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TdFe(II) emissions in the degassing phase of Tagoro submarine volcano and its correlation with the decrease of pH

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The oceanographic studies carried from 2013 to 2015 in a degassing phase submarine volcano (Tagoro volcano, Canary Islands) revealed positive anomalies in the vertical distribution of TdFe(II) concentration that correlates with an important negative anomaly in the pH. The low pH values are associated with the CO_2 emissions from hydrothermal vents located in the volcano cone. These emissions affect the pH of the surrounding waters as well as the total dissolved iron, TdFe(II), distributions in the water column. The relationship between low pH and TdFe(II) concentrations indicated that emissions of hydrothermal fluids rich in acid and iron were active in the area. The low pH values help to maintain Fe(II) in solution for a longer period of time due to a decrease in its oxidation rate. During the different cruises yo-yo and tow-yo samplings were done in order to detect temporal anomalies and also be more accurately to delimit the areas of emission. Important temporal anomalies were detected, indicating changes in the emitted fluid composition with time. Observations showed an important variability in both pH and TdFe(II) concentrations, which indicated the volcanic area was affected by a degasification process that remained in the volcano after the eruptive phase had ceased.

These studies allowed investigation of the temporal evolution of the total dissolved Fe(II) concentrations in the area and an analysis of the natural Fe(II) fertilization process. It was observed that emissions of TdFe(II) continue in the area after cessation of the molten eruptive phase. The magnitude of TdFe(II) was not the same in all the sampling periods, with high variability over a short time scale, and was also inversely related to pH. This may be due to changes in the mixing process along the shape of the volcano or changes in the amount of emitted fluids in the hydrothermal vents that mixed with the surrounded oxygenated waters.

The kinetic studies in the volcanic area showed Fe(II) oxidation rates were higher than those expected in oligotrophic seawater. The increase in the Fe(II) oxidation rate can be explained by the higher amount of macronutrients, in particular silicates, in these waters.