

Palaeoenvironmental records from tephric loess deposits aged c. 31.5 to 9.5 cal ka in the Rotorua area dated and connected to the NZ-INTIMATE climate event stratigraphy using tephrochronology

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We examined tephric loess in the Rotorua area at 13 sites dating from c. 31.5 cal ka (marked by Unit L of Mangaone subgroup) through to c. 9.4 cal ka (Rotoma tephra), much later than recorded in previous studies. The loess is dominantly massive, mainly silty or very fine sand, and typically yellowish-brown, dull yellowish-brown, or dull yellow-orange. The thickest (tephra-free) loess sequence encompassing the period c. 31.5 to c. 9.4 cal ka is 4.3 m; mean accumulation rate was ~23 mm/100-yr, ranging from ~5 mm to ~60 mm/100-yr. In the field we divided the loess into 'packets' based on 10 bounding tephra beds. At two long sequences we measured grain-size, accumulation rate, phytoliths, magnetic susceptibility, total carbon content, carbon isotopes, and potassium content as climate proxies. Nine short climate phases (*phases P1–9*) were identified within three broad climate periods (CPs): CP-1, a warm interstadial, 31.5–25.4 cal ka (*P1*); CP-2, a cold stadial/extended LGM with interstadials, c. 25.4–18.4 cal ka (*P2–6*); CP-3, a warming/transitional period leading to an interglacial, c. 18.4–9.4 cal ka (*P7, P9*), but including a late-glacial reversal c. 14.0–12.8 cal ka (*P8*). The magnetic susceptibility, potassium content, and grain-size records showed stratigraphic trends both comparable with one another and consistent with the New Zealand climate event stratigraphy (NZces), although timings were not always well synchronised: *P1* matches events NZces-11 and -10; *P2* matches NZces-9; *P3* matches NZces-8; *P4* matches NZces-7; *P5–6* match NZces-6; *P7* matches NZces-5 and -4; *P8* matches NZces-3; and *P9* matches NZces-2 and -1.