Heat flow in the Muroto forearc, SW Japan, derived from dense seismic survey: Possible effect of seamount subduction

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In the central to western Nankai Trough. a series of dense seismic reflection surveys were conducted in 2018-2020 (Nakamura et al., 2022 GRL). They show impressive topographic features of the subducting plate boundary, including a subducting seamount off Cap Muroto.
Compiled seismic dataset was used for picking BSRs (bottom-simulating reflectors), which define a boundary between the hydrate-rich formation above and a gas-bearing layer below. The heat flow values are calculated from these BSR depths in the forearc region of central-western Nankai Trough. The result was then merged with the existing heat flow data (surface, borehole and BSR-derived) in this area.
BSR-derived heat flow is calculated from the depth and the temperature at BSR, and the average thermal conductivity between seafloor and BSR. The temperature at BSR is calculated from the P-T curve for hydrate stability obtained from laboratory data. We temporarily set the thermal conductivity values at 1.3 W/m/K throughout the system. It may be revised by using the Vp model along the seismic lines and the borehole data. The depths to the BSR are populated between 400 and 500 m below seafloor. The short wavelength variations are filtered out and the obtained heat flow values are regionally averaged ones.
In general, heat flow is highest near the trough axis off Muroto (near the central Nankai Trough). In the forearc region, heat flow varies between 50-70 mW/m^2, but it is lowest in the forearc off Hyuga-Nada, westernmost portion of Nankai Trough.
On the forearc area off Muroto, the topography is characterized by a large landward embayment compared to its east and west sides, including the trough axis and deformation front. Within 20 km landward from the deformation front, heat flow is ~80 mW/m^2 in this embayed area, whereas it is 40-60 mW/m^2 on either side of embayment. Further landward, we found a low heat flow region (~60km x 30km, extending parallel to the trench) above the subducted seamount off Cape Muroto. The heat flow is ~30 mW/m2, almost half in the surrounding area. We propose that the heat flow is affected by the subduction of seamount (Nakamura et al.). It is interpreted to be as large as 20-km in diameter, and the low heat flow seems to extend above and seaward side of the seamount.
There are observations from other seamounts. In the Hyuga-nada forearc region off eastern Kyushu, the Kyushu-Palau Ridge (KPR) is obliquely subducting toward N30W since several Ma B.P. Across KPR we observed a ‘bowl-shape’ negative heat flow anomaly with its width ~50 km. The heat flow outside is ~45 mW/m^2, whereas it is ~25 mW/m^2 above the subducted KPR. In the Costa Rican convergent margin subduction of seamounts significantly disrupt the overlying sediments and heat flow variation. This variation is likely due to advective fluid flow through fractures related to seamount subduction (Harris et al., 2010 G3).
We discuss possible mechanisms of variable heat flow around the subducted seamount in this presentation.

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