

**‘Andersonian’ wrench faulting in a regional stress field:  
the 2010  $M_w$ 7.1 Darfield (Canterbury, New Zealand)  
earthquake sequence**

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**Abstract** - The  $M_w$ 7.1 Darfield earthquake sequence occurred west of Christchurch in the South Island of New Zealand. It gave rise to right-lateral strike-slip of up to 5 m along the segmented rupture trace of a subvertical fault trending  $085^\circ$  across the Canterbury Plains for  $\sim 30$  km. While this agrees with long period focal mechanisms for the mainshock, near-field data suggest a composite mainshock initiating with a reverse-slip rupture north of the strike-slip surface trace. Seismological, geodetic and geological stress determinations for the central South Island suggest that maximum compressive stress  $\sigma_1$  is horizontal and oriented  $115 \pm 5^\circ$ . The principal dextral rupture therefore lies at  $\sim 30^\circ$  to inferred regional  $\sigma_1$ , the classic ‘Andersonian’ orientation for a low-displacement wrench fault. An aftershock lineament trending c.  $145^\circ$  possibly represents a conjugate left-lateral strike-slip structure that may intersect the principal rupture. The inferred stress field is also consistent with predominantly reverse-slip reactivation of structures trending NNE-NE along the Southern Alps range-front. The main strike-slip fault appears to have low finite displacement and may represent either a fault that is fairly new-formed in the regional stress field, or an existing subvertical fault that is optimally oriented for frictional reactivation.