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Comment

## ***Interactive comment on “Positive geothermal anomalies in oceanic crust of Cretaceous age offshore Kamchatka” by G. Delisle***

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This paper reports measurements of heat flow collected in the Kamchatka region on the Pacific Plate. The data verify provide further evidence for a region of high heat flow identified by previous measurements. This site provides for the interesting possibility of examining a hydrothermal system within middle-aged oceanic crust. I have identified one major aspect of the interpretation that needs improvement and a few minor items.

### General comments

Section 5.1 I question the interpretation of a large area of high heat flow. The author appears to be making this assessment based on the contour map (Figure 9) which is constrained by four closely spaced measurements and another warm measurement

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much further to the north. Hot fluid discharge zones are typically very localized and can draw cold water from distant regions (e.g. Davis & Becker, in *Hydrogeology of the Oceanic Lithosphere*, ed. Davis and Elderfield, pp.225-227, 2004; Hutnak et al., *Nature Geoscience*, 2008). I suspect that calculated water volume is grossly overestimated.

I agree that the high heat flow data are consistent with an advective source on a plate of this age. A possibility for fluid infiltration or expulsion may be related to the faulting of the subducting plate as it bends (Greveymeyer et al., *EPSL*, 2005). Another source of high heat flow anomalies on older oceanic lithosphere are mud volcanoes (Kaul et al., *Marine Geol.*, 2006; Eldholm et al., *Geo-Marine Lett.*, 1999). There have been a number of studies focusing on hydrothermal systems operating within the crust away from the ridges. A brief review of the literature would improve this discussion and could help develop testable hypotheses that could be explored in future work.

The authors do suggest that some cool regions near the trench may be part of this hydrothermal system. However the distances from these 'low' heat flow anomalies to the high measurements is on the order of 100 km. The hydrothermal systems described by Hutnak et al. (2006) are drawing water from distances as great as 40 km and are the largest previously identified. If the author's interpretation of source region is reasonable, this would suggest that water can travel much further through the crust than previously identified. However, a more extensive study involving additional heat flow data, seismic data to constrain structures influencing fluid flow, and possibly fluid chemistry would be required to make an accurate assessment.

#### Specific comments

p454 line 10 - 'descend' should be 'descent'

p458 first paragraph - Could the high standard deviations in thermal conductivity result from uneven sediment compaction?

p458 line 18 and Figure 3 - While I agree that the temperature gradients are relatively

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constant, all sites save HF25 have one temperature measurement resulting in a negative gradient within a single interval. The interval is too small for appreciable fluid flow and is certainly not resulting from bottom water variations or variations in thermal conductivity. It would be nice to see a Bullard plot to see how constant heat flow is within each interval.

p460 line 23 - 'Therefore, and considering...' should be 'Therefore, considering...'

p462 line 13 - add units to 25000

p463 line 22 - 'are connected, cannot be decided due to lack...' This statement should be reworded. Suggest 'are connected, this connection cannot be definitively determined due to lack...'

Figure 1 - I would like to see the locations of previously collected heat flow sites on this figure as well. What is the contour interval for bathymetry?

Figure 2 - The plots have lots of whitespace and should all be placed on the same axes limits. The plots for each area could be placed on one panel with different symbols for easier comparison.

Figure 3 - Vertical axis should be labeled Temperature (oC).

Figure 4 - Second sentence is a repeat of information in the text.

Figure 5 - Add a color bar or make the contour labels larger. The sentence 'The surprisingly high...' is an interpretation best left in the text.

Figure 6 - Missing closed parenthesis on vertical axis.

Table 2 is not very useful and could be simply stated in the text.

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Interactive comment on Solid Earth Discuss., 3, 453, 2011.

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