

# PhD position in physical volcanology - computer science at the University of Geneva, Switzerland

## Applying Cellular Automata and Lattice Boltzmann methods for the study of transport and deposition of volcanic particles

Most tephra dispersal models from the volcanic literature are based on analytical solutions of simplified parameterization of the physical system. More complex models based on solving partial differential equations (PDE) are inadequate because they cannot describe the dynamics of concentrated particle suspensions, whereas the application of classical computational fluid dynamics techniques (CFD) is complicated by the different nature of the two material involved (fluid and particles) and by the continuously changing boundary conditions of the media due to deposition/erosion processes. However, processes of transport, deposition and erosion in particle sedimentation can be adequately described using a combination of multiparticle cellular automata (CA) and lattice Boltzmann (LB) models [Chopard *et al.*, 2000; Masselot and Chopard, 1998]. With this interdisciplinary project we are planning to use CA-LB models to investigate crucial tephra deposit features, such as cone-like structures in proximal areas of basaltic deposits, medial-to-distal sheet-like deposits, erosion processes during sedimentation and toppling due to slope instabilities. Results from this project will have important implications for the assessments of tephra hazard in active volcanic areas.

Chopard, B., A. Masselot, and A. Dupuis (2000), A lattice gas model for erosion and particles transport in a fluid, *Computer Physics Communications*, 129, 167-176.  
Masselot, A., and B. Chopard (1998), A lattice Boltzmann model for particle transport and deposition, *Europhysics Letters*, 42, 259-264.

### Specific tasks include:

- Application of a CA-LB model for the simulation of tephra dispersal
- Field work for the collection of dedicated data used for the validation of the model
- Data processing for the characterization of the associated eruptions

### We ask:

- Master degree in Geology, Physics, Geophysics, or Computer Science (with a taste for natural phenomena)
- Proven abilities to use and write computer codes
- Interest in natural processes and field work

### We offer:

- A dynamic environment in one of the leading European centers for computer simulations with CA-LB methods and volcanology
- All the facilities necessary for the completion of this project
- An appointment as a Doctoral Assistant funded by the Swiss National Science Foundation for an initial period of 3 years starting from May 1, 2007.

Advisors: Prof. **C. Bonadonna**, Section des Sciences de la Terre, and Prof. **B. Chopard**, CUI.

Interested applicants are encouraged to apply as soon as possible. Please email a CV, a description of motivation and experience relevant to the research project and contact details for two referees to the following address: **Costanza.Bonadonna@terre.unige.ch**