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The 2011 El Hierro submarine eruption, Canary Islands: chemical and isotopic evidence in dissolved gases of seawater

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El Hierro is the smallest of the Canary Islands and is located in the southwest extreme of the archipelago. Since 16 July, an anomalous seismicity at El Hierro Island was recorded by IGN seismic network. After the occurrence of more than 10,000 seismic events, volcanic tremor started at 05:15 on October 10, 2011, followed by a green discolouration of seawater and strong degassing on October 12, 2011, indicating the occurrence of a submarine eruption at the south of El Hierro island. Further episodes of volcanic activity had occurred during November, December 2011 and January 2012, with turbulent water, foam rings, and volcanic material again reaching the sea surface. Colour of the discoloured area has changed frequently from light green to dark brown, depending on the eruptive activity. To provide additional information about the 2011 El Hierro submarine eruption, a chemical and isotopic study of the dissolved gases in the seawater affected by the eruptive event was conducted one week after the eruption started. Sea water samples were collected by the Ignacio Lozano Oceanographic Research Vessel (ICCM). Three vertical geochemical profiles of dissolved gases were carried out near the location of the submarine eruption. Depths of the sea water samples ranged from 10 to 400 meters. Dissolved CO_2, He, N2, O_2 and Ar as well as the isotopic composition of CO_2, Ar and He were analyzed. Relatively high 3He/4He ratio were observed at most of the sea water samples reaching values up to 5.8 RA (RA the 3He/4He ratio on air) at 100 meters depth of the geochemical vertical profile closest to the eruption site, suggesting a significant volcanic-magmatic-hydrothermal discharge through the submarine eruption vent. Other dissolved gas geochemical parameters such as N2/36Ar, N2/O_2 and CO_2/O_2 ratios clearly suggest a strong presence of a submarine volcanic plume around 100 meters depth associated to this submarine eruption. The He and CO_2 isotopes systematics confirmed also clearly a important contribution of MORB type gases at all the profiles for the CO_2 emission associated to this submarine eruption.