A comparison of alluvial and bedrock river sedimentary archives for reconstructing Holocene palaeofloods in New Zealand

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Current assessment of flood risk in New Zealand is compromised by short instrumental flow records (less than 50 yr) in most large river catchments. These do typically not include the largest floods that have occurred in the past and which would cause the most damage to life, property and infrastructure. This paper reports the first Late Holocene palaeoflood reconstructions in the North Island of New Zealand within the Manawatu river (c.5950km^2), based on the sedimentary infill of oxbow lakes ('lagoons'). The geochemical proxies for the grain-size of individual flood units were compared with modelled overtopping discharges for each research location, and the monitored discharge record in order to correlate flood units with historically-known events. The sedimentary record extends beyond the historical period, and can be used to identify major flood events that occurred in the past. Flood chronologies are constrained using a combination of radiocarbon dating, OSL, documentary sources, palynology (pin-pointing the European colonization), geochemistry (associated with heavy-metal pollution), and an innovative application of cosmogenic isotopes.

The setting of the Manawatu river was compared with other flood-prone river systems in the same hydroclimatic region (south-west North Island); thee Whanganui (7380 km^2), Ruamahanga (3470 km^2) and Hutt Rivers (650 km^2). Largest floods are generated by westerly storms throughout the year. One of the primary objectives of this project is to compare fluvial sedimentary archives from bedrock valleys and various alluvial reaches. In the Whanganui catchment, which drains soft-rock terrain largely comprising Tertiary mudstones and sandstones, two sedimentary archives have been investigated: 1. Slackwater deposits on an alluvial bench c.20 m above the present river level (on the so-called Taupo terrace, commonly used for settlement) within bedrock reach of the Whanganui Gorge; 2. Palaeochannel fills on terraces 6-8 m above the river level within a mixed alluvial-bedrock reach located in the piedmont zone downstream. In contrast, study reaches in the Manawatu and Ruamahanga catchments are fully alluvial, with an extensive suite of infilled palaeochannels developed on a series of low elevation cut-terraces and on very low-gradient fluvial plains. Finally, the palaeoflood record was investigated in the shallow fills of the high-gradient wandering, semi-braided gravel-bed reaches of the Hutt River located at the margin of the greywacke Tararua Range.

Holocene palaeoflood records differ significantly in both length and nature between the four catchments conditioned by tectonic and land use histories, which strongly influence local flood sedimentation styles. Terrains with elevated post-European settlement rates of sediment supply, particularly in the Manawatu and Whanganui, generated high-resolution palaeoflood records. Results of this study demonstrate that fluvial sedimentary archives from a range of alluvial as well as

bedrock river environments are required for reconstructing regional Holocene flood histories in New Zealand, but that palaeoflood studies and their expected results need to be tailored to fit the highly diverse local setting.