We give the description of the development, test and first operative results of a prototype of electrode-based chemical analyser for continuous and long-term monitoring of deep-sea water, jointly developed by Tecnomare and INGV. The chemical analyser is a continuous water analyser, presently equipped to manage up to two electrodes. Till now we tested pH electrode able to be used in the deep sea. An outline of the chemical analyser is depicted in Fig. 1. The idea was to build all the necessary devices for automatic procedures for calibration, measure, cleaning and storage around commercial electrodes, suitable on-the-shelf for high-pressure environment (AMT Gmbh, Germany).

The system is characterised by significative innovative elements such as the automatism level, self-calibration, the analytical stability for high pressure and low temperature environments, and the possibility of being integrated in complex instrumented platforms. It has the following features: limited consumption of reagents and water sample; limited power consumption; limited dimensions; high autonomy (up to now 6 months); deep-sea operability (3500 m. w.d.); a quite wide range of environmental situations (as an example Antarctic sea temperature, Calcara, 2002;
Cenedese et al., 2004); performances comparables to laboratory analytical equipments. The prototype’s development will benefit of the experience acquired in technological projects of deep-sea observatories by INGV and Tecnomare (Beranzoli et al., 2002, 2003). These features have been reached through a project phase, proper component choice, and technical and laboratory tests. In fact, a long series of tests were performed in order to evaluate the functionality of technical solution and the response of chemical features to the automatic hydraulic hardware.

Once validated in laboratory, the system has been successfully installed on GEOSTAR observatory during the Marsili, a volcanic submerged edifice located in the southern Tyrrenian Sea, 40 miles north west from Stromboli island, for a six months mission, at a depth of 3300 m. w.d. The criteria and results of the tests and of the first long-term mission are presented, and some correlations of the pH behaviour with the CTD (realisable thanks to the instrumental synchronisation with a unique reference high precision clock), evidencing the pH data goodness.

After scientific validation, the system now can be also used stand alone, as payload of submarine vehicles (e.g. ROV, AUV) or surface buoys, and even, thanks to its peculiarity, for analysis and monitoring in those environments that requires high performance in hostile situation and absolutely nil environmental impact (as example for the exploration of Antarctic sub-glacial lakes).

Acknowledgment. This work is dedicated to the memory of Giuseppe Smriglio.

REFERENCES


