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Effects of slope on the formation of dunes in dilute, turbulent pyroclastic currents: May 18th, 1980 Mt. St. Helens eruption

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The flanks of Mt St Helens volcano (MSH) are draped with thin, cross-stratified and stratified pyroclastic density current (PDC) deposits. These are known as the proximal bedded deposits produced during the May 18th, 1980 eruption of MSH. While the concentrated portions of the afternoon PDCs followed deep topographic drainages down the steep flanks of the volcano, the dilute overriding cloud partially decoupled to develop fully dilute, turbulent PDCs on the flanks of the volcano (Beeson, D.L. 1988. Proximal Flank Facies of the May 18, 1980 Ignimbrite: Mt. St. Helens, Washington.). The deposits along the flank thus vary greatly from those found in the pumice plain, which are generally thick, massive, poorly-sorted, block-rich deposits associated with the more concentrated portions of the flow (Brand et al, accepted. Dynamics of pyroclastic density currents: Conditions that promote substrate erosion and self-channelization - Mount St Helens, Washington (USA). JVGR). We explore the influence of topography on the formation of these dilute currents and influence of slope on the currents transport and depositional mechanisms. The deposits on steeper slopes (>15°) are fines depleted relative to the proximal bedded deposits on shallower slopes (<15°). Bedform amplitude and wavelength increase with increasing slope, as does the occurrence of regressive dunes. Increasing slope causes an increase in flow velocity and thus an increase in flow turbulence. The fines depleted deposits suggest that fine ash elutriation is more efficient in flows with stronger turbulence. The longer wavelength and amplitudes suggest that bedform morphology is directly related to flow velocity, an important finding since the controls on bedform wavelength and amplitude in density stratified flows remains poorly constrained. The occurrence of regressive dunes, often interpreted as high flow-regime bedforms, on steeper slopes relative to progressive dunes on shallower slopes further attests to the control of velocity and flow regime on bedform morphology. Samples collected from recently exposed deposits and analyzed by grain size measurements, density analyses, and crystal morphoscopy studies further assess modes of origin and transport of dilute PDCs.