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## Temporal evolution of $^3\text{He}/^4\text{He}$ isotopic ratio at Dos Aguas cold mineral spring, La Palma, Canary Islands

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Recent volcanic activity of La Palma island, the fifth in extension (706 km<sup>2</sup>) and the second in elevation (2,423 m a.s.l.) of the Canarian archipelago, has taken place exclusively in the last 123 ka at the southern part of the island, where Cumbre Vieja volcano, the most active basaltic volcano in the Canaries, has been constructed. A total of seven volcanic eruptions have been reported along the main north-south rift zone of Cumbre Vieja in the last 500 years. On October 7<sup>th</sup> and 13<sup>rd</sup>, 2017, two remarkable seismic swarms interrupted a seismic silence of 46 years in Cumbre Vieja volcano with earthquakes located beneath Cumbre Vieja volcano at depths ranging between 14 and 28 km with a maximum magnitude of 2.7. Five more seismic swarms were registered in 2020.

$^3\text{He}/^4\text{He}$  ratio has been monitored at Dos Aguas cold mineral spring in La Palma Island since 1991 to date as an important volcano monitoring tool able to provide early warning signal of future volcanic unrest episodes. Magmatic helium emission studies have demonstrated to be sensitive and excellent precursors of magmatic processes occurring at depth. The highest  $^3\text{He}/^4\text{He}$  ratio reported to date from the Canarian archipelago has been measured at Dos Aguas: 10.24  $R_A$  (being  $R_A$  the ratio in atmospheric helium) (Padrón et al., 2015). This value is higher than any value found either in the lavas or terrestrial fluid in the Canary Islands, and indicates an important mantle contribution. According to the temporal evolution of the magmatic component of helium at Dos Aguas, we suggest the occurrence of aseismic magma rising episodes beneath La Palma within the upper mantle towards an ephemeral magma reservoir in the period 2007-2017. However, in the period 2017-2020, magma rising have produced seismic swarms that were accompanied also by the highest  $^3\text{He}/^4\text{He}$  ratio measured at Dos Aguas (10.42  $R_A$ ); both geochemical and geophysical signals confirm an upward magma migration towards a subcrustal magma reservoir beneath La Palma island.