Geophysical Research Abstracts
Vol. 20, EGU2018-14167-2, 2018
EGU General Assembly 2018

Soil gas ^{222}Rn survey 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 in 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 is one of the central islands of the Canarian Archipelago, located at the West African continental margin. The subaerial volcanic/magmatic history of the island started 15-16 Ma ago. The last volcanic/magmatic phase of Gran Canaria started in the late Pliocene, is restricted to the northern part of the island and has continued until the present. The youngest eruption on Gran Canaria occurred ∼3000 years BP. The island can be considered volcanically active, as testified by numerous prehistoric basanite scoria cones, maars and lava flows (Krastel and Schmincke, 2002). Radon is a naturally occurring noble gas, produced in the decay chains of uranium and thorium. Radon is volatile, and will readily partition into the gas phase during degassing. It is also soluble, and will dissolve in aqueous fluids. The volatile and short-lived nature of ^{222}Rn means that variations in ^{222}Rn activity can be used to map fluid flow along active faults and fractures in volcanic areas. An intensive geochemistry survey of soil gas ^{222}Rn was carried out from June to November 2017, as a tool to study the potential geothermal resource in Gran Canaria Island. The study area covers a surface of 688 km^2 within the island of Gran Canaria (1560 km^2). A total of 2871 samples were performed in the younger northeast portion with an average distance between sites of ≈ 250 m. ^{222}Rn activity were measured by means of a portable SARAD RTM 2010-2 radon monitor; the instrument pumped gas through a stainless steel probe inserted at 40 cm depth and measured the ^{222}Rn activity by electrostatic detection of the positively charged daughter isotopes.

The soil gas ^{222}Rn values ranged from atmospheric levels to 58 kBq·m^{-3}with an average of 9 kBq·m^{-3}. These values are higher than those observed at other volcanic islands as Tenerife, where the maximum and average measured values were 11 and 1.6 kBq·m^{-3}, respectively. The spatial distribution of soil gas ^{222}Rn activity shows high radon values in the north and south of the study area ($>$ 20 kBq·m^{-3}) and in the centre of the island ($>$ 16 kBq·m^{-3}). These results can help to identify the possible existence of actively degassing geothermal reservoirs, particularly where the interpretation and application of geophysical data is difficult.