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Variable heat-flow patterns and hydrothermal processes near the Mid-Atlantic Ridge

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Oceanic heat-flow is commonly affected by water circulation. The primary mechanism was identified by Lister (1972) near the Juan de Fuca ridge (NE Pacific) and attributed to hydrothermal flow within the oceanic basement: sea-water recharges at certain seamounts, flows within the high-permeability basement below the sediments and discharges at other seamounts. As a result, the heat-flow measured at the ocean bottom is significantly lower than expected for a conductively cooling lithosphere, as long as the fluid is not in equilibrium with the host rock. But this is not the only mechanism for low heat-flow values in the oceanic lithosphere: near the Mid-Atlantic ridge, Langseth et al (1992) have identified the process of sea-water drawdown into the sediments. Here we present results from a recent heat-flow survey (OCEANOGRAFLU, June 2013) on the Mid-Atlantic Ridge flanks at about 35°N, close to the Oceanographer fracture zone, where we have observed similar evidences that sea-water can flow directly into the surficial sediments. Where the heat-flow is lower than the conductive cooling values, the temperature-depth profiles are systematically non-linear, showing sigmoid shapes or negative gradients, and the sediment porewaters have compositions close to that of sea-water. No clear evidence for basement recharge or discharge is observed, which differs significantly from the results of a previous study 400 km North, where the heat-flow pattern was more consistent with water flowing into the oceanic basement rather than into the sediment (Lucazeau et al, 2006). We will present the relevant observations and examine the possible causes for the different processes affecting the heat-flow in the Mid-Atlantic Ridge flanks.