With recent advances in deep-sea technology, research on mid-ocean ridges has flourished and there is now an international body, InterRidge, to help coordinate it. *The Marine Scientist* spoke to **Stace Beaulieu** from InterRidge to find out the latest developments in the world of mid-ocean ridge research

Dr Stace Beaulieu working in the coldroom on the *RV Atlantis*

Keeping an eye on the deep-sea

What is InterRidge?

InterRidge is a non-profit organisation that promotes international, interdisciplinary studies of oceanic spreading centers. Our mission is to create a global research community, plan and coordinate new science programmes that no single nation can achieve alone, exchange scientific information, and share new technologies and facilities. We provide a unified voice for ocean ridge researchers worldwide. We also encourage communication between scientists, nonscientists, educators, and policy-makers, and we spearhead education and outreach efforts to raise awareness of the oceanic ridge environment.

InterRidge currently has 30 National and Regional Members and approximately 2500 individual member scientists from a total of 61 countries. For 2007 - 2009, the InterRidge (IR) programme office is hosted at the Woods Hole Oceanographic Institution (USA) and is led by a multi-disciplinary team: Jian Lin (IR Chair, marine geophysics/ geodynamics), Chris German (IR Co-Chair, geochemistry /hydrothermal activity), and Stace Beaulieu (IR Coordinator, deep-sea biology).

Why did you set up InterRidge?

InterRidge was formally established in 1991. The event that sparked the birth of InterRidge occurred when research vessels from two countries happened to visit the same spot on the ocean floor using the same resource and labor-intensive tools. Clearly it makes better sense to coordinate and share resources, so to avoid a similar situation happening again InterRidge was formed.

InterRidge remains anchored by the principle of collaboration: it is an international organisation that pools the resources of its member countries to drive oceanic ridge research forward in a way that is cost-effective, cooperative, and proven to be successful.

"Our mission is to create a global research community, plan and coordinate new science programmes that no single nation can achieve alone..."

What do you think is the secret to running a successful international 'umbrella' organisation such as InterRidge?

Communication and coordination are two strengths of the InterRidge organisation. The structure of the IR organisation includes the IR office (Chair, Co-Chair, and Coordinator), the IR Steering Committee (representatives from the Principal and Associate Member Nations), the IR Working Groups (member scientists who lead international research initiatives), the IR correspondents (representatives from all National and Regional Members), individual IR member scientists, and IR e-mailing lists. So everyone is aware of what is going on at all levels of the organisation.

The IR office serves as an information hub, organizing the Steering Committee meetings, helping the Working Groups, preparing an annual Newsletter for broad distribution, posting biweekly e-news, and administering daily the IR website.

The tubeworm *Riftia pachyptila* at the "Tica" vent site at the East Pacific Rise, 9 degrees North study area. The tubeworm cluster is surrounded by fresh basalt from an eruption that occurred in late 2005/ early 2006
Photo credit: Stace Beaulieu, WHOI

One of your aims is to encourage the protection and management of the oceanic ridge environment – have you had any tangible successes in this area, and what more could be done?

In 2006 InterRidge published a *'Statement of Commitment to Responsible Research Practices at Deep-Sea Hydrothermal Vents'* that was signed by the IR Steering Committee and Working Group Chairs. The statement was presented in 2006 at the AAAS Symposium (USA) and the Euro-Science Open Forum (held in Germany). The six guidelines for responsible research were also published in *'Oceanography Magazine'* in 2007 (Devey, C.W., Fisher, C.R., and Scott, S. "Responsible science at hydrothermal vents" Vol. 20, No. 1, p. 162-171). The guidelines were also presented at the 2007 United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea and recent presentations have also been given at scientific meetings in Brazil (November 2007) and South Korea (June 2008).

The guidelines were the result of years of discussion amongst InterRidge members, in particular spearheaded by members of the Biology Working Group. Some of the earlier efforts included a workshop that InterRidge co-sponsored in 2000 for 'Management and Conservation of Hydrothermal Vent Ecosystems', held in Canada and organized by a committee composed of biologists, geologists, and marine policy experts from InterRidge member countries.

The Mid-Atlantic Ridge is one of the earth's largest undersea mountain ranges at a length of nearly 6,200 miles. The dots represent active hydrothermal sites
Credit: University of Washington

From a geological perspective, what do you think are the highlights of what we have learned about mid-ocean ridges in the past 10 years?

There have been two major advances in geological understanding of ridge systems in the past decade, that I would like to highlight. Both have implications for hydrothermal circulation. First, under the general subject of earthquakes and seismic events, we have observed the close interplay between earthquake swarms, faulting, and changes in hydrothermal circulation. In particular, observations have been made at fast — and intermediate — spreading ridges in the eastern Pacific.

Second, under the general subject of volcanism, we now know that there is a way of generating oceanic crust entirely different than the eruption of basalt at the seafloor. At ultraslow and slow-spreading ridges, large sections of the earth's mantle may be exposed during detachment faulting, for example at the Mid-Atlantic Ridge.

In 2000, a serpentinite-hosted hydrothermal field (Lost City) was discovered just off-axis from the Mid-Atlantic Ridge. These detachment faults may also host sulfide fields, and such hydrothermal deposits were not expected at slow-spreading ridges. IR has played a critical role in studies of ultraslow spreading ridges, in particular, promoting the first mapping and sampling of the Gakkel Ridge under the Arctic Ocean, as well as in promoting multinational studies of the Southwest Indian Ridge[1].

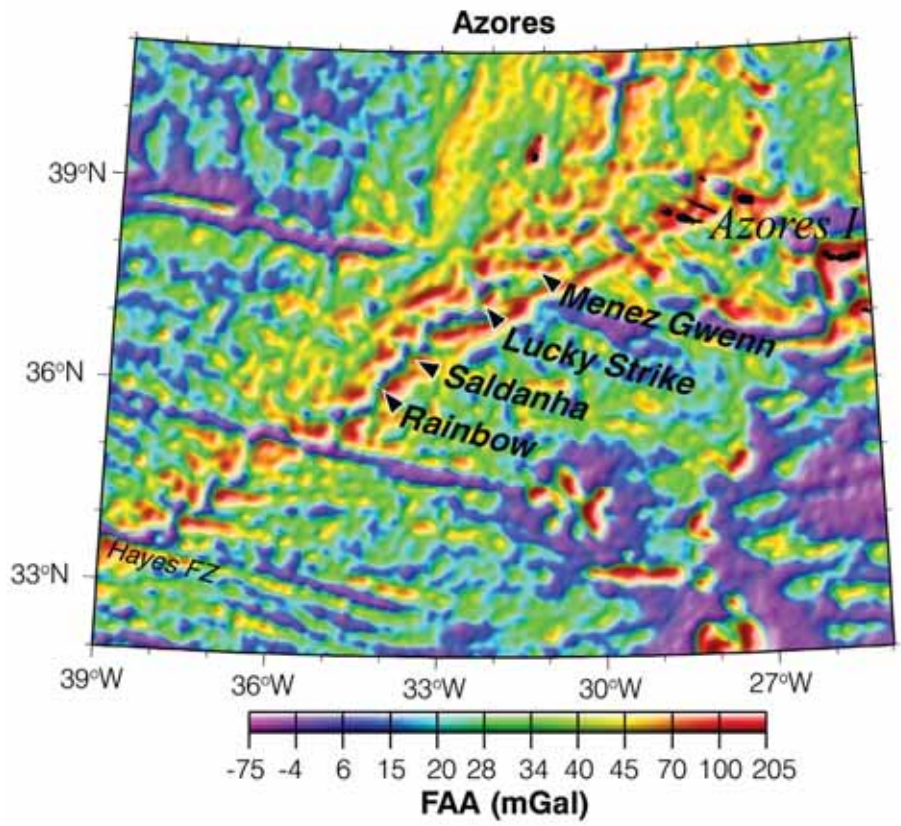
What do you think are the key questions that remain to be answered about hydrothermal vent communities?

Due to the remote nature of hydrothermal vent habitats, scientists have only been able to obtain intermittent observations of vent communities. Many questions remain as to temporal changes that occur as a new vent site is colonized, a vent community is established, and eventually senesces or is literally 'paved over' by a new seafloor eruption.

The development of *in situ* technology, such as the use of moored sediment traps to collect settling larvae over a regularly scheduled time series, and the establishment of seafloor observatories at selected vent sites in the near future will greatly contribute to our knowledge of temporal variability in these communities. InterRidge launched a new Working Group in 2008 for Vent Ecology to address such questions. In addition, further development of in situ chemical sensors will help us better understand how organisms respond to fluctuations in vent fluid chemistry in these habitats, one of the main goals of the InterRidge Working Group on Biogeochemical Interaction at Deep-Sea Vents.

The carbonate structures at the Lost City Field include this chimney more than 10 metres in height. The white, sinuous spine is freshly deposited carbonate material. The top shows evidence of collapse and re-growth, as indicated by the small newly developed cone on its top

Credit: University of Washington/ Woods Hole Oceanographic Institution



Free-air satellite-derived gravity map of the Azores area and general location of the Menez Gwen, Lucky Strike, Saldanha and Rainbow vent fields

(www.momar.org)

How quickly are newly emerging hydrothermal vents populated by marine life?

Sometimes, the newly emerging vents are actually spewing life – microbial life from the sub-surface hydrothermal system. Scientists have called these new vents 'snow-blowers' in the eastern Pacific. In terms of the time scales for metazoan organisms (animals) to arrive at a new vent site, we have been fortunate to observe a few sites in the eastern Pacific within months of an eruption, and animals were already colonizing the sites. The time for colonization of a new site is likely to depend on proximity to the nearest active sites, because dispersal of many of these organisms occurs by transport of larvae in the water column.

Do you think scientists do enough to minimize disturbance to mid-oceanic ridges and hydrothermal vent communities?

InterRidge is just about to announce the opportunity for

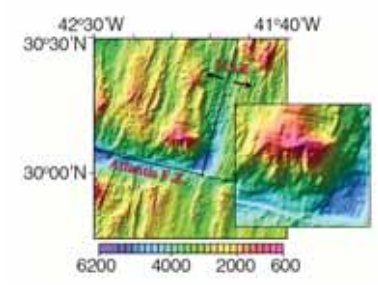
[1] Thanks to Rob Reves-Sohn (WHOI) for contributing to this answer

individual member scientists to sign onto our *'Statement of Responsible Research Practices'* discussed above. We are also involved with preparing a flier for our six guidelines that can be posted on board research vessels. One of the goals of the new Working Group for Vent Ecology is to encourage and facilitate international collaborations and sharing of samples to maximize the scientific return from the resources available to our community and minimize our collective impact on vent communities.

How do you think technology will increase our knowledge of mid-oceanic ridges in the next decade?

InterRidge strives to encourage development of technology for advancing our knowledge of ridge-crest systems. In particular, our Working Group for Monitoring and Observatories promotes the establishment of mid-ocean ridge observatories that can investigate interconnected processes from deep within the mantle to the oceanographic biosphere (and vice versa) continuously and in real-time over timescales of decades. Also as stated above, our Working Group for Biogeochemical Interaction at Deep-Sea Vents is active in developing sensors for *in situ* chemical and biological measurements.

In addition, our new Working Group for Systematic Long-Range Ridge Exploration will be involved with planning for the use of autonomous underwater vehicles (AUVs) for systematic mapping and hydrothermal exploration over long distances We envisage a particular advantage of AUVs in research operations at high latitudes, e.g., under ice in the Arctic and in difficult weather conditions in the Southern Ocean. ◎



The Atlantis Massif is west of the Mid-Atlantic Ridge and north of the Atlantis Fracture Zone. The Lost City Field is on a terrace on the side of the mountain, between 2,300 and 2,600 feet below the sea surface
Credit: Scripps Institution of Oceanography

"Sometimes, the newly emerging vents are actually spewing life – microbial life from the sub-surface hydrothermal system"

For more information see:
http://www.InterRidge.org