

Investigations on submarine hydrothermal fluids of Panarea, Aeolian Islands

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Panarea Island belongs to the back-arc volcanic system of the Aeolian archipelago, a subduction related chain of volcanoes in the south Tyrrhenian Sea. The remnants of volcanism at Panarea are permanently exhaling fluids with varying intensity along the shore and mainly in a submarine caldera to the east of the Island shaping the outlines of the investigation area which is surrounded by several volcanic domes of dacite-andesite origin building the islets Dattilo, Panarelli, Lisca Bianca, Bottaro and Lisca Nera. The submarine depression extends about 500 meters in diameter and has a maximum depth of 30 meters below sea level. Present hydrothermal features include fumaroles, hot waters with varying temperature, brines and hot sediments along fault zones elongated NE-SW and NW-SE. The whole system is likely fed by at least one shallow hydrothermal reservoir and magma resources.

Based on 20 years scuba diving experience by INGV Palermo the area of interest was investigated by scientific divers from TU Bergakademie Freiberg in September 2006 doing submarine aerial survey, sampling and in situ measurements. The whole area is characterized by countless submarine gas outlets varying in distribution and strengths. The gas consists to 97 to 99% from CO₂ and the rest being mainly H₂S. At few places water discharges could be observed as well. A brine with an EC of 100 mS/cm emits from an 8 x 4 x 1.5 meters depression ("hot lake"). The brine of this pool can hardly be explained just by boiling seawater since iodine concentrations exceed the marine background 20 fold and the enrichment of Li, K, Ca, Mn, Rb, Cs, Ba, Ce, and Tl is far beyond an enrichment derived from 60 mS/cm EC in ocean water. Sulfate concentrations are significant lower than in ocean water and sulphide and ammonia are significant elevated.

Hot water with a pH 3 and 120 °C discharges within an old crater and has build up a sinter cone ("black point"). The concentration of this hot water is close to seawater, but show a slight enrichment in the same elements found to be enriched in the "hot lake".

The average pH of all waters in the area of investigation including samples from the surface is 5.8 showing the massive impact on the surrounding ocean water with a pH of 8.3. This impact is shown by certain elements and species which are clearly different from normal ocean water.

Results of water and gas geochemistry are presented including isotope data and being compared to those from earlier investigations. Based on thermodynamic modelling different hypothesis for the origin of the fluids are discussed. From the impact on the entire water body the amount of degassing CO₂ is estimated.