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Numerical Simulation of Magma Effects on Hydrothermal Venting at Ultra-Slow Spreading Southwest Indian Ridge

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Finite element method is used to numerically simulate oceanic crust thermal dynamics in order to understand the hydrothermal venting mechanism at ultra-slow spreading ridge, whether is the ancient magma chamber still living and supplying hot magma for vents or have surrounding hotspots been affecting on the ridge continually with melting and hot magma. Two models are simulated, one is a horizontal layered oceanic crust model and the other is a model derived from wide angle seismic experiment of OBS at the ultra-slow spreading Southwest Indian Ridge (50°E, Zhao et al., 2013; Li et al., 2015; Niu et al., 2015). For the former two cases are simulated: without magma from upper mantel or with continuous magma supply, and for the latter supposing magma supply occurs only once in short period. The main conclusions are as follows: (1) Without melt magma supply at the oceanic crust bottom, a magma chamber can live only thousands $\sim$ ten thousand years. According to the simulated results in this case, the magma chamber revealed by seismic data at the mid-east shallow section of the Southwest Indian Ridge could only last 0.8Ma, the present hydrothermal venting is impossible to be the caused by the magma activity occurred during 8-11Ma (Sauter et al., 2009). (2) The magma chamber can live long time with continuous hot magma supply beneath the oceanic crust due to the melting effects of surrounding ridge hotspots, and would result hydrothermal venting with some tectonic structures condition such as detachment faults. We suggest that the present hydrothermal activities at the mid-east shallow section of the Southwest Indian Ridge are the results of melting effects or magma supply from surrounding hotspots. This research was granted by the National Basic Research program of China (grant 2012CB417301) and the National Natural Science Foundation of China (grants 41176046, 91228205).

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