

Volcanic health hazard: the acidification of seawater and trace metals accumulation study in Blue Mussels (*Mytilus galloprovincialis*). Vulcano Island (Italy)

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Mussels are considered to be heavy metals bio-accumulators and, at least in coastal areas, represent a significant part of the humans diet. Due to the fact that such animals could be breeding in active volcanic areas interested by acidification of seawater and increased mobility of heavy metals, the consumption of mussels could represent a hazard for human health.

Acidification of seawater is due to the presence of submarine vents releasing abundant volcanic CO₂-rich fluids. In aquatic system gaseous CO₂ dissolves and, hydrates to form weak carbonic acid, which is the main driver of natural weathering reactions. 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. Four geochemical surveys of the Levante Bay were carried out in April - September 2011 and May - June 2012. The main physico-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 and trace elements 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. In the area close to the main degassing vents, characterized by very low pH, macroorganisms are absent. Further north in the bay, about 300 m from the main vents the pH of seawater is only slightly lower than normal ocean waters (pH 8.2 - 7.8) resembling conditions in equilibrium with the high atmospheric CO₂ concentrations expected in the near future up to the end of the century. Therefore environments like these, naturally enriched in CO₂, are good laboratories to study the consequences of ocean acidification on aquatic biota. Furthermore acidification is tightly linked with the mobility and bio-availability of heavy metals in sea water.

A Blue Mussels transplant experiment was done along the pH gradient in order to estimate the accumulation capability in relationship with acidification of seawater. At the end of the experiment the mussels showed an increase of concentration for some elements such as (Fe, As, Mo, V and Pb) with respect to blanks.

The present study provides important information about the best environmental management of active volcanic areas such as Vulcano Island.