



The rock avalanche sediment in moraines and its implication for palaeoclimate reconstruction

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Rock avalanches mobilise a large quantity of sediment that after deposition on a glacier may cause its regime to alter. The glacier response includes change of mass balance after the rock avalanche emplacement followed by re-deposition of the rock avalanche sediment as moraine (Reznichenko et al., 2010; Reznichenko et al., 2011). Such acclimatic glacier response to a supraglacial rock avalanche deposit can confound apparent climatic signals extracted from moraine chronologies, which are widely used to infer regional climate change and are often correlated globally. Therefore, the origin of any particular dated moraine must be clarified before that date can be used for paleoclimatic interpretation.

We present a new method that identifies the presence of rock avalanche sediment in moraines, based on the characteristics of the finest sediment fraction which contrast with those of non-rock-avalanche-derived glacial sediment. Under the dry, high-stress conditions during rock avalanche emplacement, fragmenting grains form agglomerates, which are absent in the wet, lower-stress processes of sub- and en-glacial environments. We show that these agglomerates are present in some moraines in the Southern Alps of New Zealand that have been attributed to climate fluctuation. This technique has the potential to resolve long-standing arguments about the role of rock avalanches in moraine formation and to enhance the use of moraines in palaeoclimatological studies.

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