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**FORECASTING THE CONSEQUENCES OF THE
FAILURE OF THE EASTERN RIM OF CRATER LAKE,
MOUNT RUAPEHU**

A thesis presented in partial fulfilment of the requirements for
the degree of

Master of Science

In

Earth Science

at Massey University, Palmerston North, New Zealand.



MASSEY UNIVERSITY

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2011

ABSTRACT

A numerical code for simulating dry flows of granular material, Titan2D, was used to model a range of possible collapse scenarios and resulting debris avalanches from a possible failure of the eastern crater rim of Mount Ruapehu, New Zealand. The eastern rim of Crater Lake, Mount Ruapehu consists of a stratigraphic sequence of intercalating volcanoclastic diamictons, pyroclastics and lavas, some of which are highly hydrothermally altered. This rim is under outward pressure from Crater Lake and constitutes one of the steepest parts of the active volcano. Its sudden failure could involve up to 50 million m³ of rock material, almost certainly generating a debris avalanche and/or a break-out lahar up to 9 times the size of the March 2007 event. A failure of hydrothermally altered flank materials on this side of the volcano has already occurred (c. 4600 yrs Mangaio Fm. (Donoghue & Neall, 2001)). A quantitative hazard and risk analysis of this scenario has never been undertaken, despite ongoing hydrothermal alteration and considerable sapping of both the inside and outside of the rim from explosive eruptions and base surges during the 1995/1996 and 2007 eruptions. New stratigraphic data were integrated with existing high-resolution topographic information and aerial photography to produce a detailed map of the eastern rim to highlight the distribution of contrasting stratigraphic sequences and the distribution of those units with the largest degree of alteration. This information was used as the first step towards defining the likelihood of different failure volumes and geometries to be tested in numerical hazard simulations. A quantitative scenario-based hazard forecast for partial or full collapse of the crater rim and subsequent events was determined. Simulated data of flow run out, inundation, diversion, velocity and mass transport were analysed to identify the resulting hazards for the Whangaehu and Tongariro River catchments. The results of this research suggest that the Mangatoetoenui, Upper Waikato, Tongariro and Whangaehu River catchments could be greatly affected by a sudden collapse of the eastern rim and any subsequent lahar events.

ACKNOWLEDGEMENTS

I would like to sincerely thank Dr. Jon Procter, Dr. Gert Lube and Prof. Shane Cronin for their time, guidance and patience throughout this project. I am grateful to have worked with a bunch of people with such a wide range of expertise.

I am greatly appreciative for the assistance from all of the staff in the Soils and Earth Sciences group who have shared their knowledge, time and skills, especially Kate Arentsen, Prof. Vince Neall, Bob Stewart, Anja Möbis, Mike Bretherton, and Glenys Wallace.

I am grateful to the Geosciences Society of New Zealand, Massey University, and the Tongariro Natural History Society for their financial assistance from the S.J. Hastie Research Award, Massey University Masterate Scholarship and Tongariro Natural History Society Memorial Award.

I would like to thank the Team at GNS Science (Margaret Low, Chris Massey and Graham Hancox) and Harry Keys from DOC for discussion of ideas, and access to publications and photographs.

Thanks to the students of the Earth Science department who assisted in the field, laboratory and who just stopped by to have a talk or laugh. Special thanks to Amanda MacDonald-Creevey and Simon Vale, who have made this journey with me right from first year, for your friendship, humour and competitiveness.

Finally, very special thanks to my family and friends who supported me and took an interest in my studies. Pranil, thanks for your support, encouragement and willingness to climb up Ruapehu with me in the snow when no one else could go. Mum, you kept me focussed and supported me and every way throughout this process and for that I will always be grateful.

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