

## **Geochemical characteristics of the main high-temperature geothermal deep fluids presently highlighted in Caribbean Islands**

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The Caribbean Islands being part of the Lesser Antilles volcanic arc such as Guadeloupe, Martinique, Dominique, Montserrat, Santa Lucia, etc., must face the fragility of their energetic system and environment, given their insularity. However, these territories which are home to young volcanic systems possess a huge potential for power generation from high-temperature (HT) geothermal energy. Although they are experiencing mounting energy costs and CO<sub>2</sub> emissions, this promising energy source which is indispensable for them to be able to hope to achieve energy self-sufficiency, is available continuously for electricity production unlike most of other renewable energies, is cheaper than fuel-based technologies, can also be used for thermal applications such as cooling, drying uses for agriculture, fishing farmers, balneology, etc., and could contribute to generate jobs directly and indirectly, remains difficult to develop in these islands. Unfortunately, even though the first exploration works have been carried out in the 1970s in some of these territories, the Bouillante HT (260°C) geothermal power plant in Guadeloupe, exploited since 1986, is currently the alone example of electricity production in the Caribbean area. With two production units (total capacity of 15 MW<sub>e</sub>) since 2005, its present annual electricity production is close to 110 GWh (about 5-6% of the island's needs). If in the past, some deep wells drilled in the Santa Lucia and Martinique islands had to be abandoned and closed, new exploration works carried out in most of these Islands as well as deep wells recently drilled in the Dominica and Montserrat Islands suggest promising geothermal developments. As for the Bouillante field, the deep geothermal fluids highlighted in the other Islands are neutral pH seawater derived fluids mixed with meteoric fresh waters at different proportions, which interact with reservoir volcanic rocks at temperatures close to 180°C in Martinica and 230-260°C in Montserrat and Dominica. The presence of deep fluids with higher temperatures ( $\geq 280^{\circ}\text{C}$ ) and different chemical facies in the proximity of the active volcanoes is possible, but can cause problems of exploitation, as observed in the past in the Santa Lucia Island, due to the high salinity and acidity of these fluids and the low reservoir permeability. The ambitious objectives of the energy transition in the world, the recent arrival of some industrials like Ormat, majority owner and operator of the Bouillante power plant since 2015, and new investors, who aim to develop and operate future geothermal fields in the Caribbean islands, encouraged by new types of funds, is an excellent message for the future. The Caribbean Centre of Excellence of Geothermal Energy, currently being created in the Guadeloupe Island within the framework of the INTERREG V Caribbean Energetic Transition program, featuring a network of scientific research, formation and industrial activity, would have to allow promoting and developing this energy in this entire region. In this context, the success of the Bouillante story could become a stepping-stone for the geothermal development in the Caribbean area.