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Soil gas He and H_2 for surface geothermal exploration in Gran Canaria, Canary Islands

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Exploration geothermal methods include a broad range of disciplines. Among them, geochemical techniques are particularly useful in the early stages of research and even more when there are no obvious geothermal manifestations at the surface environment. Thereby, geochemical prospecting of soil gases and volatiles in the soil matrix itself can provide information of permeable areas and potential up flow. Gran Canaria in one of the central islands of the Canary Archipelago located off the West African continental margin. Eruptive activity in the late stages of the first cycle of volcanic construction of Gran Canaria progressively declined and, finally, the island entered a long period of eruptive quiescence (5.3-8.8 Ma). During this episode the island was intensely eroded. This repose period affected the entire island, but it is more evident in its southwest part, where the Miocene volcanism has not been as intensely resurfaced. The northeast part, in turn, is almost entirely covered by Pliocene to Quaternary volcanism, reaching 500 m of total deposit thickness in some places.

We report herein the results of an intensive soil gas study, focused on non-reactive and/or highly mobile gases such as helium (He) and hydrogen (H_2), in the younger northeast portion (Neocanaria) of Gran Canaria, with geothermal exploration purposes. Helium has unique characteristics as a geochemical tracer: it is chemically inert and radioactively stable, non-biogenic, highly mobile and relatively insoluble in water. Hydrogen is the second most abundant reduced gas in the atmosphere. It is one of the most abundant trace species in volcano-hydrothermal systems and is a key participant in many redox reactions occurring in the hydrothermal reservoir gas.

Soil gas samples were collected at 2,871 sites selected from June 2017 to November 2017, with an average distance between sites of $\approx$ 250 m. Soil gases were sampled at $\approx$ 40 cm depth using a metallic probe with a 60 cc hypodermic syringe and stored in 10 cc glass vials for later laboratory analysis. At the time of writing this abstract, only samples from south-east sector of the study area have been analyzed. He content was analysed by means of a quadrupole mass spectrometer (QMS; Pfeiffer Omnistar 422) and hydrogen concentrations by a micro-gas chromatograph (microGC; VARIAN CP4900). Soil He concentration showed values up to 6.1 ppm with an average of 5.22 ppm. Soil H_2 concentrations measured ranged from typical atmospheric values ($\approx$ 0.5 ppm) up to 7.2 ppm. The mean value measured for $H_2$was 1.56 ppm. The results showed here can help to identify the possible existence of permeable portions of deep-seated actively degassing geothermal reservoirs, particularly where the interpretation and application of geophysical data is difficult.