STRUCTURAL RECONSTRUCTIONS OF THE WAIMEA-FLAXMORE FAULT SYSTEM IN THE NELSON–RICHMOND URBAN AREA: IMPLICATIONS FOR SEISMIC HAZARD

F Ghisetti[1], M Johnston[2], P Wopereis[3] & R Sibson[4]
[1]TerraGeoLogica, 60 Brabant Drive, Ruby Bay 7005
[2]395 Trafalgar Street, Nelson 7001
[3] BECA Ltd, 105 Trafalgar Street, Nelson 7010
[4]Department of Geology, University of Otago, PO Box 56, Dunedin 9054
francesca.ghisetti@terrageologica.com

The Waimea-Flaxmore Fault system (W-FFS) comprises NNE-oriented, E-dipping reverse faults that superpose the Eastern Province terranes above the sedimentary units of the Moutere Depression. In the Nelson–Richmond urban area Holocene activity with earthquakes of magnitude 6.5–7.4 is estimated to have occurred at intervals of ~6 ky (Johnston and Nicol 2013). The W-FFS is interlinked offshore to the Manaia and Taranaki faults, suggesting that it belongs to a set of crustal discontinuities along the suture zone between the Median Batholith and Eastern Province terranes.

The exposure of new outcrops in the rapidly growing Nelson–Richmond urban area and the analysis of LiDAR data provided by the Nelson and Tasman city councils have been used for the ongoing revision of the Nelson city geological map (Johnston 1979). The revised map, the associated reconstruction of the top basement unconformity, and regional geological transects provide the basis for reconstructing the progressive deformation history of the W-FFS during multiple phases of Neogene to Quaternary reactivation.

Progressive retro-deformation of the geological transects and development of simplified forward models show the inferred inversion from an original set of Late Cretaceous–Eocene normal faults of the proto-W-FFS to a system of reverse faults that propagated into the cover sequence during deposition of late Miocene terrestrial units (Port Hills Gravel). Continuous activity through mechanisms of fault-propagation folding persisted during sedimentation of the Pliocene–Quaternary Moutere Gravel, with breaching of the fault tip to the surface, and strong morphological control with associated processes of surface instability.

The orientation of the W-FFS in the present-day stress field and the ongoing crustal shortening associated with the Pacific–Australia plate boundary in the northern South Island create conditions favourable to reactivation of this long-lived fault system with modes of rupture that are likely to mimic its long-term evolution.