

LAVA-SEAWATER INTERACTION EFFECTS IN THE CARBONATE SYSTEM DURING THE ERUPTION OF THE LA PALMA VOLCANO 2021

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Abstract: The effect of the lava arriving to the sea in the carbon dioxide system was studied during the eruption of the volcano located in Cabeza de Vaca (La Palma, Canary Islands) on September 19th. The affected area was a shoreline below a cliff with heights between 80-100m with a sandy beach in the southern part. The lava reached the coastal waters three times since the eruption began. An increase in temperature and salinity was observed due to seawater heating and water vapor formation, followed by an important decrease in pH_T , related to the release of magmatic volatiles and water-rock reactions. A portion of the magmatic acidic volatiles (CO_2 , SO_2 , HCl , HF , HBr) that remains after the lava transit to the ocean is released in contact with seawater and moving out, mixed with the water vapor, but also affecting the seawater pH. Changes in the alkalinity (A_T) and total dissolved inorganic carbon (C_T) were also observed, producing a decrease in both variables. In September 30th, the NC_T decreased by $90 \mu\text{mol kg}^{-1}$ while the NA_T decreased in $224 \mu\text{mol kg}^{-1}$, reaching $2180 \mu\text{mol kg}^{-1}$. This result indicates the effect is not only due to strong acid addition but to the loss of carbonate species, affecting both variables, together with silicate and phosphate precipitation with metals from the lava, changing the A_T .

The anomalies found in the carbon dioxide and hydrography properties were localized in the frontal seawater that moved up and displaced out as a tongue of 4-6m depth with anomalous values observed as far as 1.5 km in the first meter. When the lava was not arriving to the sea or was falling on previously formed rocks, the area affected was strongly limited to the first few tens of centimeters of the column and at distances of 10-15 m.

Key words: Carbonate system, lava-seawater interface, acidification.