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熱流量等から推定した海底熱水循環の空間スケール
Spatial scale of hydrothermal circulation in the Iheya north site, inferred from heat flow and other data

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Numerous surface heat flow data were obtained during 2002-2008 in the area of the Iheya-North hydrothermal field in the middle Okinawa Trough, in order to clarify the spatial extent of the hydrothermal circulation system. In 2010, Drilling stidy was carreid out during IODP Expedition 331, and new subbottom temperature data were acquired around the hydrothermal site.

Within a small basin surrounded by knolls, three distinct zones are identified with different heat flow values, which we termed the high-, moderate-, and low-heat-flow zones. In the high-heat-flow zone located near the western edge of the basin, extremely high and widely scattered heat flow values were measured within ~500 m of the active hydrothermal mounds, venting black smoker fluid of maximum 311 degC. With increasing distance east of the high-heat-flow zone, heat flow gradually decreases from 1.0 to ~0.1 W/m2 in a region where surface sediment is dominated by clay and a high-resolution bathymetry indicates a smooth seafloor surface. We term this area the moderate-heat-flow zone. Further to the east (~2 km from the high-heat-flow zone), the seafloor consists of coarser sediment with a rugged surface, and heat flow is very low (<0.1 W/m2), as designated the low-heat-flow zone. We suggest that such anomalously low heat flow can be explained by the recharge of seawater into the formation, and that hydrothermal vents or diffuse flow in the high-heat-flow zone can drive this kilometer-scale hydrothermal circulation within the Iheya-North knoll complex, if the sediment below the moderate-heat-flow zone is impermeable enough to prevent vertical fluid migration but is permeable enough to encourage horizontal flow.

2-dimensional numerical simulation was conducted to estimate possible premeability structure, including impermeable surface layer and permeable zone below. We report results from numerical simulation as well as new IODP data.

Keywords: hydrothermal circulation, Okinawa Trough, Iheya north field, heat flow, IODP