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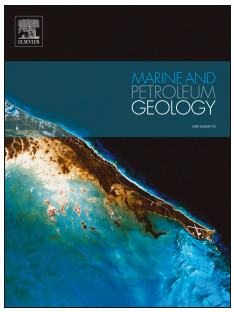

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Numerical Modeling of the Lusi Hydrothermal System: Initial Results and Future Challenges

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Abstract

The Lusi mud eruption in East Java, Indonesia, is an active clastic-dominated geyser and a sedimentary hosted hydrothermal system that has generated wide interest across many disciplines. This moderate-to-high enthalpy system is driven by multiphase and multicomponent processes, fluid and rock mechanics, and heat transport processes, all which present challenges in developing realistic numerical models of the underlying physics. We develop a hydrogeological conceptual model for this deep and complex hydrothermal system, and construct an appropriate 3D geological model using the available data. This geological model then serves as the basis for numerically simulations that include some of the dominant processes driving Lusi. We adopt a flexible continuum approach with an efficient numerical simulator based on the 3D geological model representing the deep structures of this hydrothermal system and geothermal reservoir by incorporating borehole information and seismic data obtained in the framework of the LUSI Lab project. The geological model is transformed into a computational grid using binary space partitioning (BSP) of the input geometry and octree refinement on the grid to perform multi-physics simulations. Thermodynamic calculations using the equation of state for a CO_2-bearing aqueous NaCl solution suggest that Lusi is a two-phase flow system (Water/CO_2). Finally, we present initial results from a simple hydro-mechanical multiphase numerical model that simulates processes that likely contributed to the initiation of Lusi.