 2006, geodetic monitoring will begin with an array of pressure gauges, as well as a detailed compliance study. By early 2007, a 3-D multichannel seismic survey will have provided unprecedented details of the crustal structure at 9°50'N.

Fieldwork in 2005 on the Endeavour ISS of the Juan de Fuca Ridge (JdFR) also includes a balance of monitoring, experimental, and sampling programs across a wide range of disciplines. Four interdisciplinary field programs were conducted to maintain and expand ongoing R2K and proto-NEPTUNE experiments. These research programs continued development and testing of in situ chemical and microbial sensors; conducted co-registered sampling of fluids, fauna, and chimney material; and recovered

moorings that measured heat and chemical fluxes at the segment scale. High-resolution mapping was also completed at this site, which has been chosen for one of the two initial NEPTUNE Canada nodes. Strong education outreach continues at this site with the REVEL program (http://www.ocean.washington.edu/outreach/revel/).

The first round of fieldwork at the East Lau Spreading Center ISS was completed. Building on the R2K and Japanese cruises in 2004, three R2K cruises in 2005 sampled 7 hydrothermal vent sites, including 4 never before visited by ROV or submersible. The SM2000 mounted on the Jason II was used to create fine-scale bathymetric maps of six of the sites, and high-resolution imagery was collected for photomosaics of selected areas of hydrothermal activity within the sites. These maps and imagery guided even finer scale photographic and chemical surveys, equipment deployments, and sampling of basalt, hydrothermal deposits, vent fluids, microbial mats, and benthic organisms. Some fauna collected are still alive and under study in pressure vessels in R2K-supported laboratories. A new website aimed at public audiences showcases some of this work (http://venturedeepocean.org).

The Time Critical Studies (TCS) team rallied quickly in February 2005 to respond to one of the largest submarine earthquake sequences recorded in 12 years of real-time seismo-acoustic monitoring of the northeast Pacific Ocean. Results from this response to the Endeavour segment, and information on earlier seismic events on the JdF and Gorda Ridges, will be detailed in an upcoming Eos article and are on the R2K website (http://www.Ridge2000.org). The 6-day response from detection of the event to a research ship on site confirmed the viability of the TCS concept and the abilities and commitment of the TCS scientists.

The Ridge 2000 data management office (DMO) is into its second year of operation and has a range of information posted online (http://www.marine-geo.org/ridge2000/) [Carbotte et al., 2004]. The database contains cruise information for all R2K-funded expeditions with the exception of those conducted most recently. Information includes science party, location, dates, and projects conducted, as well as an inventory of data and sample types collected on the cruises and links to download available data files and station and sample information. Site-specific compilations of hydrothermal vent locations, marker locations, and deployed instruments and experiments are also available. New capabilities to access the database have been developed including enhanced options for text-based searches and an interface to view camera images in the GeoMapApp map browser. The DMO is continuing to expand data resources for R2K science by linking directly from the R2K data system to other relevant data resources, such as the WHOI Framegrabber tool for Alvin programs at the EPR and Endeavour sites in 2004 are now available.

Ridge 2000 will host an important community meeting, Oct. 31–Nov. 2, 2005, in Vancouver, BC, to assess the status of work at each ISS and TCS, review preliminary results, and reevaluate priorities for the program to ensure success at achieving the long term goals of our Science Plan. For information, check the R2K website. All interested scientist are welcome to attend.

In November 2005, the Ridge 2000 Program office moves to the Scripps Institution of Oceanography (SIO) in San Diego, CA, where it will reside for the next three years. Donna Blackman has been elected to chair the Steering Committee and oversee the Program office at SIO. Our current Education and Outreach Coordinator Liz Goehring will continue working with the program, and will focus on educational programs and teacher development. A new part-time outreach coordinator at SIO will focus on outreach to the broader scientific community and the public. The Penn State and SIO offices will work to assure a seamless transition of responsibilities and uninterrupted service to the community.

CHUCK FISHER

Carbotte, S.M., R. Arko, D.N. Chayes, W. Haxby, K. Lehnert, S. O'Hara, W.B.F. Ryan, R.A. Weissel, T. Shipley, L. Gahagan, K. Johnson, and T. Shank, 2004. New integrated data management system for Ridge 2000 and MARGINS research, Eos Trans. AGU, 85, Dec. 21, 553, 559.

WORKING GROUP UPDATES

Ridge-Hotspot Interactions

The September 2003 Workshop in Brest, France, was a major activity of the Ridge-Hotspot Interactions working group. The details of the workshop are posted on the InterRidge web site. Elements of the workshop report were written and will be put into a final report shortly.

As a direct result of the above workshop, a group of international scientists led by Bram Murton submitted a major proposal (IODP proposal 646 Full) to the IODP program in October 2004, to drill and investigate the origin of the "V-shaped" ridges at the Reykjanes Ridge. The reviews of the proposal by the IODP SSEP were favorable

and the panel recommended immediate acquisition of site-survey geophysical data of the proposed drill sites. A parallel proposal was submitted earlier to the US NSF for doing just that. Because of the current financial constraints of the US NSF seagoing programs, it is not yet clear when the site-survey cruise will be conducted. However, there is clearly a very strong international interest in this drilling program.

Other initiatives related to ridge–hotspot interactions have been developed in different InterRidge member countries. As a German initiative, a recent workshop on plume-ridge interactions took place in Hamburg (http://www.toughcone.de/WORKSHOP/finalprogWS05.pdf) and was mostly dedicated to Iceland. German and UK scientists recently completed several cruises on the MAR near Ascension Island, in a ridge-hotspot environment. Similarly, the French and Portuguese cruises in the MOMAR area may help explain the interaction of the MAR with the Azores hotspot. French research groups have a strong interest in the Indian Ocean hotspots (continuation of current work on CIR-Reunion interaction; cruise proposals for SEIR-Amsterdam interaction). This interest is shared by Japanese scientists, who have planned a two-leg cruise for 2007 along the Rodrigues segments of the CIR and are involving French, British, and US scientists.

We are in the process of compiling a list of active or planned research projects on ridge-hotspot interactions in the different InterRidge countries. Plans are also being developed to summarize the recent efforts of individual scientists/countries in meeting sessions and to promote closer international collaboration and research activities on ridge-hotspot interactions.

JIAN LIN AND JÉRÔME DYMENT

Mid-Ocean Ridge Ecosystems (MORE)

The focus of the MORE working group is to increase international collaboration in hydrothermal biological studies and to work on integrating ridge crest biological and geological studies. This working group is the continuation of the Biology working group. It started with a first meeting in Bremen, Germany on 19 and 20 January 2004.

The first working group activity was to follow the program started out by the Biology working group and chose the time and location for the next vent symposium. This "Third international vent and seep biology meeting" takes place this September in San Diego. A draft was put together to evaluate the most exciting results obtained in the decade and identify which new questions are of interest in the future. From this information, a symposium program was developed.

The second working group activity is a major one and concerns the writing of a code of conduct for research at hydrothermal vent sites. Vent ecologists recognized this problem right from the start of InterRidge. The overall goal is to provide a structure for self policing at heavily frequented vent sites. Kim Juniper prepared a draft code which was accepted by the working group after some minor modifications. This draft code was proposed to the InterRidge Steering Committee however the discussion is still open. Urgency is needed as the World Wildlife Fund (WWF) has put together a proposal to make the Rainbow hydrothermal vent field a marine protected area (MPA). The working group will discuss this during the San Diego symposium in order to put together a final draft that is acceptable to the InterRidge Steering Committee members.

Close relationships exist between our working group and ChEss (Biogeography of deep-water chemosynthetic ecosystems). Data exchange started a year ago and discussion between the two groups is frequent.

Additional interaction and exchanges regarding interdisciplinary interests exist with other InterRidge working groups: Deep earth sampling, Monitoring and observatories, Back arc spreading systems/Back arc basins and Biogeochemical interactions at deep sea vents.

FRANÇOISE GAILL

Biogeochemical Interactions at Deep-Sea Vents

The working group's first meeting was held in December 2004 at the AGU fall meeting in San Francisco where the working group activities were presented in the R2K poster session. The working group's focus is on multidisciplinary research aimed at understanding the interactions between the biotic and abiotic components of different mid-oceanic ridge and back arc basin environments (http://www.interridge.org/ Working Groups presentation). Our primary goals are to strengthen and favour interdisciplinary and international exchange on these topics and, especially,

to foster collaboration in field studies and the development of underwater instrumentation.

The first year of activity was one of intense communication within the ridge research community as well as with scientists involved in other emerging fields of biogeosciences related to reduced environments in the deep ocean. A wide range of contributions to international conferences were provided. A session entitled "Methods, tools and strategies for biogeochemical investigation of chemosynthetic deep water systems" was organised by working group members as part of the Biogeosciences programme of the 2005 EGU General Assembly held from 24-29 April in Vienna, Austria (www.copernicus.org/EGU/ga/egu05). A second session was organised at the ASLO summer meeting entitled "Plate Tectonics and Chemotrophy at Deep-sea Vents". This focussed on new interdisciplinary cutting-edge research in microbial geochemistry of mid-ocean ridges and back-arc basins (http://aslo.org/meetings/santiago2005). Contributions will also be provided at the Geochemistry and Biogeochemistry session of the 3rd International Symposium on Hydrothermal Vent and Seep Biology, September 2005 at the Scripps Institution of Oceanography (SIO), La Jolla, California.

Working group members additionally supported the MoMAR International Workshop that was held in April 2005 in Lisbon by being part of the organising committee and participating in the workshop sessions. This meeting was an initiative of the Monitoring and Observatories working group. In 2005, working group efforts were also directed towards outreach activities, through participation at a press conference at the EGU 2005 General Assembly and through education outreach contributions to the InterRidge web site.

The preparation and search for funding for a workshop and IR-Theoretical Institute to be held in 2007 will be the working group's top priority next year. These activities were discussed at the 2005 IR Steering Committee meeting in April, and received approval by the Steering Committee members.

NADINE LE BRIS

If you are interested in finding out more about the InteRidge working groups and their activities, please take a look at our website.
www.interridge.org

Also, if you would like to submit a proposal for a new InterRidge working group, please contact the InterRidge coordinator
coordinator@interridge.org

EDUCATION AND OUTREACH

InterRidge Launches New Education Outreach Project: Science Writer-At-Sea

http://www.interridge.org/sciencewriteratsea/Norway2005/index.html

I am happy to report that the pilot test of our new Science Writer-at-Sea program was a smashing success. Rolf Pedersen graciously invited us to participate in his cruise aboard the G.O. *Sars* in July-August 2005, which featured an exciting adventure on Jan Mayen, the world's northernmost active volcano. Pedersen threw in an unexpected real-life science discovery story to boot: his research team discovered the world's northernmost vent fields on this cruise, so our pilot test outreach website grew quickly into one that also served as a news resource for media worldwide.

Thanks to the terra firma-based team of project manager/InterRidge coordinator/website extraordinaire Katja Freitag and site designer Swen Meyer, the website was up and running – looking slick, too – in no time. Given the positive responses we have received from a diverse suite of project/site reviewers since the cruise ended, we are taking the program into its next phase of development. I will be presenting the project at this year's AGU conference in San Francisco, CA, and have been invited to report on the project in two science education magazines. We are pursuing long term funding; additional partners in science, education and journalism; and partnerships with science and education magazines who may be interested in

showcasing cruise-generated stories. Our first site (which Freitag translated into German) is also being showcased in a museum in northern Germany, therefore reaching an additional public audience than we originally targeted.

Our first student writer was Rebecca Gentry, a first-year graduate student of science journalism at Columbia University (New York, USA). I couldn't have asked for a better 'guinea pig' for the program, and Rebecca enjoyed the experience as well (Figure 1). Here are some thoughts from her post-cruise review:

• "I was thrilled with the program. ... I learned so much more at sea than I ever expected. The environment of working alongside an experienced writer provided an ideal learning opportunity. ... The combination of teaching, observation, and trial and error was wonderful."

Figure 1
From left to right: R. Gentry, K.M. Kusek, R. Pedersen and I. Thorseth on the G.O. Sars.

• "I am entering Journalism School with a lot more confidence both in my abilities and in my career decision [to work in the science communications field]."

• "I got a great head start on skills that I will learn in formal journalism school (writing, editing, note-taking, interviewing, etc.) but more importantly I had a strong introduction to those skills that can only be learned through experience."

• "The ocean was a perfect learning environment because the work is intense but there are fewer distractions from the outside world. ...I loved working in the field."

More about the Project

The Science Writer-at-Sea program is one small step in a marathon need for improved coverage of science and environmental issues. It targets two significant links in the Earth science communication pipeline: marine scientists and journalists; and attempts to (re) connect people with the Earth by boosting their understanding of Earth science and its relevance to society. Student science writers are offered a sort of 'boot camp' training experience: they are first prepared with materials I've collected based on years of teaching science writing and at-sea reporting experience, and then immersed in the at-sea research environment. The students research and write innovative journalistic stories for a general audience that are featured on a uniquely designed website that includes videos and images. The science, journalism and public communities benefit: science research is effectively showcased on the website, scientists benefit from interactions with journalists, science outreach objectives are accomplished; student journalists enjoy a unique hands-on learning experience; and the website enhances public understanding of 'real' Earth science reported 'on scene at sea.' Learn more by visiting http://www.interridge.org/sciencewriteratsea/Norway2005/index.html. Have a cruise with berth space so we can do this project to showcase your research? Have an idea for a partnership? Have thoughts you want to share? Let us know what you think!
(Email kristenkusek@aol.com or coordinator@interridge.org).

KRISTEN M. KUSEK

Education and Outreach - Promoting Ridge Science in India.

Following the InterRidge Workshop "Tectonic and Oceanic Processes Along the Indian Ocean Ridge System" held in Goa, January 2005, Rajendra Drolia from the National Geophysical Research Institute, Hyderabad offered to show the film "Voyage into the Abyss" (this is a Future Vision educational program endorsed by InterRidge and can be downloaded from the IR website) at schools and universities to help promote ridge science in the Indian community on behalf of InterRidge.

In July 2005, he was able to screen the film at the Geology Department, Kumaun University, Nanital and at a few public as well as private schools in Nanital (Figure 1).

This was a huge success and there was good response from the research community as well as the approximately 2000 school children that viewed the film (Figure 2). It was an experience especially for the Indian school children to view such a film and although language - the film as in English - posed a problem, this was resolved by Rajendra Drolia giving a running commentary in Hindi (Figure 3). Drolia and the schools' teachers organized a short 'quiz' after the film in which the students fared well which showed that they were able to understand the content of the film.

छात्रों को दी भूगर्भीय घटनाओं की जानकारी

नैनीताल। मोहन लाल साह बालिका विद्या मंदिर में आज राष्ट्रीय भू-भौतिकीय अनुसंधान संस्थान हैदराबाद के उप निदेशक डा. आरके ड्रोलिया ने प्रेक्षागृह में समुद्र की अथाह गहराइयों में होने वाली घटनाओं की जानकारी दी। श्री ड्रोलिया ने विद्यार्थियों को मध्य समुद्रीय कटकीय वातावरण में समुद्रतल से चार हजार मीटर नीचे पनपने वाले जीवों के बारे में विस्तृत जानकारी दी। उन्होंने इंटररिज (जर्मनी) द्वारा तैयार समुद्र विज्ञान पर आधारित फिल्म भी विद्यार्थियों को दिखाई। डीएसबी परिसर भू-विज्ञान विभाग के प्रो. चारु पंत ने भू-विज्ञान व भू भौतिकी के अध्ययन की महत्ता व उपयोगिता के बारे में छात्राओं को बताया। कार्यक्रम में डा. एचबी त्रिपाठी, डा. संतोष कुमार, डा. अजय पाल, प्रधानाचार्या सुनीता साह, एमसी साह, महेश चन्द्र साह सहित विद्यालय की छात्राएं उपस्थित थीं। ब्यूरो

Figure 1
Local Newspaper clipping of the screening event.

Figure 2
More than 2000 school children saw the film - as can be seen, this screening had a full house!

Figure 3
Drolia explains to the students how a ridge scientist reaches the ocean floor and the various stages of deploying a submersible.

Drolia plans to screen the "Voyage into the Abyss" film during his proposed visit to Manipur and some parts of northeastern India in October 2005.

RAJENDRA DROLIA

"Voyage into the Abyss" is a Future Vision education program endorsed by InterRidge, please contact the InterRidge office if you would like more information.

FUTURE VISION
Educational Media Group

OTHER INTERRIDGE NEWS

InterRidge Workshop "Tectonic and Oceanic Processes along the Indian Ocean Ridge System".

19 – 21 January 2005, N.I.O., Goa, India

Summary

The InterRidge Workshop on "Tectonic and Oceanic Processes along the Indian Ocean Ridge System" was held at the National Institute of Oceanography, Dona Paula, Goa, India from 19 to 21 January, 2005. The workshop was well attended by participants from 10 countries (Figure 1) and covered all ridge research aspects in eight technical sessions. There were 10 special talks, 24 oral presentations and 18 poster presentations. Apart from the technical sessions, a special interactive talk was devoted to the recent seismic event that took place off Sumatra and generated a tsunami. On the second day of the workshop a film on "Volcanoes of the Deep Sea" was screened. Members of the public were also invited resulting in a full auditorium and therefore a successful outreach event. Panel discussions were held during the concluding session of the workshop, which brought out opportunities for forging collaboration among ridge researchers across the world.

The workshop was organized with financial help from the Council of Scientific and Industrial Research, InterRidge and Ridge 2000 Program, USA.

Background

The Council of Scientific & Industrial Research (CSIR), India, in association with the Department of Ocean Development, Government of India, initiated a Network Programme "Tectonic and oceanic processes along the Indian Ridge system and Back Arc Basins", to investigate the mid-ocean ridge system and the backarc basins in the Indian Ocean. The National Institute of Oceanography, Dona Paula, Goa and the National Geophysical Research Institute, Hyderabad, both constituent laboratories of the CSIR, are implementing this interdisciplinary programme. India, an associate member of InterRidge proposed to organize a workshop on "Tectonic and Oceanic Processes along the Indian Ridge System" to provide a forum for ridge researchers worldwide to exchange

ideas and results and foster collaborations. The proposal was considered and accepted as an InterRidge workshop during the 2003 InterRidge Steering Committee meeting held at Tokyo, Japan.

Workshop objectives

- To focus on the geological, geophysical, physical, chemical and biological processes along the Indian Ocean spreading centers
- To provide a forum for exchange of ideas and results
- To encourage international collaboration in exploration of Indian Ocean ridge research using latest tools and techniques.

K.A. Kamesh Raju and Abhay Mudholkar

Figure 1
Group photograph of the workshop participants.

InterRidge Workshops and Outstanding Student Poster Awards for 2005.

With three workshops and a field school and trip to Cyprus, InterRidge had a busy but very exciting year in 2005. The enthusiastic attendance of all these activities by so many scientists from different nations indicates that ridge-related science is thriving. The good news is that the number of young scientists and scientists-to-be is thriving too.

In 2001, the InterRidge steering committee decided to encourage students involved in ridge research by awarding Certificates of Excellence and prize money to best student poster presentations at InterRidge meetings. This year, InterRidge outstanding student poster awards were presented at two meetings - the InterRidge workshop "Tectonic and Oceanic Processes Along the Indian Ocean Ridge System" held in Goa, India, and the 3rd International Symposium on Hydrothermal Vent and Seep Biology, held in La Jolla, California, USA.
Congratulations to all the students!

Both student award winners of the 2nd International Symposium on Hydrothermal Vent and Seep Biology held in Brest, France, 2001 were present at the 3rd Symposium, and Jason Flores, agreed to contribute to this Newsletter to show what happened to one of the past winners!

InterRidge was also able to help subsidize 7 students to participate in the Troodos Ophiolite field school or trip to Cyprus in May (see pictures on page 49). This was a great, hands-on learning experience for all, thanks to Professor Joe Cann and his team of experts!

Katja Freitag

InterRidge Outstanding Student Poster Awards 2005	
InterRidge Workshop "Tectonic and Oceanic Processes Along the Indian Ocean Ridge System"	
"Manganese oxidation by bacterial isolates from ridge ecosystems"	Sheryl O. Fernandes, et al. (India)
"Processing and presentation of multi-beam echosounder data on Carlsberg and Central Indian ridges, Indian Ocean"	K. V. Anoop (India)
"An overview of basalts and gabbros along the Northern Central Indian Ridge"	Dwijesh Ray (India)
Honourable mentions were given to B. V. Bhaskar and K.P. Krishnan, both from India	
The panel of judges were Colin Devey (Germany), Charles Fisher (USA) and C. Subrahmanyam (India)	
3rd Symposium on Hydrothermal Vent and Seep Biology Scripps, California, USA, September 2005	
"Functional Genome Analysis of the Bacterial Endosymbiont from the Deep Sea Tube Worm Riftia Pachyptila"	Stephanie Markert et al. (Germany)
"Protein synthesis and expression patterns in Deep Sea Bathymodiolus Mussels"	Dijanna Figueroa (USA)
Honourable mentions were give to Mathis Stoeckle (Canada), Diane Poehles (USA), Carol Logan (USA) and Julius Csotonyi (Canada)	
The panel of judges were Rich Lutz (USA), Craig Cary (USA), and François Lallier (France)	

WHAT HAPPENED TO JASON FLORES? - winner of an InterRidge outstanding student poster award in 2001.

At the 2nd International Symposium on Hydrothermal Vent Biology, I was one of two winners of the inaugural InterRidge Best Student Paper Award. At that time I was beginning my third year of Ph.D. research under Chuck Fisher at Penn State University (USA). It was my first major conference award and gave me great motivation to move forward with my research. It also helped me to realize that people were actually paying attention to what I was doing and what I had to say (probably a common discovery of graduate students everywhere). The certificate from InterRidge still hangs in my office (right next to my Alvin dive certificate) and the awarded money helped to cover expenses from the trip to Brest, France for the Symposium. In the years since the 2nd Symposium, I was awarded a fellowship from the Alfred P. Sloan Foundation that helped fund the final two years of my research and writing at Penn State. I was also able nominated to serve on committees within my university that guided the graduate student recruitment process within my department, protected the rights of underrepresented minorities and promoted their involvement in the sciences. In 2003, my wife, Tonya, and I celebrated the birth of our daughter Marisa (in Latin this translates roughly to Lady of the Sea). She is two years old now and keeps us very busy. She already has a keen interest in animals (I wonder why?) and ran around for two weeks telling random strangers that she held an earthworm.

I recently finished my Ph.D. work at Penn State (Sulfide acquisition by deep-sea hydrothermal vent tubeworm hemoglobins) and have moved on to a post-doctoral position at the University of North Carolina at Charlotte where I study oyster physiology. I work in the lab of Dr. Inna Sokolova whose group is interested in the effects of pollution and temperature change on various invertebrate species. I have gotten out of vent and seep research and into research on near shore environments partly because I wanted to broaden my knowledge base and partly because of the funding and employment situation in the U.S. I also changed fields because I would eventually like to end up at a small college or university where undergraduate research and teaching is more of a focus. In this direction, I believe that I will have a larger impact on young science students and will eventually be able help increase minority involvement in the sciences.

Thanks to InterRidge and RIDGE 2000 as well as the organizers of the 2nd and 3rd International Hydrothermal Vent and Seep symposia for putting together great conferences in Brest and San Diego. I would like to pass along my congratulations to this year's winners of the Outstanding Student Poster Awards. There were many great student talks and posters in San Diego (see picture above) and I know the selection must have been difficult. I wish you all success.

JASON FLORES

"It was a very precious experience to look at geological structures beneath the ocean floor with my own eyes. I was also very happy to meet many people, to stay at a good hotel, and to eat nice food. I hope to look around more outcrops if possible".

TETSUO MATSUNO (Geophysics Student)
Graduate School of Science and Technology, Kobe University, Japan

Professor Joe Cann on the outrcrop in Cyprus (above) and a group photo of the Troodos Ophiolite field trip participants in a mined out massive sulfide open pit (right)!

World Ridge Cruise Schedule 2005/2006

Country	P.I.	Cruise ID/Location	Research Objectives	Ship	Dates (Ports)
Germany	C. Devey, K.S Lackschewitz	METEOR 62/5 MAR 4-11°S	Investigations using side-scan sonar, ROV, MARP, CTD, YoYo	FS Meteor	9 Nov-30 Dec 04 Recife to Walvis Bay
USA UK	C. German	CD 169 to the MAR 0-12°S	Study of geophysical controls of, and biogeochemical cycling at Sth MAR hydrothermal fields using TOBI, BRIDGET and ABE	RRS Charles Darwin	Feb-Mar 05 C. Verdes-Tenerife
China USA	S. Guo (COMRA) J. Lin (WHOI)	East Pacific Rise at 13°N and 1°N-3°S	Investigation of hydrothermal processes using Deep-tow side-scan and magnetics, MAPRs, rock and biological sampling	R/V DaYangYiHao (Ocean #1)	31 Aug-8 Oct 05
Germany	K. Haase	METEOR M64/1 MAR at 4° - 11° S	Investigations using ROV, TV-grab and dredging	FS Meteor	2 April-3 May 05 Abidjan -Fortaleza
Germany	H. Villinger	METEOR M64/2 MAR at 15°N	Investigations using ROV, TV-grab, CTD, as well as taking compliance measurements	FS Meteor	6 May-6 June 05
France Portugal	S. Singh, W.C. Crawford	SISMOMAR	Study of Lucky Strike Volcano and it's context in the magmatic supply and history of the Lucky Strike segment using seismic reflection, refraction and seafloor compliance measurements.	R/V l'Atalante	24 May-27 June 05
Japan	K. Okino, Y. Ohara	KH05-1 Hakuhou-maru cruise, Legs 3 & 5 to S Parece-Vela Basin	Geophysical mapping and dredging	Hakuhou-maru	15-27 June 05 (Leg 3) 17-31 July 05 (Leg 5)
France Portugal USA	J. Goslin	MAR near Azores	Deployment of 2 autonomous hydrophones to the S and WNW of the Azores. Together with 2 other instruments re-deployed further S (R/V Knorr, June 2005), these will monitor regional seismicity of the MAR around the MOMAR area.	M/V Archipelago University of the Azores, Horta	20-27 July 05
Norway	R. Pedersen, I.H. Thorseth	Mohns Ridge	1) map, sample a hydrothermal field located at the W Mohns Ridge using ROVs, 2) deploy a seismograph on N tip of Jan Mayen, 3) map parts of S-most Knipovich Ridge segment using multibeam echo sounders. The InterRidge "writer-at-sea" program was trialed on this cruise!	G.O. Sars	15 July-7 Aug 05
Japan	H. Masuda	YK05-09 Yokosuka/ Shinkai6500 cruises Leg 2 S. Mariana Trough, Philippine Sea (12°100'N~13°20'N, 143°30'E~143°50'E)	Temporal and spatial variation of hydrothermal and associated microbiological activities on and around the spreading ridge of the Mariana backarc basin.	Yokosuka/Shinkai6500	23 July-10 Aug 05 Apra, Gruam to Yokosuka, Japan
Germany	C. Devey (IFM-GEOMAR)	Poseisdon POS-326 / off Iceland (Tjörnes FZ)	Mapping and sampling young volcanic rocks of Tjörnes Fracture Zone using ROV Cherokee, wax corer, dredge and multibeam	R/V Poseidon	14-22 Sept 05 Akureyri to Akyreyri

WORLD RIDGE CRUISE SCHEDULE 2005/2006 (CONT.)

Country	P.I.	Cruise ID/Location	Research Objectives	Ship	Dates (Ports)
Russia	A. Sagalevich	3 MAR areas: Rainbow, Broken Spur and Lost City	Geochemical and biological studies of MAR hydrothermal fields, petrology studies of igneous rocks associated with these fields	R/V Akademik Mstislav Keldysh	18 Aug-18 Sept 05 St.John's, Canada to Kaliningrad, Russia
China	S. Guo (COMRA)	MAR at 14°N	Investigate hydrothermal processes through rock and biology sampling	R/V DaYangYiHao	10 Oct-18 Sept 05
Japan	N. Seama	KR05-17 Kairei Cruise Mariana Area	OBEM deployment + Geophysical mapping	Kairei	10-28 Dec 05
China	S. Guo (COMRA)	Southwest Indian Ridge	Investigation of hydrothermal processes using deep-tow side-	R/V DaYangYiHao	22 Nov 05-8 Jan 06
USA	J. Lin (WHOI)	at 50-70°E	scan and magnetics, MAPRs, rock and biological sampling		
Japan	H. Kumagai	YK05-14 Yokosuka cruises near Rodriguez Triple Junction	Geological and geophysical approaches	Yokosuka (15 Shinkai dives)	12-26 Jan 06
Germany	T. Kuhn (IFM-GEOMAR)	HYDROMAR IV/Logatchev Hydrothermal Field at MAR 14°45'N	Carry out shallow drill holes (15m) in sulfide mounds using BGS Rockdrill 2	R/V Maria S. Merian	22 April-16 May 06 Cadiz, Spain to Lisbon, Portugal
Germany	A. Koschinsky	M68/1, MAR at 4° - 11° S	Hydrothermalism on the southern MAR as part of the SPP 1144 program; investigations with ROV, AUV and TV grab	FS Meteor	May/June 06 Barbados - Recife
France	J. Goslin	MARCHE (MAR Comprehensive Hydophone Experiment) cruise	Deploy 8 autonomous hydrophones in the SOFAR channel on both flanks of the MAR to achieve long-term monitoring of seismicity of the Ridge between 31°N and 50°N. Turned-over of 4 previously moored instruments. 4 additional instruments will be moored N of the Azores, extending length of acoustic data time-series obtained during Sirena experiment (May 02-Sept 03).	R/V Le Suroit	3-24 April 06 Brest to Ponta Delgada
Japan	K. Takai	YK05-15 Yokosuka cruises near Rodriguez Triple Junction	Microbiological and geochemical approaches	Shinkai 6500 15 Shinkai dives	10 Feb-7 Mar 06
Japan	K. Tamaki	Central Indian Ridge		R/V Hakuho-moru	2006

If you are planning a ridge- or back-arc basin related cruise, please send the InterRidge office (coordinator@interridge.org) these details so that the InterRidge cruise schedule and cruise database (www.interridge.org) are kept updated.

CALENDAR OF SPREADING CENTER-RELATED EVENTS 2005/2006

26 - 27 Oct 2005	**Royal Society Meeting on Extreme Natural Hazards** *London, UK*
30 Oct - 2 Nov 2005	**Ridge 2000 Progress and Planning Meeting** *Vancouver BC, Canada*
5 - 9 Dec 2005	**AGU Fall Meeting** *San Francisco, California, USA*
	INTERNATIONAL POLAR YEAR
16 - 20 Feb 2006	**AAAS (advancing science, serving society) Meeting** *St. Louis, Missouri, USA* *Hosting a scientific session - a FIRST for InterRidge*
20 - 24 Feb 2006	**Ocean Sciences Meeting** *Honolulu, Hawaii, USA*
April 2006	**Arctic Ridge Meeting and Workshop** *to be announced*
2 - 7 April 2006	**EGU General Assembly** *Vienna, Austria*
May 2006	**USSSP – InterRidge – Ridge2000 Joint Workshop on the Evolution of Oceanic Lithosphere** *West coast, USA*
June 2006	**InterRidge Steering Committee Meeting** *Moscow, Russia*
19 - 23 June 2006	**Minterals of the Ocean – Future Developments - 3** *St. Petersburg, Russia*
9 - 14 July 2006	**11th International Deep-Sea Biology Symposium** *Southampton, UK*
15 - 19 July 2006	**EuroScience Open Forum** *Munich, Germany*
4 - 10 Aug 2006	**5th International Symbiosis Society Congress** *Vienna, Austria*
7 - 8 Nov 2006	**2nd International Young Scientists' Global Change Conference** *Beijing, China*

More details on the following and new meetings can be found at

www.interridge.org

Royal Society Meeting, London
26 and 27 October 2005

EXTREME NATURAL HAZARDS

Organised by Professor Herbert Huppert FRS and Professor Steve Sparks FRS This meeting will focus on extreme geophysical and astrophysical hazards, including earthquakes, super volcanic eruptions, tsunamis, near Earth Objects and giant landslides. Internationally-renowned speakers will discuss the frontiers and challenges in the science of extreme natural hazards as well as related topics such as prediction, forecasting, monitoring and technological innovations. The meeting will assess the role of the international scientific community and how these efforts can be better co-ordinated, integrated and funded to improve the ability to anticipate and mitigate the effects of extreme events. Issues of the accessibility of relevant science to poor nations with limited scientific infrastructure and expertise will also be discussed.

For more information, programme and to register visit: www.royalsoc.ac.uk/events

The Royal Society
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Preliminary announcement

USSSP – InterRidge – Ridge2000 Joint Workshop on the Evolution of Oceanic Lithosphere

Ridge 2000 and the US Science Support Program for IODP, with additional support from InterRidge, have agreed to jointly fund this international workshop. Discussions with other national and regional IODP "ridge" science programs are underway. Interested scientists are encouraged to contact their national program representatives.
The overall objective is to enunciate and prioritize scientific problems concerning the formation and evolution of the oceanic lithosphere that can be achieved by IODP using available technology. A key objective will be to identify areas/problems that overlap the objectives of IODP with those of InterRidge and the national "ridge" programs such as Ridge 2000 and MOMAR.
Our tentative plan is to hold the workshop on the US west coast for 3 days in the first two weeks of May 2006.
Comments and volunteers are welcome.

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MINISTRY OF NATURAL RESOURCES OF THE RUSSIAN FEDERATION - RUSSIAN ACADEMY OF SCIENCES - VNIIOKEANGEOLOGIA - RUSSIAN FOUNDATION FOR BASIC RESEARCH

International Conference

MINERALS OF THE OCEAN – FUTURE DEVELOPMENTS-3

19-23 June, 2006, St. Petersburg, Russia

During past decades, marine investigations have elaborated a vast number of theoretical and practical approaches in prospecting of mineral resources, such as massive sulfides, ferromanganese crusts and nodules, phosphorites and gas hydrates. New results using well-known methods, new ideas and strategies, and previously unsolvable problems will be the main themes of the Conference, where the international community of marine geologists are welcome to discuss the most cogent questions posed by the unique occurrences of marine mineral deposits.

SUGGESTED TOPICS (OTHER TOPICS ARE WELCOMED TO BE PROPOSED)

Hydrothermal deposits	Ferromanganese Oxide and Phosphorite deposits	Gas hydrates
- geochemical indicators of hydrothermal plumes	- geodynamical (tectonic) analysis of ocean floor	- methods of exploration (seismic, side-scan profiling, etc)
- vent fluids; influence of phase separation on hydrothermal mineralization	- morphostructural analysis of seamount surfaces	- appraisal of size based on a integrated methods
- petrochemical characteristics of massive sulfides hosted rocks	- geochemical exploration	- methods of recovery
- geochemistry and mineralogy of sediments as indicators of sulfide mineralization	- methods of exploration (incl. drilling)	- economic evaluation of deposit
- geochemistry and mineralogy of hydro-thermal deposits	- age of host rocks and deposits	MAIN DATES & DEADLINES Registration Form: 1 February, 2006 Abstracts: 1 April, 2006 Distribution of Programme with the list of participants and invitations – after 1 May, 2006
- evolution of marine hydrothermal systems over a time	- quantification of deposit types, grade, and tonnage	
- new methods of hydrothermal deposits exploration	- physical and chemical properties of the water column	
	- mechanisms of incorporation of metals	

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International Symbiosis Society
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4 - 10 august 2006 - vienna, austria
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symbiosis teaching workshop
symbiosis definitions and directions panell discussion
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web site www.isscongress2006.com
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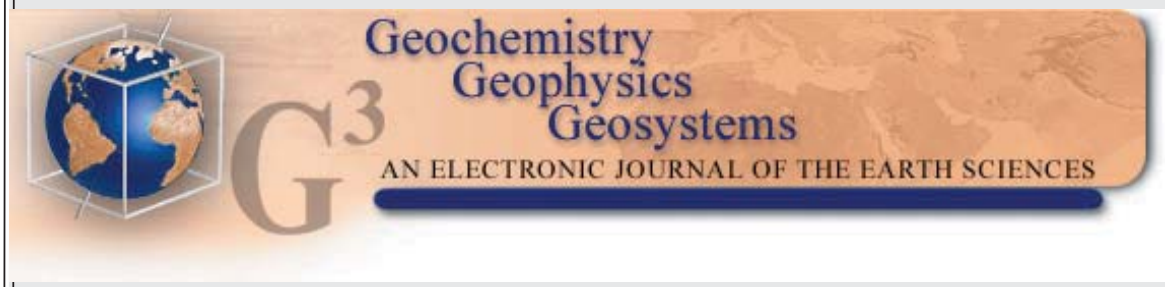

NEW G-CUBED THEME ENTITLED

"FORMATION AND EVOLUTION OF OCEANIC CRUST FORMED AT FAST SPREADING RATES"

BY G-CUBED THEME GUEST EDITORS DAMON A. H. TEAGLE AND DOUGLAS WILSON

Continuous sections of the ocean crust are essential to improve our knowledge and understanding of the magmatic, hydrothermal, and tectonic processes that occur during the accretion and maturation of the oceanic basement. G-cubed's latest theme "Formation and Evolution of Oceanic Crust formed at Fast Spreading Rates" is focused on, but not restricted to, studies of 15 Ma-old ocean crust formed at the East Pacific Rise recently drilled at Site 1256 during ODP Leg 206 and to be further cored on IODP Expeditions 309 and 312 (July - December 2005). This 3-leg campaign will provide the first continuous in situ sampling of ocean crust from the extrusive lavas, though the sheeted dikes and down into the uppermost gabbros. It will provide the first links between gabbro and overlying lava chemistries, test the postulated spreading rate dependence of the depth to axial low velocity zones imaged by multi-channel seismic experiments, provide important calibrations of seismic layering and critical samples to establish the origin of marine magnetic anomalies. We welcome all relevant geological, tectonic, geophysical, and geochemical studies of the ocean crust formed at fast spreading rates, from Site 1256 and elsewhere.

This theme is now open to new manuscript submissions.
Authors wishing to submit manuscripts should do so via the G-cubed submissions website:
http://gcubed-submit.agu.org/

proposed closing date - June 2008

(Authors are encouraged to contact the editors directly to discuss new submissions to the theme in advance of submitting papers to the above website. Damon A. H. Teagle -dat@noc.soton.ac.uk; Douglas Wilson -wilson@geol.ucsb.edu)

To find out more about G-cubed, visit the website at http://www.agu.org/journals/gc/
This site provides instructions and much additional helpful information to authors -- please read carefully before making your submissions to the submissions website.

IODP Web Portal Relaunched

The Integrated Ocean Drilling Program web site has a completely new look and feel. The newly designed site features new content and links, including links to numerous IODP national offices and program partners, a news/media center, a page for new subscribers to the IODP-MI e-newsletter, access to program information generated in Japan, Europe, and the U.S., and an integrated, hyperlinked calendar for IODP events, meetings, expeditions, and other program elements. Ongoing web development will result in a powerful search engine that will enable visitors to locate IODP scientific papers, scientists, and program elements globally.

To visit the new site, go to www.iodp.org.

The newsletter subscription link is on the home page, bottom right. Sample newsletters are at News/Media.

IFM-GEOMAR
Leibniz-Institut für Meereswissenschaften
an der Universität Kiel

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THESE ERRORS HAVE BEEN CORRECTED IN THE ONLINE VERSION OF InterRidge NEWS

Please note the changes to the figure captions for the article "Active source electromagnetic survey of hydrothermal venting areas at the Saldanha Massif, Mid-Atlantic Ridge - the CD 167/2004 cruise.", Dzhatieva et al. (pages 12 and 13 respectively):

Figure 1
CD167 multibeam bathymetry with controlled-source electromagnetic survey map. Ocean bottom receivers continuously record horizontal electric field as the time series, while Deep-towed Active Source Instrument (DASI) transmits wave signal for frequency-domain sounding. Lines are DASI tows completed; signs - positions of ocean bottom receivers.

Figure 2
Spectrogram for the approx. two-day recording of one of the Low-frequency ElectroMagnetic Underwater Recorders (LEMUR) presents a good signal to noise ratio. The large peak at about 339 dataset occurred when DASI was transmitting along line AA at 0.25 Hz on 13 December. There is some background noise, believed to be caused by both internal and external noises. The scale corresponds to the electric field amplitude.

Coordinator report – somehow it slipped in! The 30th anniversary of the discovery of vents was in 2007!

An additional cruise has been added to France's national report (Table 1):
Marche to the MAR, PI is J. Goslin.

The China-USA cruise (PI's S. Guo, COMRA and J. Lin, WHOI) to the East Pacific Rise at 13°N and 1°N-3°S did not take place from 9 Jan-10 April 05 (page 50, cruise schedule). The correct dates are 31 Aug-8 Oct 05. This has also been corrected in the online cruise database.

Last Errata Update: 18 Nov 2005

REMINDER
The Deadline for InterRidge News
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