Geophysical Research Abstracts
Vol. 12, EGU2010-10527, 2010
EGU General Assembly 2010

Volcanic and non-volcanic debris avalanche deposit

Irene Manzella (1), Jeremy Phillips (2), and Costanza Bonadonna (1)

(1) Department of Mineralogy, Université de Genève, Switzerland (irene.manzella@unige.ch/ +41223793601), (2) Department Of Earth Sciences, Center for Environmental and Geophysical Flows, University of Bristol, UK (J.C.Phillips@bristol.ac.uk)

Dry debris avalanches are characterized by extremely rapid, flow-like motion of large masses and they travel extremely long distances showing much greater mobility than could be predicted using frictional models. Rock avalanches (i.e. flows of fragmented rock derived from a bed-rock failure) and volcanic debris avalanches (i.e. block and ash flows caused by volcanic sector collapses) are both examples of this phenomenon. However, field observations show that volcanic-derived avalanches travel typically greater distance than non-volcanic rock avalanches.

At present time the mechanisms involved in these phenomena are still mostly unknown. Several theories have been developed to explain their long runouts but there is no general agreement on a comprehensive rheological law and many questions remain unsolved.

The main goal of this research is to constrain experimentally the effect of the characteristics of flow material on runout, deposit morphology and granular flow mechanisms. This will help identify the main differences between volcanic and non-volcanic debris avalanches.

Preliminary experiments of unconstrained granular flows have been carried out at the École Polytechinique Féderale de Lausanne. Three kinds of material with different grain size distribution were used: a fine sand with D90 of 0.55mm and two types of gravel with similar density and friction coefficient but with D90 values of respectively 2 and 4 mm.

Experiments showed relevant differences between sand and gravel deposit morphologies. The shape of the sand deposit is rather regular and compact whereas the gravel deposit showed well defined angular discontinuities: a central zone with a small slope and several ridges and a front, rear and sides with strong inclination. The presence of ridges and a steep front in gravel deposit evidence a rapid stop of the mass. These morphological features are also often observed in the field. For this reason this kind of gravel results to be more suitable for future laboratory experiments. Moreover, tests with fine sand suggested that air drag and electrostatic effects get relevant for small particles. This strongly influences collisional properties, inducing a behaviour which differs from large scale events.

Comparison of tests carried out with gravel with similar characteristics (i.e. density, friction coefficient, composition) but with different grain size distributions showed similar deposit morphology. This suggests that above a certain limit for which air drag and electrostatic effects are avoided or negligible, grain size and sorting do not significantly affect flow propagation.

Future experiments will be carried out varying the porosity of the grains to better emphasize the difference between volcanic and non-volcanic debris avalanches.