Another kind of "volcanic risk": the acidification of sea-water. Vulcano Island (Italy) a natural laboratory for ocean acidification studies

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Acidification of seawater is one of the aspect tightly linked to volcanic risk, due to the presence of submarine vents releasing abundant volcanic fluids. In aquatic system CO2 gas dissolves, hydrates and dissociates to form weak carbonic acid, which is the main driver of natural weathering reactions [Drever, 1997]. The result of the CO2 increase is seawater acidification.
Vulcano Island, the southernmost of Aeolian Islands, is located in the Southern Tyrrhenian Sea (Italy), approximately 18 miles off the NE coast of Sicily. The Baia di Levante can be considered a natural laboratory where almost all of the biogeochemical processes related to the ocean acidification can be studied. In this area many submarine vents release CO2. Four geochemical surveys of the Bay were carried out in April - September 2011 and May - June 2012. The main physic-chemical parameters (T, pH, Eh, electric conductivity) were measured at more than 70 sites and more than 40 samples for chemical analyses were collected at representative points. Major (Na, K, Mg, Ca, Cl, SO4) and some minor components (B, Sr, Fe) and trace elements (Mn, Mo, Al, U, Ce, Pb, Tm, Tb, Nd, Th) dissolved in water, the chemical composition of dissolved gases (He, H2, O2, N2, CH4 and CO2) and the isotopic composition of total dissolved inorganic carbon were determined in the laboratory. The bubbling CO2 produces a strong decrease in pH from the normal seawater value of 8.2 down to 5.5 (Figure 1). In the area close to the main degassing vents, characterized by very low pH, macroorganisms were absent.
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At Baia di Levante, about 300 m from the main vents the seawater is only slightly acidic (pH 6.5 - 7.0) resembling the ocean water conditions in equilibrium with the high atmospheric CO2 concentrations expected in the near future. Therefore environments like this, naturally enriched in CO2, are good laboratories to study the consequences of ocean acidification on aquatic biota [Doney et al., 2009].
Furthermore acidification is tightly linked with the mobility and bio-availability of heavy metals [Millero et al., 2009] in sea water and volcanoes were always the favourite choice for human settlements; as a consequence economic anthropological activity, such as fishing, could be dangerous for human health, because of the presence toxic level of trace metals in the food chain due to the presence of the volcano's.
The present study could provide important information about the best environmental management of volcanic areas such as Vulcano Island.

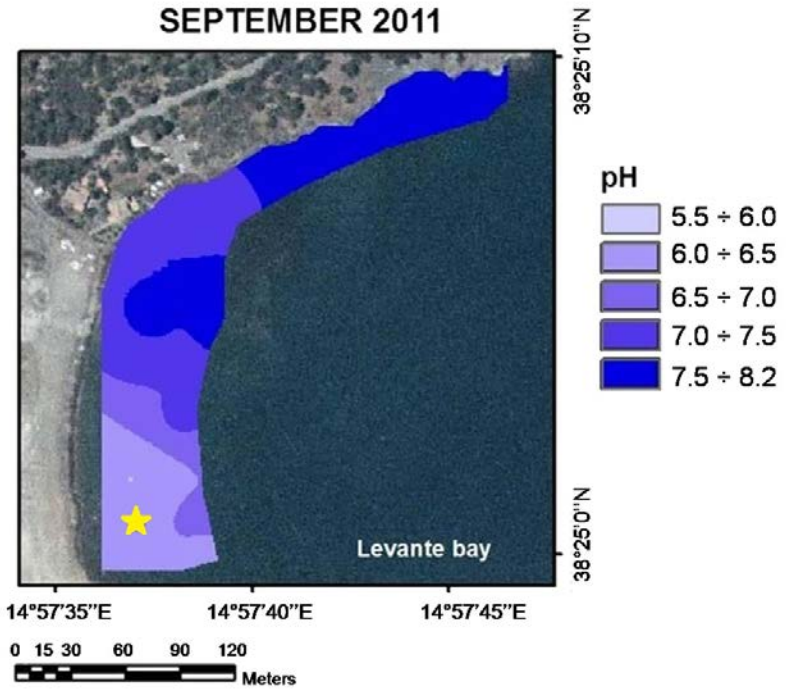

Figure 1. The bubbling CO2 area which produce the pH gradient in "Baia di Levante". The yellow star is the main gasses emitting point.

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