LAKE TAHOE’S SUBMERGED RECORD OF ACTIVE FAULTING IS CHARACTERISTIC OF THE BASIN AND RANGE


Lake Tahoe occupies a large fault-controlled basin at the boundary between the tectonic provinces of the extensional Basin and Range and the relatively stable Sierra Nevada block. Multiple lines of evidence support the conclusion that the Lake Tahoe Basin is tectonically active at a level characteristic of the Basin and Range, which has not been fully appreciated, due to the extensive water coverage; First, the overall basin morphology and relative escarpment heights are comparable to the adjacent Carson Valley to the east, which is bounded by active faults. In addition, active faults with clear scarps have been imaged in both the bathymetry and subsurface, bounding the west margin of the lake basin and extending onshore. Furthermore, submerged late Pleistocene to early Holocene age shorelines are faulted. By utilizing a novel combination of high resolution seismic CHIRP, LIDAR and AMS C-14 dated sediment cores, we have characterized the active faults within Lake Tahoe. We have collected a striking sub-meter resolution seismic image of the Stateline fault expressed by a 10 m high surface scarp, located at a depth of 500 m. Cumulative fault slip rates and extension rates across the lake basin encompassing several faults, including the Stateline fault, were estimated by correlating the 9-15 m of vertical displacement across the entire lake basin, of a submerged shoreline, to an approximately 23 m displacement of the McKinney Bay slide deposits across the Stateline fault. We estimate the age of this single-fault strainmarker by extrapolating a sedimentation rate derived from a new sediment core located in the associated hanging-wall block. We have estimated a maximum age of approximately 90 ka for the the McKinney Bay slide deposits. Considering that the basin-wide submerged shoreline strainmarker is displaced about half of the single-fault displacement McKinney Bay slide deposits, allows a corresponding maximum age estimate. By assuming constant fault sliprates and fault dips of 60 degrees we estimate an extension rate, across the entire lake basin encompassing several faults, of 0.5 mm/yr ±0.35 mm/yr. Given the dimensions of the Lake Tahoe faults and typical displacements, this strain is most likely released in large M7 range earthquakes. Future work will focus on characterizing the offshore onfault paleoseismic histories.
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Recent Investigations of Basin and Range Paleoseismology (Posters)
Sharwan Smith Center: Ballroom
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