

Lost Landslides: Fluvial censoring of rock-avalanches in the South Island, New Zealand

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Project Outline

Rock avalanches are large (typically $>10^6$ m³), rapid, flow-like landslides that are some of the largest terrestrial landslides in the world. These landslides can be highly destructive and the deposits may reside in the landscape for up to 10^4 years however it is thought that the record of their occurrence in the Southern Alps, New Zealand has been censored by fluvial erosion, vegetation growth occlusion in water bodies such as lakes and fiords and entrainment in glaciers.

This project aims to develop a method by which fluvially reworked agglomerates, sub-millimetre grains composed of smaller micron to sub-micron sized grains that are produced under intense pressure during a rock-avalanching event, can be traced through fluvial systems. If successful, this technique could be used as a diagnostic method by which fluvial systems with no known rock-avalanche deposits could be tested for rock-avalanche presence and allow an examination of the extent of fluvial rock-avalanche censoring.

Fieldwork and Methodology

Fieldwork was carried out on South Island, New Zealand and aimed to visit rock-avalanche deposits and affected rivers in order to collect fine grained sediment samples for analysis on a Scanning Electron Microscope back in the UK.

- 1. Stanley River and Ram Creek** - Both sites are known to have experienced rock-avalanches in the recent past and are easily accessible (Figure 1). The sampling strategy was to collect samples upstream of deposits, of the deposits themselves and downstream as far as was practically possible, including abandoned terraces, active channel sediment and bar surfaces. This strategy allows the tracing of particles from a point source to downstream areas and can show the preservation potential as a function of distance downstream from the original deposit.
- 2. Poerua River** - Whilst the Poerua River deposit is not accessible an alluvial fan was deposited in part from a rock-avalanche dam-outburst flood in 1999 and also from subsequent pluvial flooding between 1999 and 2003. The river has now incised into the fan and a large 2 metre exposure remains. High-resolution vertical sampling of this exposure was conducted to explore the potential for burial of the rock-avalanche agglomerate signal in discrete layers of the fan.
- 3. West Coast rivers** - Some west coast rivers have known deposits and others have no recorded deposits. Samples were taken from 23 rivers to examine whether agglomerates are ubiquitous in New Zealand fluvial material and if every catchment has at some point been affected.



Figure 1. A) Lake Stanley rock-avalanche dam, formed in 1929 and stable overflow channel; B) Agglomerate particle from a sample the base of the rock-avalanche deposit showing a coherent grain composed of micron scale grains (red lines) in a sub-micron matrix; C) Agglomerate grain recovered from fluvial sediments ~400m downstream of the rock-avalanche showing similar composition to B.