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On the extent of the high heat flow anomaly observed seaward of the Japan Trench

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Recent studies revealed that the Pacific plate subducting along the Japan Trench may not be so cold as estimated from its old age, over 100 m.y. On the seaward slope of the trench along a parallel of 38^o45'N, heat flow was found to be variable: high (70 to 120 mW/m^2) at some locations and normal for the seafloor age (about 50 mW/m^2) at others. Young volcanic rocks sampled on the seaward trench slope and on the ocean basin about 500 km away from the trench indicate the existence of peculiar intra-plate volcanism ('petit spot').

We conducted heat flow surveys in the area around the Japan Trench on KR08-10 (R/V Kairei) and KT-08-25 (R/V Tansei-maru) cruises in 2008 for further investigation of these thermal anomalies on the old Pacific plate. Measurements were made along two E-W lines at around 40^o15'N and 37^o50'N, mainly seaward of the trench. Ordinary deep-sea heat-flow probes were used at most stations, while temperature profile measurements were made with a piston core sampling system with temperature sensors mounted on the barrel at some stations. Physical properties of seafloor sediments, including thermal conductivity, were measured on the core samples. Temperature gradient was also measured using short probes for submersibles (SAHF) during dives of ROV Kaiko 7000II.

Both at 40^o15'N and at 37^o50'N, high heat flow values were measured as well as normal values on the upper part of the seaward trench slope and on the outer rise, with the highest values exceeding 100 mW/m^2. It strongly suggests that the heat flow anomaly extends along the Japan Trench at least in the northern part. We conducted closely-spaced measurements in a relatively flat region at around 40^o15'N, 145^o40'N and found that heat flow varies along the E-W line by nearly 100 % in only about 2 km, which indicates that this anomaly originates from some thermal feature at a shallow depth. On the other hand, high heat flow values were obtained in the vicinity of an over 100-m high cliff with no significant variation across the cliff. These results provide constraints on the cause(s) of the high heat flow anomaly. We intend to construct a thermal model of the topmost part of the Pacific plate consistent with the surface heat flow data for better estimation of the temperature distribution of the subduction plate interface landward of the trench.