WAIKATO BRANCH PRESENTS THE HOCHSTETTER LECTURE 2025

Past, Present, and Future Earthquakes on the Alpine Fault:
What Lies Beneath and What Lies Ahead?

Prof. John Townend
(Victoria University of Wellington)

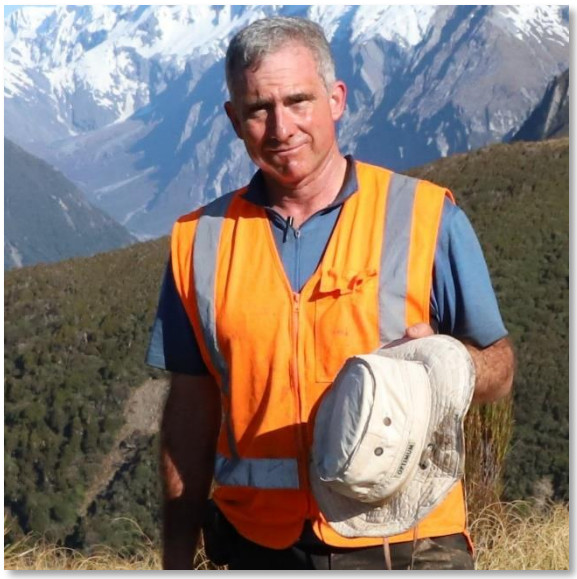
Public lecture

18th Sept

5pm

Room S1.03 (S-block)

University of Waikato



Several decades of painstaking paleoseismological research — using geological measurements to determine the timing and magnitudes of past Alpine Fault earthquakes — have yielded one of the most spatially and temporally extensive paleoearthquake records of any fault worldwide. This record indicates that the Alpine Fault produces large earthquakes on timescales of less than 300 years and that, although the times between one earthquake and the next are remarkably consistent, their inferred sizes vary from depending on which of three sections of the fault rupture at once. More than 300 years have passed since the last major earthquake, in 1717 CE, and the Alpine Fault is thus late in the typical period between successive earthquakes: the likelihood of a magnitude 7 earthquake occurring in the coming 50 years is estimated to be 75%; the odds of that earthquake being larger than magnitude 8 are ~80%.

Scientific drilling studies reveal that the Alpine Fault is also unusually hot, at least along its central section near Aoraki/Mt Cook where the most rapid uplift of the Southern Alps is occurring and where long-term slip rates are the highest. Variations in temperature along the length of the Alpine Fault have since been found to affect the distribution of present-day low-magnitude seismicity and deep aseismic creep, and are likely to influence patterns of slip in future large earthquakes.

Despite substantial advances in understanding the Alpine Fault's past and present-day seismicity, how and where the fault will slip in a future earthquake and what groundshaking will result are difficult to anticipate without knowing which of many geologically- and geophysically-plausible scenarios eventuates.

This year's Hochstetter Lecture will review how understanding of the Alpine Fault's earthquake-generating behaviour has developed in recent years, catalysed by novel paleoseismological, geological, and seismological studies including the Deep Fault Drilling Project (DFDP) and the 450 km-long Southern Alps Long Skinny Array (SALSA), and how technological advances such as optical fibre sensing, "virtual earthquakes", and artificial intelligence are providing new insight into fault zone structure and earthquake generation.

The concluding portion of the lecture will address what steps the earthquake science community could take now to record invaluable data during the next Alpine Fault earthquake and thus inform global understanding of earthquake rupture phenomena.