CO_2 fluxes in the submarine hydrothermal system of Panarea

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The measurement of CO_2 fluxes in terrestrial and submarine hydrothermal systems is affected by large uncertainties. Different methodologies were applied by scientific divers to estimate areal gas fluxes and determine massive gas discharges in water depths between 8 and 30 m in the hydrothermal system of Panarea, Italy.

Because several hundreds of hydrothermal vents exist in the submerged caldera of Panarea it is impossible to measure each gas discharge directly. Therefor gas discharges were classified in 5 groups with respect to their amount of gas release. Class A to D (0 to < 40 l/min) discharges were measured by displacement of water in a graduated container according to [1].

By visual counting and classifying discharge points within areas of increased hydrothermal acitivity, a rough estimation of diffuse gas release was realized. Massive gas discharges (class E, 40 – 100 l/min) were determined by means of a device based on impeller and temperature readings [2]. Corrections concerning gas temperature and hydrostatic pressure were performed.

A substantial percentage of the investigated gas discharge points (75 – 95%, $n \approx 700$) was classified as weak (class A – D). About 10 fumaroles were identified as very intense gas releases (class E). Small gas discharges had been estimated to release up to 30 ± 14.5 t/d CO_2, while massive outlets account for 5 ± 0.6 t/d CO_2 in the submarine area of the caldera. The total CO_2 flux was calculated by considering the dissolution of CO_2 during the ascent to the sea floor [3]. Assuming 20 – 40% of gas dissolution, the total CO_2 flux in the submarine hydrothermal system of Panarea was estimated to be 47 ± 15.1 t/d CO_2. This is about 26% of the CO_2 emission of the nearby terrestrial volcano Vulcano [4] and <0.47% compared to all Mediterranean hydrothermal emissions [5].

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Structure, evolution and function of the root bacterial microbiota of Arabisopsis species

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Plants touch with their roots soil - one of the richest microbial ecosystems on earth. At this contact zone, the secretion of poorly characterized root exudates fuels the differentiation of a distinct rhizosphere bacterial microbiota compared to the surrounding soil. Rhizobacteria provide microbial services affecting plant growth and health and contribute to ecosystem functioning. We examined the composition and evolution of the bacterial root microbiota within a phylogenetic framework of host species, including *Arabidopsis thaliana* and its sister species *Arabidopsis halleri* and *Arabidopsis lyrata* and evolutionarily ancient *Cardamine hirsuta* with pyrosequencing of 16S rRNA gene amplicon libraries. The composition of rhizobacterial communities varies most as a function of environmental condition and consists of a taxonomically narrow and evolutionarily conserved core microbiota consisting of Actinomycetales, Burkholderiales, and Flavobacteriales. We identified few root microbiota members that provide unique signatures for each host species, possibly reflecting host-specific requirements in a given environment. Most of these host species-dependent microbiota signatures were found for the phylogenetically oldest *C. hirsuta*, indicating that root microbiota diversification is linked to the evolutionary divergence time of the host species. *A. halleri* is the only plant among the tested species that grows on heavy metal (e.g. Cadmium) contaminated soils, tolerating high levels of Cd and accumulating high levels of Cd in leafs. We have initiated the examination of rhizobacterial communities of *A. halleri* grown in soils with elevated heavy metals coupled with community profiling of enrichment cultures and metal uptake measures in leafs. In this context, first insights into microbiota services will be provided.

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