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Deep-seated landslides and seismic triggering along major transcurrent faults in central Asia and California.

Derek Rust (1), Andrey Korjenkov (2), Alexander Bobrovskii (2), and Ernes Mamyrov (2)

(1) School of Earth and Environmental Sciences, University of Portsmouth, Portsmouth, UK (derek.rust@port.ac.uk), (2) Institute of Communications and Information Technologies, Kyrgyz-Russian Slavic University, Bishkek, Kyrgyzstan

The Tien Shan mountains of central Asia, the northernmost expression of India-Eurasia collision, are characterised by active deformation (GPS measured contraction rates of ∼20 mm a-1), rapid uplift and steep slopes prone to landsliding. In addition to seismogenic structures associated with contraction, the mountain belt is bisected by the Talas-Fergana fault, a poorly-known, historically aseismic, 700-km-long dextral strike-slip structure displaying active faulting and landslide features similar to those along the San Andreas fault in the Transverse Ranges of southern California. In both cases uplift along fault traces making up the fault zones has produced a deep central trough occupied by landslide and reworked landslide deposits, bordered by mountain ridges dominated by high to medium grade metamorphic bedrock and acting as landslide source areas. Moreover, palaeoseismic evidence suggests both fault zones may be regarded as seismic gaps characterised by relatively infrequent large-magnitude earthquakes. The numerous deep-seated landslides along both fault zones record a long history of landsliding based on: 1) radiocarbon dating; 2) sequences of lacustrine deposits containing apparent seismites and formed in landslide-dammed lakes now breached and drained; 3) recorded offsets and entrenchment of drainage features and deposits, associated with a characteristic cycle of fluvial reworking of landslide masses; 4) perched gravels preserved high on central trough walls and interpreted as related to reworking of landslide deposits; 5) degree of erosional and depositional degradation, including a time-series of landslide mass – lacustrine deposit assemblages. Together, these features suggest a landslide history characterised by large-volume failures, a pattern thought to mirror that of seismic strain release along these apparently locked fault systems. It seems likely that deep-seated landslides are effectively only triggered by major faulting events in these settings and radiocarbon dating of lacustrine deposits is underway with the aim of providing an extended palaeoseismological record. The ground shaking accompanying these events is likely to trigger deep-seated landslides at high threshold values, with other landslide-inducing mechanisms unable to attain these threshold values, or significantly lower them, during inter-earthquake periods.
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