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Microscale sedimentary dynamics and lateral variations in pyroclastic bedforms: Examples from deposits of the 2006 pyroclastic currents at Tungurahua volcano (Ecuador).

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Pyroclastic currents sign their passage through depositional organization of the transported pyroclasts as sedimentary successions . These sediments record part of the history of the parental flows. High-resolution documentation at the scale of individual laminae is necessary to unravel the dynamics of transport and deposition of pyroclastic currents. Pyroclastic bedforms are notorious for their stoss-aggrading nature producing a variety of backset laminations. The processes for their formation are however still a mystery.

A dataset of 50 m2 of sediment plates (a type of lacquer peels) was created in dune bedforms from the August 2006 pyroclastic currents at Tungurahua volcano (Ecuador). These plates can be investigated at unprecedented resolution. Through a survey of close-by lateral transects taken from single pyroclastic bedforms we show that the bedform architectures vary drastically in lateral and longitudinal direction. Based on this, we suggest three processes of stoss-deposition unrelated to supercritical flows:
-"Differential draping" accounts for a current-influenced fallout from thick currents and produces continuous lamination from stoss to lee, with laminae thicker on the stoss faces.
-"Short lived bursting" are recognized from very steep truncations of the stoss face of a bedform, followed by rapid burial of these truncation scars through steep backset beds. We believe that such sedimentary signatures are related to coherent turbulent bursts that evolve close to the substrate and impact against bedforms.
-Finally, "granular pools" are massive lensoidal beds that tend to be thicker on the stoss side of a topography than on the lees. They are interpreted as related to granular-based flows for which topography has a crucial effect on the sedimentary dynamics.

All types of sedimentary facies linking to the inferred processes are encountered within a single outcrop. They occur concurrently with a variety of other structures, such as backset-ripple laminasets, shear-derived "shark fin" patterns, or low-angle, HCS-like patterns.

Lateral transects within a single bedform show that a sudden evolution in the depositional patterns occurs within less than a meter lateral distance, so that the progressive/regressive nature of a bedform cannot be used to infer the flow regime or supercritical nature. Similarly, former interpretation of proximal "chute and pools" and more distal "antidunes" seem to be a coincidence, since both types are encountered on the same isochrone in a single bedform.
Finally, we address the question of scale-invariance on patterns formerly interpreted as "chute and pools", which can help to unravel the mysteries of pyroclastic backset laminations.