

The 2002 Hydrothermal Vent Science Cruise To the Mid-Atlantic Ridge System

on board *RV AKADEMIK Keldysh* and its two *Mir* submersibles
Offered by the P.P. Shirshov Institute and Deep Ocean Expeditions

June 13th to July 13th 2002

A JOURNEY TO THE EDGE OF CREATION

There are few people privileged to witness first-hand the awe-inspiring sight of an active hydrothermal vent system at the deep ocean floor. As Richard Ellis described in his book – *Deep Atlantic* "...The landscape of hydrothermal vents is one of the most amazing sights on earth. It is also one of the least-viewed directly by human eyes; from submersibles only a handful of people have ever seen the pillow lava, the black and white smoking chimneys and the hot, shimmering water of the vents..."

These vent fields are found along the length of a 40,000 mile long submerged mountain ridge that encircles the earth. It is along this mid-ocean ridge system that the earth's tectonic plates are continuously created by molten rock spewing forth from the fiery cauldrons deep in the bowels of the earth.

As well as the geological and topographic uniqueness of these fantastic areas, the fauna that has evolved around them is even more bizarre. All early theories and predictions characterized the deep-sea environment as very food-limited and sterile. So it was with great surprise that the scientific community greeted the discovery of deep-sea hydrothermal vents and their rich attendant faunas in 1977. As Cindy Van Dover stated in her book – *The Ecology of Deep-Sea Hydrothermal Vents* - "... one can hardly imagine a greater contrast to the biology of the typical soft-sediment deep sea than the terming oases of life at hydrothermal vents."

These sites are biological wonderlands of alien marine life. Vast colonies of white crabs, blind shrimps, mussels, clams and ribbon fish populate these deep ocean ecosystems. What is extraordinary is that life here survives on a chemosynthetic process rather than a photosynthetic (i.e., sun-driven) system. "These animals have one of the most stressful habitats imaginable: high pressures, no light, therefore no photosynthetic productivity; and waters laden with toxic substances. Through evolutionary changes, the vent animals met these challenges, and can tolerate and even thrive in their unusual environment." (George Somero)

As Richard Ellis concluded "... these creatures of the hydrothermal vents flourish in a pitch-black, superheated, sulfide-rich environment without any connection whatever with sunlight. They are as far removed from life as we previously understood it, as life on another planet." Prior to the discovery of the hydrothermal vents no scientist would have predicted the existence of such a parallel life system here on earth. A life system that depended on the synthesizing of hydrogen sulfide and other normally toxic chemicals would have seemed like the plot of a science fiction book or a prediction for possible life forms on other planets or other solar systems.

A dive to an active hydrothermal vent is very similar to a voyage into space. Rather than "outer space" we are journeying into "inner space" on what NASA has rightly labeled as a "mission to planet Earth". These are journeys back in time to the first cataclysmic days that saw the birth of nature on the blue planet.

Much science has been done on those worldwide hydrothermal vent systems since their discovery 35 years ago but much more remains to be done. In June and early July of 2002, the Russian research vessel *RV Akademik Keldysh* and its two deep-diving submersibles *Mir I* and *Mir II* will depart from the Azores Islands in the Mid-Atlantic on a four week voyage of scientific research and discovery at the Mid-Atlantic Ridge

hydrothermal vent system. The plan is to carry out multiple dives on 5 different vent locations and to conduct scientific observations and research at each of those.

The main scientific program will be planned and carried out by scientists from the P.P. Shirshov Institute of Oceanology and the Russian Academy of Sciences, Moscow. Dr. Anatoly Sagalevitch, a world-renowned scientist and submersible expert, will lead the science team. Scientists from other countries will also be invited to participate in a joint collaboration with the Russian science team.

What makes the Shirshov Institute programs different from other excellent deep-sea programs of different nations is the use of two deep-diving submersibles on one “mother” ship. This is a totally unique situation and provides extraordinary flexibility and opportunities that are not always available to a “one submersible” operation. One special opportunity the “two submersible” system creates is that we can offer to a very limited number (6 persons) of the general public the chance to participate in and support this scientific expedition.

The expedition fee paid by each of the general public participants will be used in its entirety to help fund the expedition. In return, the participant will be aboard *Keldysh* for the full expedition and will have the opportunity to occupy an observers’ seat on three (3) different dives to hydrothermal vents. Each person will dive on three geographically distinct vent fields so that there will be a fascinating diversity on each dive. The dives would normally last from 6 to 9 hours depending on the depth of the individual field. Also, for couples or friends it will be possible to share this experience. They can divide the three dives between themselves as long as they are willing to share a cabin on board *Keldysh*.

All dives will participate in the overall scientific and underwater imaging programs. The underwater operations will be recorded on board the submersibles using latest generation underwater video systems both for scientific and documentary purposes. All participants will receive a video for their personal use at the end of the expedition showing the work on the vent sites.

On board *Keldysh* there will be ample chance for the expedition participants to talk to and mix with the international scientific team. You will be welcome to observe technical and analytical work on deck and in the laboratories. A series of lectures and orientation briefings will be presented; there will be very much a 'learning atmosphere' on board. A specialized library of books and videotapes, with a particular focus on the deep sea in general and hydrothermal vents in particular, will be available for 'self-study'.

Remember that very few scientists have had the opportunity to dive to the spectacular and unique hydrothermal vent sites. Even fewer 'lay' persons have had this opportunity and none of them has dived to three different hydrothermal vent locations. Membership in an extremely rare and unique 'club' beckons. This expedition will appeal only to a few but they will be special human beings with a highly developed curiosity and sense of adventure as well as being driven by a desire for a unique definition of themselves. They will also feel a keen interest in supporting ocean science at its frontier. Many scientists believe that vent life systems may have been the overall cradle of life on earth and there is strong conjecture that chemosynthetic life systems may exist on other planets or moons. This expedition truly involves being at the boundaries of evolutionary life and fundamental geological processes.

This exciting program comes about through our close collaboration with the P.P. Shirshov Institute of Oceanology and the Russian Academy of Sciences, Moscow. It is their scientific expedition aboard their vessel and submersibles. The Shirshov Institute, Dr. Sagalevitch and his scientific team have kindly given us the permission to offer this very limited participation in the expedition and to select 'lay' participants/observers.

There is one other possible variation on this participation. Many 'lay' persons interested in the natural world have close personal or professional contacts with scientists. So they may wish to sponsor or support the work of a particular scientists. Therefore in our program it would be possible for our participants to pay the expedition participation fee and then divide the three dive seats between themselves and a scientist of their choosing. Any individual science program, however, would need to be reviewed and accepted by Dr.

Sagalevitch and the Shirshov Institute. Also, any resulting scientific papers would need to be co-authored with the Shirshov Institute or an individual participating Russian scientist.

Finally, It is important to remember that this will be a “full fledged” scientific expedition. Participants will be part of the expedition and the focus of the expedition will be scientific research. This is NOT a “tour”. Onboard comforts are very good and your opportunities to learn will be extensive but participate with an expedition approach in mind.

THE EXPEDITION PARTICIPATION FEE

The expedition participation fee is US\$ 55,000. The fee includes all accommodation and meals on board the *RV Akademik Keldysh*. The onboard food and comfort will be of a high standard and the ship’s normal amenities will provide pleasant diversions throughout the expedition. But most importantly, the fee includes participation as an observer on three distinct *Mir* submersible scientific dives to three different hydrothermal vent sites. The actual vent locations for each participant’s dives will be decided on a “first come, first choice” basis but will be subject to final confirmation by Dr. Sagalevitch as the head of the expedition.

However the fee does NOT INCLUDE any air tickets to or from the Azores, or internally within the Azores; hotels or meals ashore before or after the expedition; any on board accounts of a personal nature such as wines or alcoholic beverages, communication costs, personal laundry or personal tips; excess baggage charges.

Please note that all participants will be met by an expedition staff member at Ponta Delgado airport on Sao Miguel Island in the Azores and transported to *Keldysh*. The vessel will depart Ponta Delgado the evening of June 13th. The expedition will end in Pico Island, Azores on July 13th. Please review the detailed itinerary below.

THE ITINERARY:

June 13	Arrival by air at Ponta Delgado, Sao Miguel Island. Transfer to vessel. Evening depart for our voyage to the first vent site.
June 14-18	At sea
June 19	Arrival Snake Pit hydrothermal vent site. Lay navigation transponders.
June 20-22	Snake Pit hydrothermal vent site.
June 23	Snake Pit hydrothermal vent site. Evening departure to Tag hydrothermal vent site.
June 24	Morning arrival at Tag hydrothermal vent site. Lay navigation transponders.
June 25	Tag hydrothermal vent site.
June 26	Tag hydrothermal vent site. Evening departure to Broken Spur Hydrothermal vent site.
June 27	Morning arrival Broken Spur hydrothermal vent site. Lay navigation transponders.
June 28-29	Broken Spur hydrothermal vent site.
June 30	Broken Spur hydrothermal vent site. Evening depart to Lost City hydrothermal vent site.
July 01	Morning arrival at Lost City hydrothermal vent site. Lay navigation transponders.
July 02-04	Lost City hydrothermal vent site.
July 05	Lost City . Evening departure to Lucky Strike hydrothermal vent site.
July 06-07	At sea.
July 08	Afternoon arrival at Lucky Strike hydrothermal vent site. Lay navigation transponders.
July 09-11	Lucky Strike hydrothermal vent site.
July 12	Lucky Strike . Evening departure to Pico, Azores.
July 13	Morning arrival Pico Island, Azores. Participants depart for home.

From the Azores, we sail aboard the world’s largest oceanographic research vessel – the *Akademik Mstislav Keldysh* – to our first dive site, 1300 miles (2100 kms.) to the southwest. Your dive to the various hydrothermal vent sites will be made aboard either the *Mir I* or *Mir II* submersible. These are vessels capable of reaching ocean depths of 20,000 feet (6,090m). Housed aboard the *Keldysh*, the *Mirs* (meaning

'peace' in Russian) are two of only four manned submersibles in the world capable of reaching these depths.

Their pressure hulls are constructed of special nickel steel, specifically designed to withstand the enormous pressures in these ocean depths. The *Mir's* cabin compartment is seven feet (2.1m) in diameter, accommodating one pilot and two passengers. No traditional bathroom facilities exist on board however a special pre-dive diet will help keep you comfortable. A box lunch is available for a snack during your 6-9 hour dive. Air pressure inside the cabin remains at a constant one atmosphere and the air is recycled in a manner similar to that used on board spacecraft.

Prior to your dive day, there will be a special orientation briefing and an on-deck visit to the inside of one of the *Mirs* to fully acquaint you with your 'innerspace ship'. In addition, the *Mir* support staff and other on board experts will be always available to answer your questions about the dive and operations of these unique submersibles.

THE DESCENT

Following a pre-dive briefing, you'll enter the submersible, then the *Keldysh* on-board crane will lift the *Mirs* into the ocean. They usually dive about an hour apart. After pre-dive testing, ballast water will be pumped into the tanks and you'll begin your descent at a rate of 100 feet (31m) per minute. Three view ports, each seven inches thick will be your windows to this undersea world. By 800 feet (245m) all traces of sunlight will be gone and you will be immersed in total darkness. To conserve power, the *Mir* submersibles descend without external lights. However the pilot will at times switch them on to observe passing marine life. Even in the darkness, the ocean is alive. Be sure to look for tiny bioluminescent creatures, whose glowing characteristics require no lights to be seen. By 4,000 feet (1,220m) the interior of the *Mir* will start to cool and you may want to don extra clothing. Topside the *Keldysh* (only occasionally out of voice contact) will help navigate the *Mir* to the vent field 7,875 feet (2,400m) below the ocean surface. Every dive is a working dive so your deep dive observations will provide valuable data for the on-board research scientists.

OBSERVING THE HYDROTHERMAL VENTS

Your *Mir* pilots have explored numerous active vent fields throughout the world over the past 15 years as well as having done important research in the fields of geology, biology and oceanography. On your dive they will help you to interpret what you are seeing. And there will be incredible opportunities for you to make your own film or video images using the powerful outside floodlights carried by the submersible. You are now in 'innerspace', a person from another planet...

As you enter the active vent zones you will marvel at the incredible, almost other worldly, scenes spread before you. Shimmering patterns of superheated water abound as vents 'breathe' into the cold seawater (34°F/1°C). Black smokers belch out plumes of dark stygian elements. Mineral deposits spewed onto the seafloor surrounding the vents offer a beautiful kaleidoscope of colour. A recent lava flow will produce 'pillow lava' formations – Mother Earth's new crust, fresh out of the oven.

Especially important are the robust and diverse life forms crowding around these erupting vents. Here are some of the oldest life forms on earth, unknown to man until just two decades ago, ready to be seen and captured on film for later reflection.

RV AKADEMIK KELDYSH

Built in Finland, *Akademik Keldysh* is one of the best-known oceanographic and deep diving support vessels in the world. Owned and operated by The P.P. Shirshov Institute, Russian Academy of Sciences, its crew of nearly 88 scientists and technicians have worked together for over 20 years, participating in deep dive expeditions all over the world using both *Pisces* and *Mir* submersibles. Equipped for long-duration cruising, *Keldysh* is 400 feet long and has a displacement of 6,240 tons.

The energetic support and expertise of the *Mir* submersible team led by Dr Anatoly Sagalevitch and Captain Yuriy Gorbach and his *Keldysh* crew is what will make our expedition successful. They are a highly skilled, professional team running one of the most unique and safest underwater operations in the world.

You may have seen the *Keldysh* and *MIRs* in National Geographic photo and film projects; IMAX films and in director James Cameron's epic motion picture *Titanic*. The *MIRs* have made over 104 dives to *Titanic* (depth 12,000 feet).

In addition to its many laboratories, the *Keldysh* features a small reference library covering underwater geology, oceanography and deep-sea exploration. For relaxation there is a sauna, outdoor pool and sports court. Because the ship was designed for long-duration cruises, your quarters aboard the *Keldysh* are comfortable and quite spacious. Tasty meals are prepared by our European chef and highlighted by the occasional Russian speciality. A pleasant lounge with a bar is available for our participants. Movies are often shown there in the evenings. And to keep in touch with home or business there are satellite communications (phone, fax and e-mail) available home.

EXPEDITION LEADERSHIP

Professor Anatoly Sagalevitch

Dr Sagalevitch played a major role in the *Mir* submersibles' design and implementation and has been the Chief Scientist and Head of Expedition on board the *Keldysh* since 1989 and has completed 24 expeditions in that role. He has visited 17 different hydrothermal fields and spent more than 2000 hours underwater as a submersible pilot. He has led expeditions to *Titanic*, *Bismarck*, the Russian submarines *Komsomolets* and *Kursk* as well as the Japanese submarine *I-52* and many other sites. Dr. Sagalevitch is a world renowned scientist and has written and published numerous scientific articles. He will lead the team of scientists, submersible pilots and technicians.

Dr Don Walsh

Renowned oceanographer, retired U.S. Navy captain, former submarine captain and the US Navy's first submersible pilot. Don made world headlines in 1960 when he piloted the Navy bathyscaph *Trieste* to the deepest point in the world ocean, Challenger Deep in the Mariana trench. Since that time he has been continuously involved in deep-ocean engineering and operations. He is a 'veteran' of Deep Ocean Expeditions programs having participated in all the expeditions offered by the company.

Mike McDowell

Mike is a leading innovator in Expedition cruising and eco-tourism. He has been involved in organising expeditions worldwide for over 30 years. Along with a colleague, Mike was also involved in the founding of Quark Expeditions in 1991. Quark pioneered the use of icebreakers to take tourists into the frozen reaches of the Arctic and Antarctica. Since that time, thousands of discerning travellers have enjoyed these unique expedition experiences. An adventurer in his own right, he has made 9 deep dives in the *Mirs*. Other adventures have taken him to such diverse areas as the slopes of Mount Everest and both the North and South Pole.

A Final Note on Your Leaders:

All of your expedition leadership are members of the 100 year old Explorers Club in New York. In 2000, Professor Sagalevitch was awarded their prestigious Lowell Thomas Award for exploration.

DEEP OCEAN EXPEDITIONS: SOMETHING ABOUT OUR COMPANY

In 1998 Deep Ocean Expeditions in collaboration with the P.P. Shirshov Institute developed a new direction in expedition cruising: diving into the oceans depths for adventure and in support of science. This was the beginning of "adventure diving" using manned submersibles to explore man's history and natural phenomena beneath the sea. Thus Deep Ocean Expeditions was born.

DOE's first expedition was to the wreck of the *RMS Titanic*, using two Russian *Mir* submersibles and their mothership *Akademik Keldysh*. This program has been successfully repeated in 1999, 2000 and 2001.

The company's second expedition took place in Oct 1999 diving to the 'Rainbow' hydrothermal vents on the mid-Atlantic ridge. In 2001, DOE conducted expeditions to the the WWII German battleship *Bismarck*, *RMS Titanic* and an exploration to the Northern Caribbean to investigate an unknown sonar target which turned out to be a 200 year old wreck located at 16,000 feet. DOE has also conducted expeditions using the *Deep Rover* and *Remora* submersibles at Toulon and Marseille to dive to Roman wrecks in the Mediterranean.

DOE primarily operates to help support science while providing a unique and very rare opportunity for small groups of the general public to experience and explore the hidden depths.

Deep Ocean Expeditions is not in the business of salvage work. We make respectful visits to sites of great scientific interest, triumph and tragedy. An extremely important part of Deep Ocean Expeditions 'modus operandi' is its clearly stated intent to support science. So a key feature of all expeditions is the strong scientific content. In the case of the Keldysh/Mir operations is provided mainly by expert Russian scientists from The P.P. Shirshov Institute and the Russian Academy of Sciences.

EXPEDITION PREPARATORY PACKAGE:

Deep Ocean Expeditions will prepare a pre-expedition information package for participants, which will include a number of scientific and informational papers, maps, publications and articles that will help orient participants into the world of hydrothermal vents and deep-sea exploration. Relevant books will also be sent to each individual to allow ample and comprehensive reading before the expedition.

IMMEDIATE SUGGESTIONS FOR READING

To learn more about hydrothermal vents and the deep ocean floor you can obtain the following books from your library or from Amazon.com or other reputable book sources:

Mapping the Deep: The extraordinary story of Ocean Science by Robert Kunzig Sort of Books, London

Deep Atlantic: Life, Death and Exploration in the Abyss by Richard Ellis Alfred A. Knopf, New York

The Eternal Darkness: A Personal History of Deep-sea Exploration by Robert Ballard Princeton University Press

The Ecology of Deep-Sea Hydrothermal Vents by Cindy Van Dover Princeton University Press