

## **Geothermal activity related to transtensional context evidenced by petrological and structural data in the St Kitts Island (Lesser Antilles)**

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Volcanic area may be the main target for high enthalpy geothermal production. Several islands in Lesser Antilles want to develop this energy to produce electricity; St Kitts is one of them. Field analysis allows to propose a geodynamic framework for the dynamic of hydrothermal reservoir in the vicinity of an active volcano.

St. Kitts Island is located in the northern part of the Lesser Antilles volcanic arc. Volcanic activity initiated at around 3 Ma in the southern part of the island and migrated progressively north-westward until its current position at the active Mt. Liamuiga volcano.

Andesites are the large majority of magmatic rocks in the form of lava, dome, sills and dikes intrusive into pyroclastic deposits. Several evidences of active hydrothermal system such as fumaroles, boiling water are present in the St Kitts Island. All of these activities are structurally controlled.

Satellite images and Digital Topographic Map analyses at regional scale and systematic measurement of fractures at outcrop scale highlight four main structural lineaments with NE-SW, NW-SE, N-S, and E-W trends respectively. Furthermore detailed field observations allow us to precise the geometry and kinematics of major faults. The main NW-SE steeply dipping left-lateral strike-slip faults and associated NE-SW normal faults with a NW dip correspond to a trans-tensional context.

The southern oldest part of the island exposes greenschist facies rocks, which contrast with the non-metamorphic northern younger rocks. This huge jump of metamorphism could reflect exhumation related to normal faulting. In the Frigate Bay area, on the trace of main normal fault, the rocks present an intensive structural and petrological transformations related to hydrothermal fluid circulations. Located at the intersection of the main fault system, this site is interpreted as a hydrothermal paleosystem and is considered as an analogue of the deep northern part of the island under a current hydrothermal activity. Petrophysical properties are measured on a selected set of samples representative of the main petro-structural facies, andesite, volcano-sedimentary, and altered of the both previous. These properties show large ranges of variation, porosity from 2 to 40%, permeability from 10<sup>-3</sup> to 3 D; thermal conductivity is relatively low, 1.5 W.m<sup>-1</sup>.K<sup>-1</sup>. These petrographic and structural elements with their petrophysical properties are used to develop a first hydrothermal model for the deep geothermal reservoir.