CHEMICAL CHARACTERISTICS OF A SUBMARINE HYDROTHERMAL SYSTEM OFFSHORE KOS ISLAND, ON THE HELLENIC VOLCANIC ARC

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Abstract

A submarine hydrothermal system offshore Kos is described in terms of its geomorphological setting, temperature, pH, conductivity and the compositional variability of the hydrothermal waters. Fine yellow to brown colour hydrothermal precipitates accumulate around the hydrothermal springs forming a thin film on the surface of the seafloor. Temperature increases in hydrothermal springs relative to the ambient bottom water. The hydrothermal water at the main hydrothermal field is of low pH, and of lower conductivity and dissolved oxygen relative to the ambient bottom water. Ca and F increase distinctly in the hydrothermal springs relative to the ambient water, while Mg decreases in the hydrothermal springs relative to the ambient bottom water. The hydro- thermal water discharging on the beach is enriched in Ca and F, while it contains lower amounts of Mg relative to the submarine hydrothermal spring.

Key-words: Chemical Analysis, pH, Oxygen, Hellenic Arc

Introduction

Submarine hydrothermal systems occurring along the mid-ocean ridge system were extensively investigated during the last few decades. The compositional variability of hydrothermal waters and sediments was determined and the hydrothermal processes involved in their formation were deduced in a variety of hydrothermal environments. However, our knowledge on island arc submarine hydrothermal systems is relatively limited. Although the Santorini hydrothermal field is known for some time only a few other submarine hydrothermal fields were described from the Hellenic Volcanic Arc (Figure 1), such as the Kephalos Bay, Kos, and Yali [1], the Milos hydrothermal fields [2,3] and recently a hydrothermal field offshore Methana Peninsula [4].

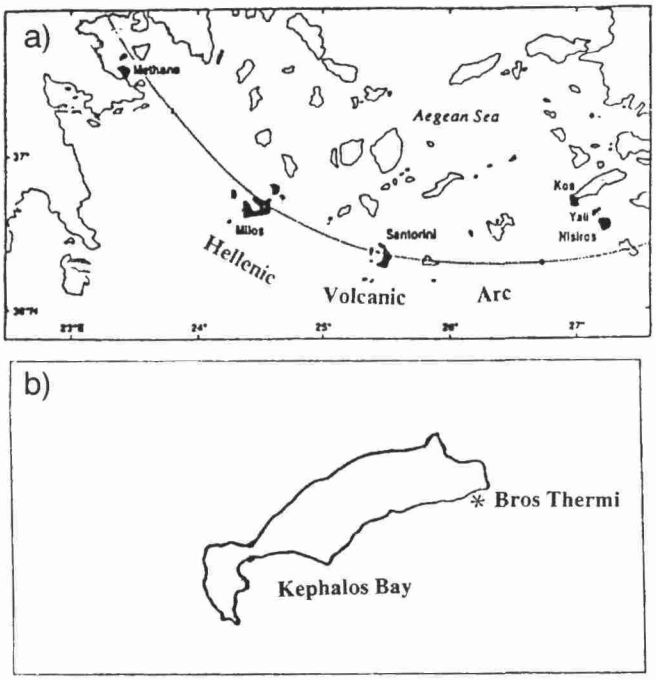

Figure 1 : a) Map showing the location of Kos island in the Hellenic Volcanic Island Arc and b) Location of the hydrothermal field in Bros Thermi.

Considering the existing petrological and tectonic variability along the Hellenic Volcanic Arc the detailed description of new hydrothermal systems is of great importance, because they will allow the deduction of the specific hydrothermal processes occurring in the whole Arc. In this work a submarine hydrothermal field is described offshore Kos, the location of which is shown in Figure 1.

For the morphological description of the hydrothermal field scuba diving was undertaken. The visual observations made and the pictures taken by scuba diving revealed that in the area investigated three major hydrothermal fields occur. One hydrothermal field propagates along a 15 m line of NE-SW direction, starting at 40 m from the coast. A second hydrothermal site occurs on the same line but nearer to the coast. These two areas constitute the zone A. The third hydrothermal site appears as a circular zone of 1.5 m diameter occurring west of the first area at 30 m from the coast described as zone B (Figure 2). Hydrothermal precipitates varying in colour from brown to yellow are very characteristic of the seafloor around the submarine hydrothermal vents.

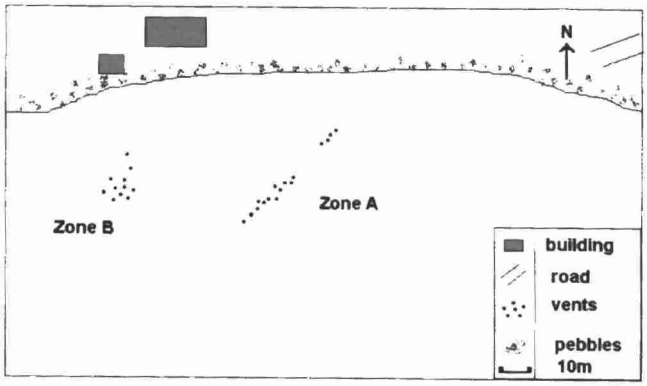

Figure 2 : Sketch map of the hydrothermal field Bros Thermi Kos, Greece.

Methodology

Vent waters were carried immediately after collection to the field laboratory. After filtration through pre-weighted dry 0.45μm pore size membrane filters, samples were put into plastic acid-cleaned containers and were acidified to pH=2 . After the appropriate dilution with de-ionised water of the filtered hydrothermal waters, samples were analysed applying Flame Atomic Absorption Spectrometry for Ca, Mg and Sr. Working standards were prepared from "1000 mg/l Ready to use" Merck stock solutions. To avoid contamination problems all glassware and labware were immersed in 10% HNO3 for 72 hours and rinsed thoroughly with de-ionised water while results checked both with reagent blank and sample blank while precision was checked with replicate analyses. Spectroscopic techniques, carried out with the operation of a PERKIN ELMER 2100 Atomic Absorption Spectrometer equipped with a deuterium-arc correction. Fluoride was determined operating Ion 85 Analyser Radiometer Copenhagen, a potentiometric apparatus [5].

Oxygen concentrations were obtained with the Rosemount Delta 4010 Oxygen digital analyser immediately upon collection, applying the conditions described by the manufacturer. Conductivity and pH measurements were taken with pH-meter (temperature compensated), and Conductivity-meter LF95 of WTW both instruments were calibrated prior analysis.

Water sampling

Hydrothermal water sampling was carried out by SCUBA diving using inverted funnels placed over the seeps, connected with 2 plastic bags, while timing the collection of gas and water [3]. Sampling of this type results in more condense samples due to the isolation of the vent spots from the penetration of the ambient seawater into the sampler while the first bag was used to flush out the seawater from the funnel. The water depth varied from 2.50m to 5.50m. The hydrothermal field has been divided in zones A (east) and B (west), on the basis of the differences in location and appearance of the venting sites (Figure 2).