Geophysical Research Abstracts,
Vol. 11, EGU2009-198, 2009
EGU General Assembly 2009

Emplacement of volcanic debris avalanche landslide deposits: new insight from distinct element numerical simulations

N. Thompson, M. Bennett, and N. Petford
Bournemouth University, School of Conservation Sciences, United Kingdom (nickdthompson@hotmail.com)

Due to their relatively rare occurrence and unpredictability, not to mention the hazards likely involved, the emplacement processes of large-scale volcanic debris avalanche events remain poorly understood. For these reasons, much of what we know about this complex process must be interpreted from deposits that remain in the geologic record. These deposits typically contain a suite of commonly observed characteristics, such as original stratigraphy preservation and finer-grained basal (shearing?) layers. Interpreting the formation and evolution of these structures remains important in understanding the processes that occur after flank/sector detachment until deposition.

The distinct element numerical modelling technique is used in this study to investigate avalanche emplacement processes. Particle bonding is introduced to a generalized flank collapse scenario; when stresses are overcome in the failed mass, the bond breaks. Material with pervasive bond breakage subsequently behaves as a granular material. This approach allows mechanically plausible faulting to initiate and evolve with emergent behaviors as the avalanche extends through the runout space.

Though further work is needed in calibrating the microproperties and stress state of the failure mass, initial observations show good agreement with deposit structures discussed in the literature and observed in ASTER satellite imagery. This includes separate mechanisms for the development of hummocky topography, toreva block formation and a progressive rounding of blocks of bonded particles. These blocks are present primarily on the surface of the subsequent deposit and decrease in size distally. Additionally, no particle bonds remain along the basal surface of the deposit which perhaps indicates at least the structural evolution of a basal shearing layer, a suggested long runout mechanism in real world avalanches.

It is observed in these simulations that the noted deposit features develop through block sliding of an initially intact mass, horst and graben development and progressive block fragmentation as has been commonly suggested in the literature. It is also observed that the faulting which develops early in the emplacement process is most influential in developing deposit structures; another common suggestion in the literature. The numerical model therefore suggests that common structural evolution processes in a failure mass may facilitate the development of characteristic structures universally observed in volcanic debris avalanche deposits.