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Session: Geothermal Research – Volcanology

Oral presentation

Contribution of multi-methods geophysics to improve the regional knowledge of Bouillante geothermal Province (Guadeloupe)

Lydie Gailler[1], Vincent Bouchot[1], Jean-Michel Baltassat[1], Nicolas Coppo[1], Bernard Bourgeois[1], Guillaume Martelet[1], Isabelle Thinon[1]

[1] BRGM, 3 avenue Claude Guillemin, 45060 ORLEANS LA SOURCE

Corresponding author: l.gailler@brgm.fr

The need to understand the geological context of the Bouillante geothermal Province (Basse-Terre, Guadeloupe, French West Indies) has led to numerous onshore and offshore geophysical investigations. This work presents a compilation of all available, subaerial and marine, gravity and magnetic, electric and magnetotelluric data acquired during the last 30 years.

Oldest electric and magnetotelluric data were digitalized from manuscripts (area of interest from Mahaut to Basse-Terre). Although we faced different problems related to missing acquisition parameters, we partially reconstruct MT tensors to provide a qualitative interpretation of resistivity distribution at depth. The previous interpretations have been improved and evidenced well developed conductive anomalies overlying more resistive ones at the location of, but also beyond, the geothermal field area.

The large-scale gravity signal (from Montserrat to La Dominique) is used to explore existence and geometry of deep dense intrusive complexes beneath La Soufrière and the Bouillante Chain (if existing) volcanoes which could be interpreted as heat sources for the geothermal systems. Modelling has been initiated to constrain the geometry of such structures together with the distribution of more or less dense products both onshore and offshore.

Because Guadeloupe volcanism spars the Brunhes-Matuyama geomagnetic reversal (0.78 Ma), analysis of magnetic anomalies highlight areas predominantly composed of formations either younger or older than the reversal. Modeling is used to reconstruct a generalized topography of the island at 0.78 Ma. The detailed analysis of the offshore magnetic lineaments will be tentatively used to understand the inheritance of the lithosphere structure in the island evolution.

An updated large-scale model of the geothermal system will be proposed based on geological constraints and previous geophysical interpretations. This synthesis could act as a guide in the implantation of upcoming surveys in order to better constrain the Bouillante geothermal Province, and to improve the knowledge the island evolution as a whole.

This post-doctoral study is carried out in the framework of a "Carnot institute" labeled project.