

The eruption of the submarine volcano Tagoro at the island of El Hierro, Canary Islands, Spain: 5 years registering physical-chemical anomalies

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**Abstract:**

On October 10 2011 an underwater eruption gave rise to a novel shallow submarine volcano south of the island of El Hierro, Canary Islands, Spain. During the eruption large quantities of mantle-derived gases, solutes and heat were released into the surrounding waters.

During the magmatic phase, from October 2011 to March 2012, extreme physical-chemical perturbations comprising thermal changes, water acidification, deoxygenation and metal-enrichment, resulted in significant alterations to the activity and composition of local plankton communities. The release of CO<sub>2</sub> produced total inorganic carbon concentrations ranging from 4,000 to 7,500 µmol kg<sup>-1</sup> causing water acidification of up to 2.8 units. These high CO<sub>2</sub> levels generated high pCO<sub>2</sub> waters with values ranging from 12,000 to 150,000 µatm at the surface. The area exhibit maximum concentrations of reduced sulfur and total Fe (II) species (200 and 50 µmol kg<sup>-1</sup>, respectively) and higher concentrations of dissolved Cu, Cd, Pb and Al with maximum values of 6.1, 6.7, 5.8 and 2,122 nM, respectively. These physical-chemical anomalies had a major impact on local pelagic communities. In that way, the volcano-affected area has exhibited responses that are occurring globally, making El Hierro into a unique natural laboratory where the principal climate change stressors are acting simultaneously. The results emerging from this volcanic eruption will help to improve our understanding of how future climate change may impact marine biota [1].

After March 2012, the area evolved to a hydrothermal system offering the opportunity to study both the dynamic associated to the degassing process and changes at the physical-chemical properties of the system. In order to keep monitoring the impact of the eruption, periodic multidisciplinary cruises were carried out during the last 5 years (Bimbache, Raprocan, Cetobaph, Vulcano-I-II and Vulcana).

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[1] Fraile-Nuez et al., 2012. The submarine volcano eruption at the island of El Hierro: physical-chemical perturbation and biological response. Scientific Reports 2:486.

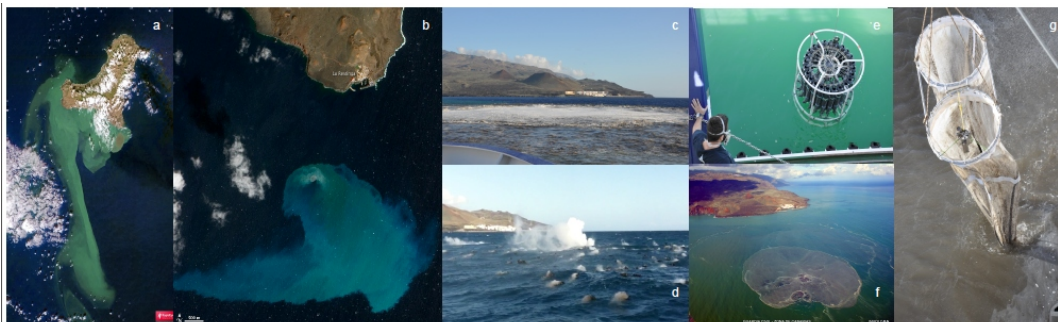


Figure 1.- a) a true color, high-resolution RapidEye satellite images featuring a gigantic stain visible on the surface of Las Calmas Sea, Spain (11-26-2011). b) Image acquired by the Advanced Land Imager (ALI) aboard the Earth Observing-1 satellite (NASA award-winning image 2013). c) Bubbling 11-05-2011. d) Pyroclastic rocks floating and expelling the internal gas. e) CTD-Carrousel over the submarine volcano. f) Helicopter flight over the volcano (INVOLCAN). g) WP2 net over the submarine volcano.