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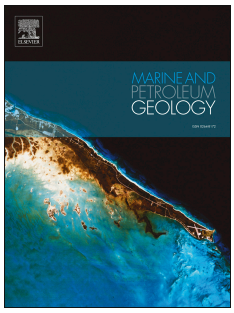

Modelling fluid flow in active clastic piercements: Challenges and approaches

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Modelling fluid flow in active clastic piercements: challenges and approaches.

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Abstract

Clastic eruptions are the surface expression of piercement structures such as mud volcanoes or hydrothermal vent complexes and involve subsurface sediment remobilisation and fluid flow processes. During these eruptions, many different processes are involved over a wide range of temporal and physical scales, which makes it a highly challenging multi-phase and multi-processes system to model. Field studies on piercement structures rarely include monitoring and detailed descriptions of clastic eruptions, and only a few attempts have been made to model fluid flow during these events. Moreover, these models have usually only considered one or two dimensions and/or have a limited spatial resolution.

In this paper, we summarise the elements that are relevant for modelling fluid flow during clastic eruption: the geometry of the system, the ascending material and the host rocks. We present the main challenges associated with the identification of processes and quantification of parameters. By analogy to magmatic systems, we suggest that the type of clastic eruptions could be controlled by the liquid-gas flow pattern in the conduit. Effusive eruptions could be explained in terms of annular flows, while slug or churn flows could be expected during explosive events. We also propose that the viscosity of liquid mud controls the presence of slug flows in the conduit.