

Evaluation of methods for investigating shallow submarine geothermal features: gas flow monitoring and fluid sampling by scuba diving

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Submarine features are accessible for scientific scuba-divers to about 40 meters below sea surface. However, only few methods and techniques are available for monitoring and sampling fumaroles and submarine water discharges. More or less no devices are available for long term monitoring which is due to harsh conditions such as highly corrosive water, bacterial growths, waves and tidal impact as well as fisher nets, anchors, and even vandalism attacks.

A robust device based on indirect gas flow monitoring by means of acoustic measurements was developed. ABCO₂ (acoustic bubble counter, type 2) utilizes acoustic oscillations generated during the bubble-forming at the vent's nozzle and the bubble stream knocking at the device. First applications at submarine Panarea Volcano provide an important insight into gas flow variations over time. In addition to well-known influences by ocean tides, evidence for seismic induced gas flow changes is shown by long term records.

Sampling submarine geothermal gas vents requires primarily the separation of gas from water. For gas sampling both a small hand held funnel and a bigger stationary funnel made of stainless steel with a trapping plexus glass chamber for water free gas collection was used. A bypass on the side below the trapping chamber allows surplus gas to escape. By means of a self-sealing-connector on the top of the chamber either a tube, for sampling large amounts of gas at the water surface or 1 liter containers can be connected. An additional septum can be utilized for gas sampling e.g. by means of syringes.

By in-situ-determination of pH, temperature and electrical conductivity in a flow-through cell with a multi parameter probe it was possible distinguishing between seawater and geothermal water. A submarine drilling device was developed to place a PTFE lance into the sea floor to a depth of 1m. Water sampling from this submarine groundwater well was conducted by means of 450 mL-syringes.

During a two weeks field campaign in September 2006 scientific divers from TU Bergakademie Freiberg utilized the self developed equipment and devices at the submarine caldera of Panarea, Eolian Island. Results from gas and water geochemistry are published elsewhere. During follow up surveys in November 2006 and May 2007 first long term data were gathered.