Geophysical Research Abstracts
Vol. 18, EGU2016-542, 2016
EGU General Assembly 2016

Truncation planes from a dilute pyroclastic density current: field data and analogue experiments.

Guilhem Amin Douillet (1), Lukas Gegg (1), Celia Mato (2), Ulrich Kueppers (1), and Donald B. Dingwell (1)
(1) LMU, Earth and Environmental Sciences, Munich, Germany (g.douillet@min.uni-muenchen.de), (2) Université Joseph Fourier a Grenoble

Pyroclastic density currents (PDCs) are a catastrophic transport mode of ground hugging gas-particle mixtures associated with explosive volcanic eruptions. The extremely high sedimentation rates and turbulence levels of these particulate density currents can freeze and preserve dynamic phenomena that happen but are not recorded in other sedimentary environments. Several intriguing and unanticipated features have been identified in outcrops and reproduced via analogue experiments, with the potential to change our views on morphodynamics and particle motion.
Three types of small-scale (ca. 10 cm) erosion structures were observed on the stoss side of dune bedforms in the field: 1) vertical erosion planes covered with stoss-aggrading, vertical lamination, 2) overturned laminations at the preserved limit of erosion planes and 3) loss of stratification at erosion planes. These features are interpreted to indicate rapidly evolving velocities, undeveloped boundary layers, and a diffuse zone rather than a sharp border defining the flow-bed interface.
Most experimental work on particle motion and erosion from the literature has been accomplished under constant conditions and with planar particle beds. Here, in order to reproduce the field observations, short-lived air-jets generated with a compressor-gun were shot into stratified beds of coarse particles (300 μm) of low density (1000 kg/m3). These "eroding jets" were filmed with a high speed camera and the deposits were sectioned after the experiments.
The three natural types of erosion characteristics were experimentally generated. Vertical erosion planes are produced by small-scale, relatively sustained jets. Overturned laminations are due to a fluidization-like behavior at the erosion front of short-lived, strong jets, demonstrating that the fluid's velocity profile penetrates into the deposit. Loss of lamination seems related to the nature of erosion onset in packages.

Rather than providing simple answers, the dataset raises questions and the need for further work on the sedimentation of pyroclastic density currents and turbulence in general. Our threshold-based concepts to explain the formation and initiation of bedforms may be inadequate in many highly depositional settings.

This presentation will hopefully trigger discussions and exchange of ideas between sedimentologists, geomorphologists and physicists from all backgrounds.