Geophysical Research Abstracts
Vol. 12, EGU2010-7124-2, 2010
EGU General Assembly 2010


# Sedimentological analysis of fine-grained deposits from the 2006 pyroclastic density currents at Tungurahua volcano (Ecuador).

Guilhem Amin DOUILLET (1,2,3), Fabian Goldstein (1), Ulrich Kueppers (1), Yan Lavallee (1), Donald B. Dingwell (1), Claude Robin (2,3)

(1) Earth and Environment, LMU - University of Munich, Munich, Germany, (2) Institut de Recherche pour le Développement, Clermont Ferrand, France, (3) Instituto Geofísico de la Escuela Politécnica Nacional, Quito, Ecuador

Tungurahua volcano has been intermittently active since the start of its recent erupting cycle in 1999. The volcano represents a direct danger for approximately 25.000 inhabitants and a hydrological dam. Pyroclastic density currents generated during a period of peak activity in July and August 2006 reached populated areas and caused fatalities and damages to infrastructures. After a pause of six months, explosions started again in early January 2010. A good understanding of the influence of topography on flow path and sedimentation is essential for the management of volcanic hazards for such small-volume pyroclastic flows.
The August 2006 explosive activity created numerous pyroclastic density currents descending the N-, W- and SW-flanks and directed by the hydrological network. The associated deposits show complex sedimentological characteristics and consist of rather coarse deposits found inside the valleys accompanied by a fine-grained, coarse-depleted unit mostly found on valley shoulders and undercut slopes. This study focuses on the latter facies, usually defined as “surge deposit”. We shed light on the genesis of the distinct sedimentological structures and surface appearance.
We thoroughly mapped the fine-grained unit. Dune structures are omnipresent on the surface of this unit. They are several decimeters to 1 meter high and up to 10 meters long. Dip angles range from 15 to 40°. They have an upslope curved crested shape and the steepest side is upslope. Mapping the direction of more than 800 dunes, we were able to reconstruct small-scale flow directions. The direction of the dunes indicates that this unit was decoupled from the main flow in forced conditions like in curves and is strongly influenced by the local topography. This decoupling causes a dramatic change in the flow conditions (hydraulic jump) and thus the deposition conditions.
Despite their homogenous shape, dunes exhibit complex sedimentological inner structures. Beds are usually centimeter thick with a range in grain-size from medium to very coarse. Structures observed include climbing structures, truncations, cut and fills or ripples. This variety of inner structures, as well as the grain size variation between two beds evidence that an unstable, turbulent and complex flow made up of hundreds of pulses created the fine-grained deposits.
We collected samples all along and across the deposit to analyze the grain-size distribution, composition, and roundness. We found that the dunes’ dip angles are higher than the theoretical repose angle of the same fine-grained material at room temperature. As a consequence, special conditions must have acted during deposition. Grain size analysis (principal mode $\sim$1.5 phi) show that the fine-grained material is mainly issued from the coarse pyroclastic flow, were it is also partly produced. The feature creating the fine-grained deposit is a transitional state between the coarse pyroclastic flow and the moving ash cloud.
Our investigations contribute to an enhanced understanding of the conditions during flow and deposition of PDCs. We document the origin and generation of the fine-grained material, the interactions between pyroclastic flow, surge and moving ash cloud as well as the interaction between flow and topography.