InterRidge Statement of Commitment to Responsible Research Practices at Deep-sea Hydrothermal Vents

Colin Devey (on behalf of InterRidge)
Leibniz Institute of Marine Sciences at the University of Kiel (IFM-GEOMAR)
Kiel, Germany

Abstract

As marine research scientists we especially appreciate the uniqueness and complexity of the deep-sea hydrothermal vent fauna and environments, and are particularly interested in preserving vents for their scientific, aesthetic, ecological, and potential economic values. In fact, because of the specialized nature of the equipment required to work at deep-sea hydrothermal vents, such as occupied and unoccupied research submersibles, scientists are the primary group of people who have the opportunity to visit these extraordinary environments. The potential for significant impact of scientific activities on a single vent site or a population of vent animals pales in comparison to the potential for disturbance by volcanic/tectonic events or industrial mining/harvesting activities. Nonetheless, we recognize that some scientific activities could adversely affect individual sites or impact communities more than is necessary, if research activities are not carefully planned and executed. In addition, because only a limited number of sites are currently known and scientists from a wide variety of disciplines frequently work at single locations, we recognize the potential for use conflicts among scientists, at sites where scientific activity is intense.

The sustainable use and protection of the oceans is best served by a fundamental understanding of complex marine systems. This understanding is only attainable through scientific research. As a result, detailed research on the oceans is an integral and necessary part of effective resource management and environmental protection. Most forms of observation and investigation of natural systems involve some disturbance of the systems being studied. In the interest of environmental stewardship, it must be the goal of research scientists to minimize disturbances as much as possible, while still gathering the information necessary both to understand the systems and to form a basis for sustainable use strategies. Therefore, marine scientists should always evaluate their research plans from a conservative standpoint, and choose the most environmentally friendly research approach.

Why are hydrothermal vent ecosystems important and different?

Hydrothermal vents are present in all of the world's oceans in areas associated with tectonic and/or volcanic activity. The most abundant and widely distributed of these are hydrothermal vents associated with deep-sea spreading centers, areas where the plates that make up the surface of the Earth are moving apart and new sea-floor is being formed. Understanding this process of plate tectonics is central to understanding the dynamics of our planet, including extreme geological events such as tsunamis, earthquakes, and volcanic eruptions. Furthermore, this process results in extreme environments that are home to high densities of specialized microbes and animals, the study of which may lead to exciting new discoveries applicable to societal needs.

Hydrothermal-vent environments are extreme for life because of the chemistry and temperature of the hydrothermal fluid, the rapid temporal changes in the fluid properties, and the extreme gradients that characterize the environments the organisms inhabit. Hydrothermal-vent environments are also very productive because of the chemical energy in the vent fluid, energy that microbes can harvest and use to reproduce, grow and thrive. As a result, hydrothermal vents are characterized by dense communities of remarkable animals that are specially adapted for life at the vents and are different from the fauna found in the surrounding deep sea. The specialized microbes that form the basis of the biological productivity at all hydrothermal vents include groups that can live in truly extreme conditions of temperature and chemistry. These include some of the most primitive forms of life on Earth. Deep-sea hydrothermal vent communities were discovered in the late 1970's and we have only begun to unravel the potential of scientific discovery contained in the fluids, microbes, and animals of these exciting, but remote, environments. Furthermore, hydrothermal vents in different areas of the world are home to different communities of animals, in the same way that the different continents are home to different groups of animals and plants. There are currently six biogeographic provinces of hydrothermal vent fauna spread around the Pacific, Atlantic, and Indian Oceans that are recognized by hydrothermal vent biologists. It is likely that additional biogeographic provinces will be discovered as additional spreading systems are explored in more remote areas of the deep sea (e.g., in the Arctic Ocean). The potential for continuing fundamental discoveries of biotechnological and perhaps medical importance is high in the fauna of these extreme environments. Continuing

study of these environments is essential to developing an understanding of the ecology of the deep sea, the limits to life, and perhaps even the origin of life.

Because of the tight coupling between the biological activity and the hydrothermal fluid, high density communities are only found in areas of active venting of hydrothermal fluid. However, active vent sites are distributed very patchily along oceanic spreading centers. Distances between active vents can be as little as a few tens of meters, but sites are often separated by as much as 100 km or more. We do not fully understand how the animals that live at vents have adapted to the long-range dispersal and colonization challenges that lead to rapid community development as soon as new vents are formed. However, their dispersal and colonization abilities contribute to a high degree of homogeneity between communities within a biogeographic province.

The presence of hydrothermal vents can be very erratic over time as well. Hydrothermal vents are a direct result of dynamic and often ephemeral tectonic and volcanic activity. Individual vents can form and then cease to be active on time scales of years. Consequently, the microbial and animal communities that the vents sustain can develop and die out on very short time scales. Over the first three decades of study after their discovery, numerous vent systems and their biological communities have been seen to develop and then cease to exist. Metapopulations of vent animals must be adapted to extreme geological events, including events that may cover a vent site in hot lava, topple a 75m tall hydrothermal chimney, or result in complete cessation of venting at a site.

Responsible Research Practices

The Primary purpose of this document is to affirm our commitment to responsible research activity at hydrothermal vents. As members of an international research community we encourage all scientists to abide by the following guidelines:

1) Avoid, in the conduct of scientific research, activities that will have deleterious impacts on the sustainability of populations of hydrothermal vent organisms.

2) Avoid, in the conduct of scientific research, activities that lead to long lasting and significant alteration and/or visual degradation of vent sites.

3) Avoid collections that are not essential to the conduct of scientific research.

4) Avoid, in the conduct of scientific research, transplanting biota or geological material between sites.

5) Familiarize yourself with the status of current and planned research in an area and avoid activities that will compromise experiments or observations of other researchers. Assure that your own research activities and plans are known to the rest of the international research community through InterRidge and other public domain data bases.

6) Facilitate the fullest possible use of all biological, chemical and geological samples collected through collaborations and cooperation amongst the global community of scientists.

We also reaffirm our commitment to open international sharing of data, ideas and samples in order to avoid unnecessary re-sampling and impact on hydrothermal vents, and to further our global understanding of these habitats for the good of all people on Earth.

For example, the international community through the Census of Marine Life program and InterRidge are developing open databases with detailed information on all available vent biological samples preserved in laboratories and museums around the globe as a resource to minimize repeat sampling of vent fauna. In addition, many national ridge programs are hosting open-access databases of geological, chemical, and biological hydrothermal vent data.

InterRidge

InterRidge is a non-profit organization concerned with promoting all aspects of mid-ocean ridge research for the benefit of all people of the world. InterRidge members realize that research on this globally distributed but remote system can only be achieved by international collaboration and cooperation.

The InterRidge mandate has four principal components:

1) To build and maintain an interactive international ridge research community.

2) To identify, through InterRidge working groups and the workshops and conferences they organize, the most compelling questions in ridge research and develop program plans to address these questions.

3) To act as a representative body for international ridge scientists in policy discussions.

4) Through education and outreach, to communicate the importance and excitement of ridge research to the general public and decision makers worldwide.

At present InterRidge is directed by a steering committee made up of representatives from 11 member nations, representing not only their own national scientists but also those from an additional 17 corresponding nations.

Colin Devey

Born and educated in England (BSc Royal School of Mines, D.Phil. Oxford), he came to Kiel, Germany as post-doc in 1988. During his time in Germany has studied hotspot and spreading axis magmatism. He became Professor for "Petrology of the Ocean Floor" in Bremen 1998 before returning to Kiel in 2004 to lead the Research Division "Dynamics of the Ocean Floor" at IFM-GEOMAR. He presently is Chair of InterRidge and leader of the German national ridge studies project "SPP1144: From Mantle to Ocean".