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Thermal decomposition of carbonates and fluid pressurisation during seismic slip

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There is evidence of release of CO_2 gases during seismic slip. A high content of dissolved CO_2 is commonly observed in water springs near active faults. Infrared mapping in pseudotachylites from the Nojima fault (Japan) revealed a carbon supersaturation in the melts and the quantity of CO_2 released during the 1995 Kobe earthquake was evaluated to 1.8 to 3.4 10^3 tons (Famin et al. 2007). This production of CO_2 is due to the thermal decomposition of carbonates and is an additional mechanism in the processes of fault weakening.

In this paper, we introduce this chemical coupling in the analysis of shear heating and fluid pressurisation phenomenon (Sulem et al. 2007). The equations that govern the evolution of pore pressure and temperature inside a rapidly deforming shear band consisting of carbonate rock, and the mass of exsoluted CO_2 are deduced from the mass and energy balance of the multi-phases saturated medium and from the kinetics of the chemical decomposition of calcite. The thickness of the sheared zone is a key parameter of the analysis.

References

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