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In situ flow-analysers for the chemical characterisation of deep-sea hydrothermal vent habitats

R. Vuillemin (1), P.-M. Sarradin(2), C. Le Gall (2), D. Birot (3) and N. Le Bris (2)

(1) IFREMER, Dept. TSI, Brest, France (2) IFREMER Dept. EEP, Brest, France, (3) IFREMER, Dept. GM, Brest, France

The chemical characterisation of habitats is a main challenge for the study of deep-sea hydrothermal vent ecosystems. The restricted access of great depth to deep-sea submersibles or landers strongly limit the capacity to collect fluid samples. Furthermore, it usually takes hours to recover these samples. This approach is inappropriate to resolve steep spatial gradients and describe metastable chemical conditions characterise the mixing interface between vent fluid and seawater surrounding the organisms. In situ chemical analysis is a much more relevant method to determine physico-chemical ranges in vent habitats. For this purpose, a dual-channel flow analyser with spectrophotometric detection, the ALCHIMIST, was developed at IFREMER on a similar instrumental principle as the 'Scanner' earlier built-up by Johnson et al. (1986). In this case, however, FIA (Flow Injection Analysis) was privileged against continuous flow analysis. Since 1998, the device has been implemented on several deep-sea vehicles (Victor ROV, DSRV Nautile and Alvin) for short term studies at different hydrothermal vent fields. Simultaneous analysis of sulfide and, either nitrate or iron II, were performed during sequences of one or two hours. In combination with temperature measurements, these measurements enabled to discriminate some of the main chemical features of different vent habitats of the East Pacific Rise or Mid-Atlantic Ridge.

Short term measurements from submersibles are however unable to account for variation at daily or longer time-scales, hence limiting the relevance of the data sets with respect to the conditions experienced by the animals. Medium to long-term autonomous

measurements is the objective that is now pursued, based on the integration of innovative technological devices in the field of actuators and optical detection. An autonomous analyser is being developed for yearly deployment in the context of the MoMAR deep-sea hydrothermal observatory on the Mid-Atlantic Ridge, as part of the EC FP6 STREP project EXOCET-D. Performance and future prospects of this new device will presented here.