The post-glacial lava flows of Tongariro volcano - new insights from airborne interferometric radar

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High resolution, three-dimensional measurements of the shape and surface features of lava flows allow inferences to be drawn about emplacement conditions in lavas for which no co-eruptive field observations were made (e.g. Mackay et al. 1998). In the last fifteen thousand years, Tongariro volcano, in the North Island of New Zealand, has erupted several blocky lava flow-fields from various summit vents (figure 1), which range in composition from andesite to basaltic andesite (e.g. Hobden 1997).

Despite their age, the surface features of these flow-fields are well preserved in comparison with older lavas at Tongariro, because they were erupted after the last glacial maximum, and have also not been significantly eroded or buried by fluvial and volcanic processes. To date, topological interpretations of the prehistoric lava flows at Tongariro have been hindered by a lack of high-resolution topographic data.

In November 1996 and August 2000, the topography of the Tongariro Volcanic Centre was mapped in detail by the airborne NASA C-band topographic interferometric synthetic aperture radar system (TOPSAR), as part of the Pacific Rim (PACRIM) missions. The TOPSAR data provide a new opportunity to investigate the morphology of lava flows at Tongariro volcano. The resolution is detailed enough to map the surface features preserved in the flow-fields.

Two aspects of lava morphology are investigated and interpreted. Firstly, the gross morphology, or the entire shape of the lava flow field including dimensions such as length, area, margin height and derived volume, are used in conjunction with previously derived relationships (Hulme & Fielder 1977, Kilburn & Lopes 1991) to constrain the duration and flow rate of each lava eruption. Secondly, the surface morphological features are used to constrain emplacement conditions further; features such as individual lava flows within a flow-field, surface folding, levées and drained channels, and the surrounding topography. In particular, a new mechanism for surface folding in andesite lava flows is discovered (Stevens, 2002). The TOPSAR data thus provide new insights into lava emplacement behaviour in the past fifteen thousand years at Tongariro volcano.

References

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