Print

2008 Annual Report: Cruise Summaries

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R/V *Atlantis*

(Woods Hole Oceanographic Institution)

Days at sea: 261; Cruises: 13; *Alvin* dives: 107
Investigators Served: 284 ; Nautical miles: 19,592

The *R/V Atlantis* began the 2008 operating year using the submersible *Alvin* to study the microbiology and biogeochemistry of hydrothermal vent communities at the East Pacific Rise (EPR) on the mid-ocean ridge. This cruise ended in San Diego, where *Alvin* was offloaded in preparation for an eight-week dry-docking of *Atlantis*. In late April, *Atlantis* transited to the Gulf of California designated site for the National Science Foundation's MARGINS research program with the ROV *Jason*, to study the transition from continental to oceanic crust. *Alvin* then resumed operations at the EPR using *in situ* voltammetric analyzers (metal ion analyzers) to study hydrothermal vents, and conducting a program to establish a long-term geodetic network at the Ridge 2000 Integrated Studies Site (studies of life and planetary processes at the mid-ocean ridge.) *Atlantis* then transited to Astoria, Oregon for three *Alvin* cruises at the Juan de Fuca Ridge off the Oregon-Washington coast. These cruises combined a variety of programs, including:

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- The study of the biology of hydrothermal vent paralvinellids (specialized heat-tolerant deep-dwelling worms);
- Vent flow and turbulence monitoring;
- A continuing program at the ODP (Ocean Drilling Program) borehole observatories (sensors inside the seafloor crust);
- Testing optical communication sensors; modeling hyperthermophile (heat-loving bacteria) growth; and
- Continuation of the NOAA-VENTS Research Program for studies of undersea volcanoes and venting.

Atlantis and *Alvin* returned to San Diego in September for a two-week open period and the Navy INSURV ship condition inspection. In October, *Atlantis* transited to Guaymas Basin off Mexico for *Alvin* dives to study microbial carbon and sulfur cycling in the hydrothermally-altered sediments. *Atlantis* and *Alvin* continued to work between Guaymas Basin and EPR for the remaining two cruises studying abundance, diversity and activity of single-celled microorganisms and protists; studying genomes from environmental samples ("metagenomic exploration") to infer virus-host interactions in these deep-sea hydrothermal vent environments; and microbiology and biogeochemistry of autotrophic (chemosynthetic) microbes. *Atlantis* ended the year at sea near the Galapagos Triple Junction with a mapping survey to understand how deformation of Earth's crust is distributed at tectonic plate triple junctions.

R/V *Knorr*

(Woods Hole Oceanographic Institution)

Days at sea: 287; Cruises: 9
Investigators Served: 212; Nautical miles: 40,844

The R/V *Knorr* began her operating year exploring deep-sea hydrothermal vents and testing communications between multiple autonomous underwater robotic vehicles off Ascension Island. *Knorr* then transited to Charleston, SC for a thirty-day shipyard period before returning to Woods Hole. In March, *Knorr* departed for the first of two legs of a north Atlantic polar air sampling program called *Icealot*. NOAA's *Icealot* program brought *Knorr* just above 80°N latitude, the most northern point traveled for the vessel. *Knorr* continued to work off Iceland with a cruise using autonomous gliders for measurements of the North Atlantic phytoplankton bloom. In May, *Knorr* transited to Norfolk to support the first of the US GEOTRACES intercalibration cruises off Bermuda (GEOTRACES is an international program to study marine biogeochemical cycles—turnover of different chemical forms—of trace elements and isotopes, and intercalibration is to ensure comparable results from different cruises and labs.) Operations began again in August with two mooring deployments during a transit to Nuuk, Greenland. From Nuuk, *Knorr* continued to support a multi-year project in the Davis Strait, monitoring the variability of water mass fluxes (exchanges) between the Arctic and Atlantic Oceans. *Knorr* then transited to Iceland for a collaborative research project to study the dynamics of ocean shelf-ocean basin exchange south of the Denmark Strait. This cruise included an extensive web-based at-sea outreach program with U.S. and Icelandic schools, with vessel tours for local school children in Iceland and Woods Hole. *Knorr* returned to Woods Hole in November for the Navy INSURV ship condition inspection. *Knorr* then loaded the Long Core system and transited to Panama for a Pacific program that investigated the marine ecosystems processes in the oxygen minimum zone. *Knorr* ended the 2008 operating year at sea off of Costa Rica.

R/V *Oceanus*

Days at sea: 209; Cruises: 13
Investigators Served: 186; Nautical miles: 29,588

The *R/V Oceanus* began operations in April with a study of plankton and the carbon cycle in surface waters between Maine and Bermuda. The second cruise of the year supported the testing and sea trials for the autonomous underwater vehicle *Sentry*. At

(Woods Hole Oceanographic Institution)

the end of April and again in May, *Oceanus* carried out two biology cruises to determine the extent of natural genetic diversity of the harmful algae *Alexandrium* in the Gulf of Maine and to better understand the forces that structure phytoplankton communities. In early May, *Oceanus* carried out a continuing physical oceanography study of the mechanism and rates of North Atlantic Deep Water (cold, dense, saline water sinking at high latitutes) export to lower latitudes at line "W" off Bermuda. *Oceanus* then completed an extensive sediment-coring program to collect deep-sea benthic foraminifera (shelled single-celled animals used for investigating sediment ages and past ocean temperature proxies.) In July, *Oceanus* accommodated an ongoing unscheduled NOAA program that services an array of moorings in the northwest tropical Atlantic from Guadeloupe to Barbados. From Barbados, *Oceanus* began a trans-Atlantic CTD (conductivity, temperature, depth) sampling cruise with multiple Principal Investigators studying the role of trace metals in regulating ocean biogeochemical cycles and upper-ocean mixing. The first leg of this program ended in Cape Verde and the second leg ended in the Canary Islands. In September, the *Oceanus* transited through the Suez Canal to Jeddah, Saudi Arabia to support collaboration between WHOI and King Abdullah University of Science and Technology (KAUST) with two cruises in the Red Sea, including a water column study and a study of deep brine pools. On completion of these cruises, *Oceanus* transited to St. Thomas, US Virgin Islands, to continue the KAUST project testing equipment and collecting data in environments similar to those in the Red Sea. *Oceanus* then conducted the Bermuda Atlantic Time-series (BATS) and Hydrostation 'S' cruise and ended its operating year at Woods Hole in December.

R/V *Tioga*

(Photo by Tom Kleindinst, Woods Hole Oceanographic Institution)

Days at sea: 107; Investigators Served: 477

The 2008 schedule for the *R/V Tioga* included many trips throughout the year to the Martha's Vineyard Coastal Observatory (MVCO) for deployment and recovery of equipment, as well as for servicing and maintenance. Other operations took *Tioga* as far as Massachusetts Bay, Cape Cod Bay, Long Island Sound, and the Connecticut River. A variety of work was conducted, including engineering tests of the autonomous underwater vehicles *Sentry* and a *REMUS 600*; deployment and recovery of instruments, moorings, and sonar communications equipment; deployments of Real Time Acoustic Tracking Systems (RATS) for location and study of right whales; tagging of right whales and sea turtles; sediment coring; and Spray Glider operations. In addition, educational science trips for WHOI's Summer Student Fellows and for other groups were conducted in Buzzards Bay and Vineyard Sound.

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