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# Diffuse helium and hydrogen degassing to reveal hidden geothermal resources in oceanic volcanic islands: The Canarian archipelago case study

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During geothermal exploration, the geochemical methods are extensively used and play a major role in both exploration and exploitation phases. They are particularly useful to assess the subsurface temperatures in the reservoir, the origin of the fluid, and flow directions within the reservoir. The geochemical exploration is based on the assumption that fluids on the surface reflect physico-chemical and thermal conditions in the geothermal reservoir at depth. However, in many occasions there is not any evidence of endogenous fluids manifestations at surface, that traditionally evidence the presence of an active geothermal system. Discovery of new geothermal systems will therefore require exploration of areas where the resources are either hidden or lie at great depths. Geochemical methods for geothermal exploration at these areas must include soil gas surveys, based on the detection of anomalously high concentrations of some hydrothermal gases in the soil atmosphere, generally between 40 cm and 1 meter depth from the surface. Among soil gases, particularly interest has been addressed to non-reactive and/or highly mobile gases. They offer important advantages for the detection of vertical permeability structures, because their interaction with the surrounding rocks or fluids during the ascent toward the surface is minimum. This is the case of helium (He) and hydrogen (H2), that have unique characteristics as a geochemical tracer, owing to their chemical and physical characteristics. Enrichments of He and H2 observed in the soil atmosphere can be attributed almost exclusively to migration of deep-seated gas toward the surface.

In this work we show the results of soil gas geochemistry studies, focused mainly in non-reactive and/or highly mobile gases as He and H2, in five minning grids at Tenerife and Gran Canaria, Canay Islands, Spain, during 2011-2014. The primary objective was to use different geochemical evidences of deep-seated gas emission to sort the possible geothermal potential in five minning grids, thus reducing the uncertainty inherent to the selection of the area with the highest success in the selection of future exploratory wells. By combining the overall information obtained by statistical-graphical analysis of the soil He and H2 data, visual inspection of their spatial distribution and analysis of some interesting chemical ratios, two of the five minning licenses, located at the southern and western parts of Tenerife Islands, seemed to show the highest geothermal potential of the five mining grids studied. These results will be useful for future implementation and development of geothermal energy in the Canaries, the only Spanish territory with potential high enthalpy geothermal resources.