

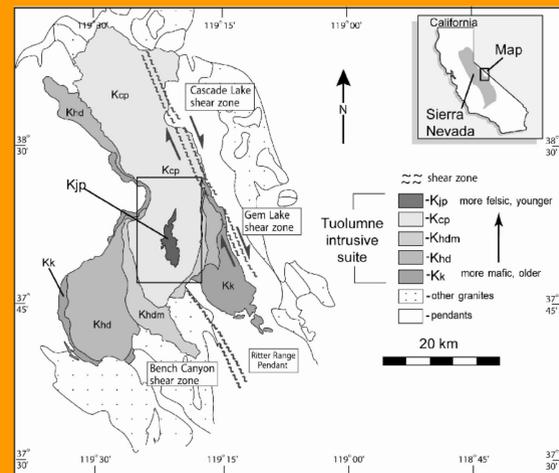
Did Deglacial Unloading Reactivate the Lost Lakes Fault, a Brittle Structure in the Tuolumne Intrusive Suite, Sierra Nevada, USA?

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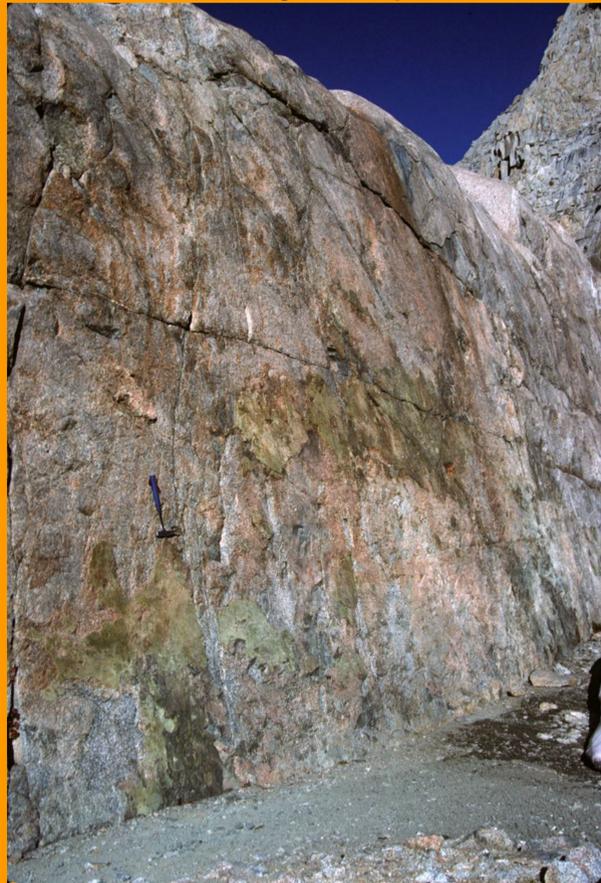
Abstract

The Lost Lakes Fault is an ~8 km long north-striking structure exposed along the Sierra Crest in Yosemite National Park. The northernmost 3 km is exposed in a series of west-facing cirques while the southern 5 km lies in a southward-draining glacial basin. In the west-facing cirques, the fault is marked by a prominent eastward-facing scarp that dips 80 degrees and ranges in height from ~0.5-10 m, with 4-6 m being typical. The topographic expression of the fault in the south-draining basin is minor. Field evidence indicates at least three periods of fault activity: an early phase (Cretaceous in timing?) and two Quaternary phases. The early phase is supported by the occurrence of pseudotachylite, cataclasite, chlorite, quartz, and epidote along the fault surface, which we interpret to indicate deformation at substantially greater pressures and temperatures than those provided by the near-surface environment. The scarp's lower-most portion is highly planar and displays delicate slickenlines and vein coatings while the scarp's upper reaches are rounded and glacially polished. We interpret this evidence to mean at least two phases of Quaternary activity: a pre- to syn-glacial phase and a post-glacial phase. Immediately to the west of the faulted cirques is the northwest-trending Lyell Canyon which was filled with ~730 m of ice during the Last Glacial Maximum. Our primary hypothesis is that deglaciation triggered the Quaternary displacement on the Lost Lakes Fault. If so, displacements on this fault might have occurred repeatedly through various glacial episodes and the shear sense might have been reversed during periods of glacial growth. Alternative hypotheses are that it was reactivated due to the topographic amplification of seismic energy radiating from the Sierran Frontal Fault or from regional tectonic stresses.

The Lost Lakes Fault is an ~8 km long structure exposed in the Tuolumne Intrusive Suite along the western edge of the Sierra Crest.



Topographically the fault is marked by a scarp up to ~10 m high that dips 80E.



Field evidence indicates at least 3 periods of fault activity.

1- An early phase (Cretaceous in timing?) as evidenced by pseudotachylite, chlorite, and epidote along the fault surface.

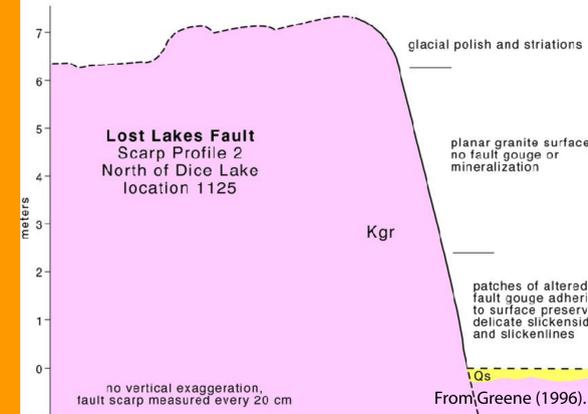
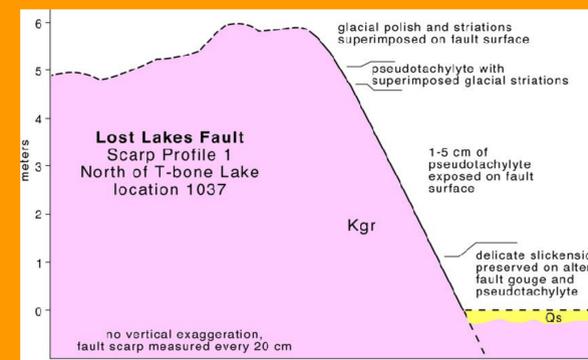


Photographs by RAB; dime for scale, diameter = 18 mm.



2- Two Quaternary phases.

A- A pre- or syn-glaciation phase, as evidenced by rounding of the top of the fault scarp by glaciation.

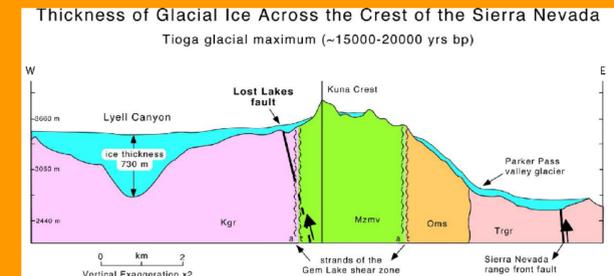


2- B- and a post-glaciation phase, as evidenced by the preservation of delicate slickenlines along the base of the scarp.



What triggered reactivation of the Lost Lakes Fault?

- 1- Deglaciation of the adjacent Lyell Canyon?
- 2- Seismic energy radiating from the Sierra Nevada range front fault?
- 3- Regional tectonic stress?

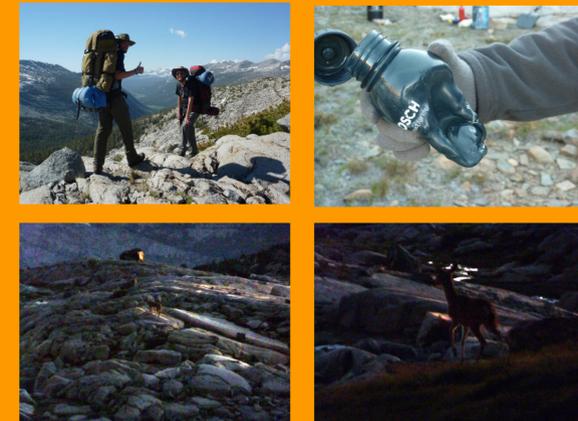


From Greene (1996).

We are testing the deglaciation hypothesis with ¹⁰Be dates from the fault scarp and erratic boulders at the top and bottom of Lyell Canyon. The boulders will bracket the deglaciation of Lyell Canyon; if the fault scarp dates do not match the timing of deglaciation then this hypothesis may be rejected.



Acknowledgements



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