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# Thermal Structure of the Slow-spreading Segment Centre in the Presence of Crustal Magma Chamber

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Thermal models predict that steady state axial magma chambers (AMCs) along mid-ocean ridges cannot be sustained at spreading rates less than 30 mm/year. Moreover, stability of an AMC is predominantly influenced by the rate of the magma supply and by the efficiency of the hydrothermal circulation. Discovery of an AMC at the slow-spreading Lucky Strike segment along Mid-Atlantic Ridge (37.6˚N) gives a motivation to investigate the parameters that control the presence and the long term stability of the AMC or its temporal variability. Within the MOMARNet project, we investigate different models with varying magma supply rates, AMC geometries and hydrothermal cooling rates to evaluate the parameters which determine the thermal structure of slow-spreading ridges, allowing for the presence of either steady state or unsteady state AMCs.

We used spectral flow solution and finite difference technique to calculate the 3-D conduction and advection of heat associated with the asthenospheric flow below a slow-spreading mid ocean ridge. Calculated asthenospheric flow is driven by diverging constant thickness plates (6km) with a half-spreading rate of 1.1cm/yr. The thermal models include hydrothermal cooling parameterized by Nusselt number ranging from 6 to 10 and consider the heat associated with magma emplacement (injection temperature). Emplacement of the magma is modeled by determining the heat source term at the ridge axis including the injection temperature, specific and latent heat of the magma which are derived from previous modeling and laboratory experiments. By varying and exploring the parameter space, we constrain the critical magma supply and required hydrothermal cooling rates required for the development of an AMC underlain by a hot asthenospheric crust, an isolated AMC within colder lithospheric crust, or absence of an AMC.