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Can subaerial lava form iron rich buoyant plumes in the ocean?

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On the 19th of September 2021, the Tajogaite volcano in La Palma, Canary Islands started its eruptive phase. The volcanic activity lasted 85 days. The volcano is situated 6 km away from the coast and stands at 1120 m above sea level. However, on the 29th of September, the lava arrived in the ocean.

The interaction between lava and seawater has received significant interest, since multiple reactions can take place that act as sources or sinks of elements, consequently changing the chemical properties of the surrounding seawater. However, most of these studies are based on underwater hydrothermal vent sites.

In this presentation, we will show how the three lava-seawater events strongly affected the seawater properties as the lava interacted with the seawater. The evolution of surface and water column physicochemical properties (temperature, salinity, carbonate system variables, dissolved oxygen), iron concentrations (soluble (sFe), dissolved (dFe) and total dissolvable (TdFe)) concentrations, and iron ligands were characterized during 13 visits to the frontal zone of the newly formed deltas.

On the 12th of November, a large volume of hot and high salinity seawater promoted pH values in the frontal zone of 7.0 with important decreases in alkalinity and total dissolved inorganic carbon. These waters were also characterised by high iron concentrations reaching 18 nM, 117 nM, and 2024 nM for sFe, dFe, and TdFe, respectively. The decrease in the density of the water caused a “buoyant plume” like what is observed in deep hydrothermal sites, however, the top of this plume reached the surface. The plume travelled in the top meter of the water column over 1 km away from the coast, naturally fertilising the surrounding photic layer.