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# Seafloor morphology and the thermal evolution of oceanic lithosphere

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Standard reference models for the cooling of oceanic lithosphere, on average, predict the observed temperature-dependent properties, such as depth and heat flow with age. However, for all generally accepted models a significant discrepancy exists between measured and expected heat flow for ages less than about 65 million years. Traditionally lower measured heat flow average values are explained by significant hydrothermal circulation through the uppermost oceanic crust. In this approach, it is assumed that some of the heat transferred by conduction from lithospheric depths is removed by the water flow and transferred between the oceans and crust at locations where the seafloor is bare or poorly sedimented. This component of heat transfer would not be detected by the measurements, which record only conductive transfer. However, recently Hofmeister and Criss [2005] have suggested that hydrothermal circulation is not a significant factor, so the measured marine heat flow results should be used instead of the thermal models in calculating total heat loss for the earth. This approach lowers the loss by about 25%. This hypothesis is tested by examining whether the discrepancy between the predicted and measured heat flows varies between sites such that the highest heat flow is observed where hydrothermal flux should be least due to the regional topography of the igneous basement and sediment thickness. This appears to be the case. Sites with ages less than 65 million years in areas with smooth basement and thick sediment cover have average heat flow equal to that expected from thermal cooling models, except at the very youngest ages. In contrast, sites in areas with thinly sedimented basement outcrops have significantly lower heat flow. These sites make up a progressively lower fraction of the total at older ages as sedinent cover increases. Moreover, for all site types, the measured heat flow approaches the cooling model's predictions at older ages. As a result, by 65 million years the net measured heat flow is essentially that predicted by the cooling model. These results are consistent with the hypothesis that hydrothermal heat transfer in the oceanic crust is significant.