Recent Seismicity and Surface Deformation at Lake Tahoe: An Update on Lower Crustal Magma Movement

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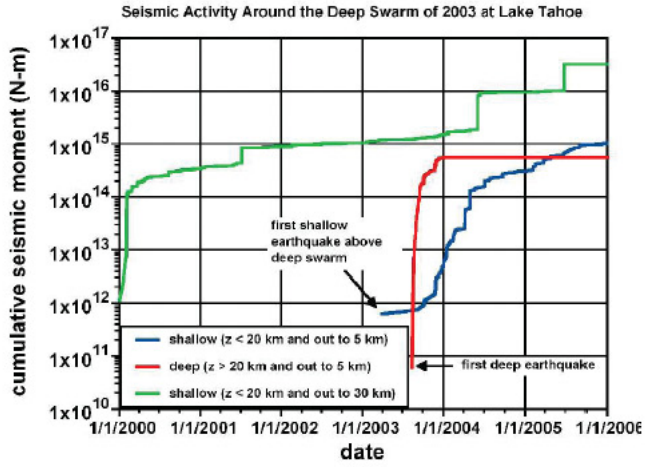

Figure 1. Cumulative seismic moment as a function of time for deep and shallow earthquakes the Tahoe seismic swarm.

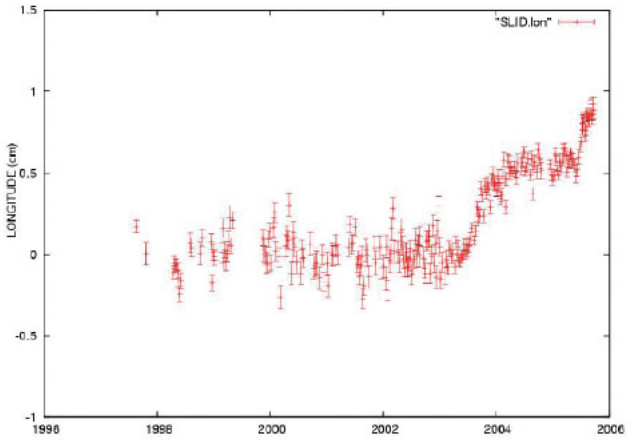

Figure 2. GPS time series (longitude) for site SLID which is ~15-20 km east of the epicenters.

In late 2003 a lower crustal seismic swarm (29-33 km depth) occurred beneath the north end of Lake Tahoe on the California-Nevada border. This swarm was accompanied by an ~1 cm northeastward motion of the continuous GPS site SLID on Slide Mountain, Nevada. The position and motion of SLID with respect to the northeast-dipping planar cluster of seismicity suggested that the earthquakes and surface motion were caused by a progressive filling of a crack with magma, injected from below [Blewitt, 2004; Smith et al., 2004]. This activity began again in mid-2005 when another movement, of size and direction nearly equal to the 2003 event, was observed with GPS at SLID. However, this time the associated cluster of seismic activity was shallower and more energetic (Figure 1). The distribution of shallow seismicity follows a spatial pattern that is strongly focused to the north of the original swarm, and divided into separate northwest and northeast trending clusters. This distribution suggests some influence by the tectonic structures of the Great Basin/Sierra Nevada transition zone, and may provide some clues about the state of stress in this active transtensional system. We have established nine new GPS sites around the Tahoe region that will help constrain the depth and location of future fluid motions should they occur [Hammond et al., 2006]. Planned installations for PBO will further enhance our ability to monitor this motion.

References

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