Heat Flow measurements reveal pervasive fluid circulation, related to the subducting slow-spreading oceanic basement, within the Northern Lesser Antilles outer forearc.

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Atypical along-dip stability of heat-flow values from the trench to the forearc in the Northern Lesser Antilles reveal the hydrothermal convection of a ventilated fluid system, where the subducting crust consists in exhumed and serpentinized mantle rocks.

We compare the thermal structure of Northern and Central Lesser Antilles along two margin-perpendicular profiles located offshore off Antigua and Martinique Islands, respectively. We perform 2-D steady-state finite elements thermal modelling constrained by heat flow measurements, deep multichannel reflection and wide angle seismic data recorded during the Antithesis cruises. Along the Antigua profile, the heat flow remains atypically constant, at 40 ± 15 mW.m-2 from the trench to the forearc. This "flat" trend, trench to forearc, contrasts with decreasing heat-flow values 1/ from 70 to 40 mW.m-2 along the Martinique profile and 2/ from 55 to 30 Mw.m-2 for calculated heat-flow values derived from purely conductive heat transfer. Thus, compared to the typical landward decrease in conductive heat-flow, measurements in the Northern Lesser Antilles reveal a geothermal gradient that is 10-20% lower in the trench and 40-50% higher beneath the forearc.
Offshore of Antigua, geological and tectonic settings favor ventilated-type fluid circulation (see Klingelhoefer et al., this session), which is consistent with the heat-flow stability. In the trench, the subducting oceanic basement, crystalized at the slow-spreading Mid-Atlantic Ridge, partly consists in serpentinized exhumed mantle rock (Klingelhoefer, et al., submit), deeply and pervasively affected by deep ridgeward-dipping shear planes (Marcaillou et al., 2017). This dense and pervasive tectonic fabric favors hydrothermal cooling by downward-flowing fluids and thus low heat flow values. At the forearc, the 50-km-wide deeply-rooted Tintamarre faults system (Boucard et al., submit, and this session) is associated to increased porosity and high water content (Klingelhoefer, et al., submit, and this session). This fault system provides pathways collecting fluids, which results from overpressure and deserpentinisation at depth, generating hydrothermal warming and high heat-flow values in surface.

Mots-Clés : Seismogenic zone, Thermal modelling, Heat flow, Exhumed mantle rocks, Serpentinite dehydration reaction, Northern Lesser Antilles.t