NASA/JPL hydrothermal vent bio-sampler

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On the bottom of the oceans with volcanic activity present, hydrothermal vents can be found which spew out mineral rich superheated water from the porous seafloor crust. Some of these vents are situated several thousands of meters below the surface where the sunlight never reaches. Yet life thrives here on the minerals and chemical compounds that the vent water brings up with it. This chemosynthetic microbial community forms the basis of some of the most interesting ecosystems on our planet and could possibly also be found on other water rich planets and moons in the solar system. Perhaps under the icy surface of the moon Europa there exist hydrothermal vents with such biota thriving independently of the solar energy.

The Hydrothermal Vent Bio-sampler (HVB) is a system which will be used to collect pristine samples of the water emanating from hydrothermal vents. An array of temperature and flow sensors will monitor the sampling conditions. This will allow for the samples to be collected from defined locations within the plume, and the diversity and distribution of the chemosynthetic communities that might live there can be accurately described. The samples will have to be taken without any contamination from the surrounding water, thus the pristine requirement. Monitoring the flow will assure that enough water has been sampled to account for the low biomass of these environments. The system will be using a series of filters, down to 0.2 μm in pore size, and the samples can be directly collected from the system for both culture- and molecular-based biological analyses.

The HVB is designed to operate under the extreme conditions at the bottom of the ocean by the hydrothermal vents. This means the system needs to be able to handle temperatures of up to $400°$C and pressures of up to 10,200 PSI, corresponding to the depth of about 7,000 km below the surface.

After testing at a hydrothermal vent system in the Eyjafjordur fjord off the coast of Iceland modifications and improvements were made to the HVB. This system has, amongst others, now successfully passed the pressure test at Scripps Institution of Oceanography and an ocean test off the coast of Los Angeles. Later this spring the HVB will return to the Icelandic vents to be operated and to take samples looking for biology in the vent plume water.