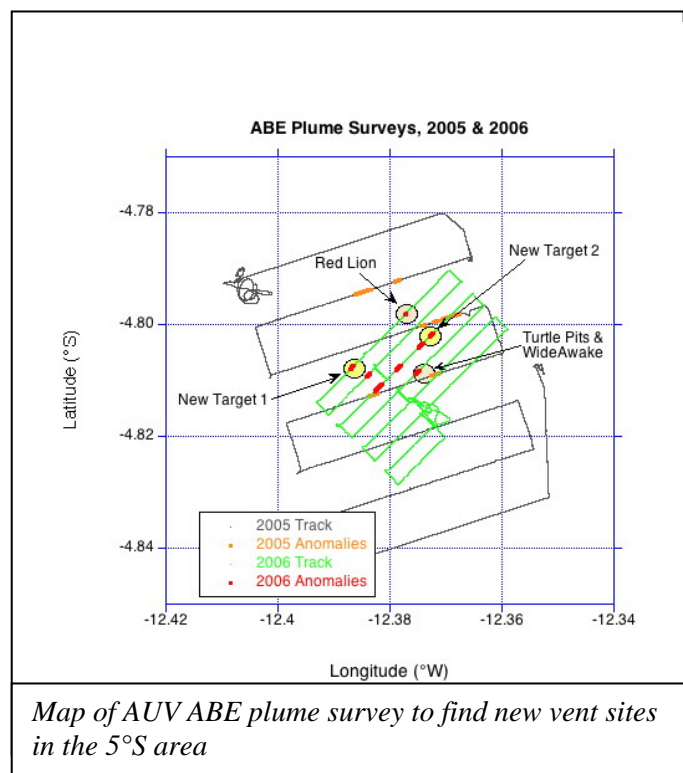


### 3. Weekly Report M68/1, 8-14 May, 2006

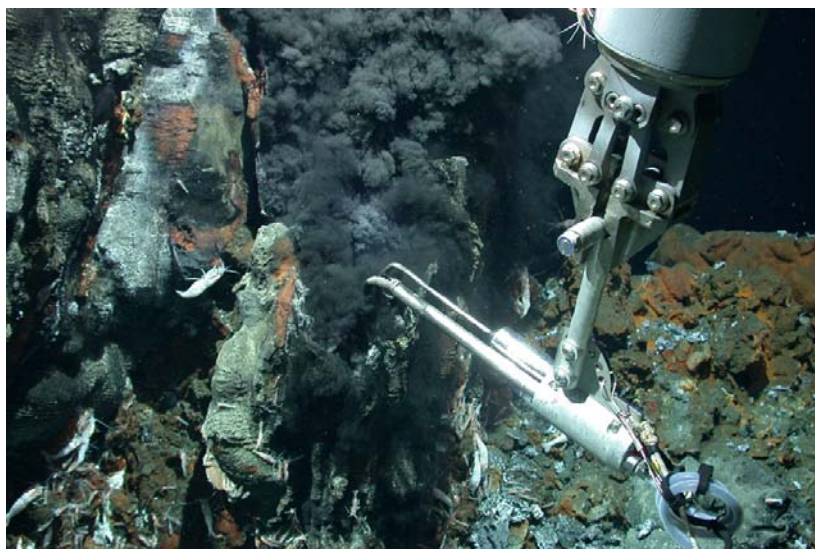
During the night of May 9/10 we finally arrived in our first working area at 5°S, first deploying three transponders as preparation for the first dive of the AUV ABE, which followed immediately after a CTD station. Venting fluid from hydrothermal fields is hot, particle-laden and low in oxygen (“reducing”) and rises above the vent on the seafloor somewhat like a thundercloud rises in air, with a narrow stem and large flat head. A complete AUV survey for the exploration of hydrothermal vents therefore consists of three phases. During phase 1, the wide head of the hydrothermal plume is mapped on a larger scale (at 200-300 m above the seafloor), using the CTD, redox and turbidity sensor data to locate the center of the hydrothermal plume. In Phase 2, based on the data from phase 1, the seafloor is mapped at high resolution from 50 m above the seafloor with a survey line spacing which should allow the rising stem of the plume to be intercepted. As the rising plume has a limited width, this information already enables a good location of the active vent site. In the 3<sup>rd</sup> phase, a photo survey of a limited area directly around the rising stem is carried out from 5 m above the seafloor, providing information about the smoker structures and faunal abundances. This information can then be used to prepare a ROV dive in detail. With this combination of the two devices we achieve an optimum use of the ROV, because the time-consuming search for the vent sites is not required during the ROV dive, instead we can dedicate all of the precious ROV time to those things for which a ROV is ideally suited - the sampling of fluids, biological materials, rocks and sulphides. As during the survey of the AUV other devices including ROV or CTD can be deployed in parallel, this also allows for an optimum use of ship time, even if the logistics of day-to-day cruise planning take on another dimension of complexity!



Our first AUV dive covered the vent fields Turtle Pits, Red Lion and Wideawake, known from the cruises CD-169 and M64/1 in 2005, in SW-NE directed tracks and also included sites southwest and east of these fields, where we had detected hydrothermal signals in the water column last year. In parallel, the first ROV dive in the Wideawake mussel field and the Turtle Pits hot vent field started in the morning of May 10. The smokers had significantly grown since last year, reaching heights of up to about 13 m (8m was last year's maximum), and were still very active. After a total dive time of 12 hours without technical problems, the ROV brought mussel samples, hot fluids and rock samples on board and provided happy scientist a night of hard work.

The nights are also filled with intense hydrographic investigations of the area to gain more information about how the hydrothermal plumes are spreading in the water column and hence

about the regional input of hydrothermal material to the oceans. Numerous plume signals at different sites were recorded. In the morning of May 11 the ROV started its second dive, targeted at the Red Lion field with its four very different smokers. Here we also observed changes compared to our observations in 2005: the smoker “shrimp farm” with its large horizontal flanges didn’t really do its name justice, as it was much less densely covered with shrimps, “sugar head”, which in the previous year had got its name from the dense shrimp accumulation on top, had lost its head, and the shrimps had apparently moved to “Mephisto”. Only “Tannenbaum” still looks like a Christmas tree decorated with snow flakes.



*Picture from an ROV dive in the Turtle Pits hydrothermal field, showing sampling of the boiling hot fluid at a black smoker*

With the ROV working perfectly, May 12<sup>th</sup> saw the 3rd dive in a row to finish the program in Wideawake and Turtle Pits that we had started on the first day. The difficult search for Calyptogena clams, which are much rarer than the abundant Bathymodiolus mussels, was a success. The dive however was completed with a sensation: The ROV pilots succeeded in inserting the temperature sensor of the fluid probe deep into the outlet of one of the hot vents. Boiling of the fluids was clearly visible from the emanation of gas bubbles, an unusual

observation in 3000 m water depth. Over several minutes a constant fluid temperature of 407°C was measured! This is the highest temperature ever measured so far in a hydrothermal fluid, which was not expected from the slow-spreading Mid-Atlantic Ridge where volcanic eruptions producing very hot fluids were thought to be rare.

And now while AUV and CTD stations prepare us for the discovery of the next vent fields in this hydrothermally very active area at 5°S, we continue working on samples and data and enjoy the success of the first three working days, which was possible due to the intense preparation, excellent work of the ROV and AUV teams, and very good cooperation between scientists, ship’s crew, and the technical working groups.

With best wishes from the central Atlantic  
*Andrea Koschinsky and all cruise participants of M68/1*