Geophysical Research Abstracts
Vol. 14, EGU2012-8643, 2012
EGU General Assembly 2012

Fracturing driven by gas exsolution

A Hafver (1), ME Kobchenko (1), A Malthe-Sørenssen (1), and P Meakin (2)

(1) Physics of Geological Processes, University of Oslo, Box 1048 Blindern, N-0316 Oslo, Norway, (2) Idaho National Laboratory, P.O. Box 1625, Mail Stop 2211, Idaho Falls, Idaho 83415-2211, USA

The formation and dynamics of fractures due to uniform fluid production is important for many geological systems, such as for primary migration of hydrocarbons, dehydration and devolatilization reactions. However, the basic mechanism of the process or the key signature in the form of fracture network geometries are not understood. We have therefore developed a set of analogue experiments addressing the fracturing of a thin, confined layer of gelatin which consumes sugar to generate CO_2. Exploratory experimental studies show that the system exhibits a complex dynamics with clear fracture-fracture interactions during fluid production and expulsion. Here, we introduce a model to address the dynamics observed in the experiment by focusing on the material failure process induced by bubble formation during CO_2 production. We use a discrete element model to address the elastic gel matrix with a coupled representation of the dissolved gas. The failure of individual bonds is modeled as a thermally activated processes - where the transition probability depends on the local stress as well as the local saturation of the dissolved gas. The model is used to address the phase-diagram for the fracture patterns, with a particular focus on hierarchical fracture system and drainage dynamics during fluid expulsion.