The Wellington Fault is one of the major active dextral faults of the North Island of New Zealand. We have investigated fault-offset abandoned fluvial terraces at sites in the Hutt Valley, north of Wellington, to determine the activity of the southern-most Wellington-Hutt Valley segment of the Wellington Fault (WHV), during the last ~100,000 years.

Although now modified or destroyed due to suburban development, we have re-evaluated displacement measurements of the fault-offset terraces using new digital topographic data derived from photogrammetric analysis of historical air photos. Using previously published Optically Stimulated Luminescence (OSL) and radiocarbon ages for the terraces, together with terrace position, we have also modelled their probable ages.

From our displacement measurements and terrace ages, we estimate an average net (predominately dextral) slip rate for the WHV fault of about 5.7 mm/yr for the Holocene. Moreover, our investigation shows that the slip rate has not been steady during this time. Results indicate a period of heightened ground-rupture activity between 10,000 and 8,000 years ago, followed by a period of relative quiescence between 8,000 and 4,500 years ago, then another period of heightened activity in the last 4,500 years. This inference compares well with evidence for the timing of past ground-rupture events from palaeoseismological studies at other sites along the WHV fault.

Newly obtained OSL ages for older fluvial terraces, previously estimated as being up to 140,000 years old, will allow the slip rate and associated hazard of the WHV fault to be extended through to the late Quaternary.