Ecole Doctorale des Sciences Fondamentales

SUBJECT OF THE THESIS

Title of the thesis: Mechanisms of formation of pyroclastic flows from eruptive column collapse, an experimental approach.

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Project Summary:

Pyroclastic flows are hot mixtures of gas and particles generated by explosive volcanic eruptions and that can propagate at high velocity over distances of several kilometres. Large-volume pyroclastic flows are generated from continuous collapse of eruptive columns, through material accumulation on the ground and lateral propagation of the biphasic mixture. The mechanisms of formation of the mixture at the impact zone, which may control the properties of pyroclastic flows, are poorly known: can the accumulation of particles from the collapse of a dilute mixture lead to the formation of a dense flow? Does decoupling between a dense basal part and a dilute upper part occur? Can interstitial pore fluid pressure arise in the dense part? What is the influence of the initial mass flux on the flow propagation mechanisms and on the runout distance?

In order to address these issues experiments will be conducted at Laboratoire Magmas et Volcans. The experiments will consist of releasing continuously particles, from a reservoir at given height and whose mass flux will be controlled, which will collapse onto a plane whose inclination will be varied. The granular materials will consist of natural volcanic ash or of a mixture of particles whose mean diameter and grain size distribution will be varied. The mechanisms of particles accumulation at the impact zone and of formation of the flows along the inclined plane will be investigated quantitatively from data of movies of high speed videos and of pressure sensors, and with probes that will permit to measure the particle concentrations. The scaling laws relating the flow runout distance to the initial mass flux will be determined.