

Proximal pyroclastic density current deposits at a glaciated composite volcano: Mount Ruapehu, New Zealand

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Young (<13.6 ka BP cal.) proximal pyroclastic density current (PDC) deposits at Ruapehu Volcano, New Zealand are described for the first time. The deposits result from some of the largest known eruptions at Ruapehu and its subsequent transition to vulcanian and phreatomagmatic activity. They provide insight into the emplacement and preservation of small to medium volume PDCs at glaciated composite volcanoes, reflecting complex interactions with palaeomorphology and possibly also changing ice cover at the volcano. Five distinct PDC episodes have been observed. 1.) The oldest units are massive pumiceous deposits including a full spectrum of dense to highly expanded pumices that represent collapsing plinian columns sourced from Ruapehu's Northern Crater. These are correlated with a sequence of plinian fall deposits preserved on the ring plain. Directly overlying these is unit 2.), an unusual <30m thick variably welded grey-black PDC deposit that comprises rounded monolithologic scoriaceous clasts supported by a vesicular ash matrix. Unit 2 is interpreted to represent a collapsing near-vent spatter pile deposited on the steep upper flanks. Transport over ice may have been significant in producing the unusual rounding of the clasts and vesicular matrix, but the incipient welding and presence of well developed cooling fractures suggest that extensive cooling did not occur during transport. The role of ice in the emplacement of this flow may be important for understanding the pyroclastic flow hazard at similar glaciated composite volcanoes worldwide. 3.) A younger locally exposed pumiceous PDC deposit containing fibrous and colour banded pumices is thought to correlate to the last known plinian episode at Ruapehu, associated with the opening of the presently active South Crater. 4.) Overlying this is a sequence of small PDC deposits with dense juvenile clasts that may represent flows generated from vulcanian eruptions sourced from smaller degassed magma pockets remaining after the plinian events. This sequence is capped by 5.) a thin (<1m) black PDC deposit containing distinctive large (<1m) cauliflower and breadcrust bombs. The complete PDC sequence reveals systematic temporal changes in magma composition, density, and the role of magma mingling during a period of significant change at Ruapehu. Complex interactions with palaeomorphology and possibly surface ice appear to have been important factors in the generation, emplacement and preservation of the PDCs, and these effects are important for understanding the until now overlooked PDC hazard at Ruapehu and other glaciated composite volcanoes worldwide.