Paleoseismicity and slip rate of the strike-slip Hope Fault, South Island: A well-segmented and frequent earthquake source in New Zealand

Langridge, R.M. (1), Khajavi, N. (2), Hemphill-Haley, M. A. (3), Almond, P., (4), Duncan R. (5).

(1) GNS Science, PO Box 30-368, Lower Hutt, New Zealand
(2) Dept. of Geology, University of Canterbury, Private Bag 4800, Christchurch, New Zealand
(3) Dept. of Geology, Humboldt State University, Arcata, California, CA 95521, USA
(4) Dept. of Soil Science, Lincoln University, Lincoln, New Zealand
(5) Dept. of Ecology, Lincoln University, Lincoln, New Zealand
Corresponding Author: Langridge, R.M., (r.langridge@gns.cri.nz)

The Hope Fault is a major dextral-slip fault within the Marlborough Fault System, which accommodates the transition between the Alpine Fault and the Hikurangi subduction zone, in the northern South Island. Paleoseismic and slip rate studies have been undertaken along three of the major sections of the strongly segmented Hope Fault. Due to the short historical record in New Zealand only one segment of the fault (Hope River; 1888) is known to have ruptured during the last 170 yr.

To the west, the Hurunui section of the fault has a slip rate of c. 13 ± 1.5 mm/yr and an estimated recurrence interval of 310-490 yr. A trench along this section shows evidence for three rupture events during the last c. 850 yr. Based on radiocarbon dates, the most recent event occurred at c. AD 1650-1830. Dendrochronologic studies along this part of the fault indicate that the forest underwent a major recolonisation event at c. AD 1820 which is attributed to this most recent event.

The Hope River segment (HRS), between the Hanmer Basin and the Hurunui section, ruptured during the M 7.1 September 1 1888 Amuri earthquake. Co-seismic dextral displacements measured after the earthquake were 1.5-2.6 m. The slip rate of the HRS is c. 14 ± 3 mm/yr. At this meeting we present results from a new trench located only 3.5 km west of the end of the HRS that exposes faulted peats and silts.

The Hanmer Fault is a major normal fault within the Hanmer Basin, a 5 km wide pull-apart basin separating the HRS and Conway segment. Trenches across the Hanmer Fault display evidence for three rupture events during the last c. 1200 yr. In the east, the Conway segment has a slip rate of <23 ± 4 mm/yr and a recurrence interval of 180-310 yr. Trenches there display evidence for three events during the last c. 900 yr.

Taken collectively, these results suggest that the Hope Fault is a major source of seismic hazard and strain release. It is plausible that the three young events along the Hurunui and Conway segments are roughly co-temporal and possibly are along strike continuations of rupture events along the central Alpine Fault. These data may indicate that the most active and segmented part of the plate boundary through northern South Island releases strain via sequences of large earthquake ruptures.