Submitted to AGU Fall Meeting 2004

Spatial Variations in Strain Inferred by GPS Across the Yucca Mountain Region, Southern Nevada

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We present the results of processing 4.5 years of data from 28 BARGEN GPS stations in the region of Yucca Mountain. The GPS network includes 16 stations densely spaced around Yucca Mountain. Far-field stations are located in the southern Basin and Range and also across the Eastern California Shear Zone (ECSZ) at the latitude of $\sim$ 36$\deg$N.
Velocity estimates for the local Yucca Mountain stations, relative to a station (LITT) $\sim$ 15 km to the SE of Yucca Mountain, generally trend NW (after North American plate rotation has been removed). Velocities increase in magnitude from east to west. The total change in velocity across the local network is 1.0 $\pm$ 0.1 mm/yr (from the most eastern to the most western local station, TIVA to BULL). There is also a sudden change from higher to lower velocities $\sim$ 10 km to the east of Yucca Mountain.
Shear strain magnitude for the 16 stations $<$ 55 km from Yucca Mountain is estimated to be 16.7 $\pm$ 0.7 ns/yr, with right-lateral simple shear at $\sim$ N30$\deg$W. This strain rate assumes a uniform strain field, however, which is not strictly the case. For the 9 stations to the west of the sudden change in velocities (to the east of Yucca Mountain) the shear strain magnitude is 13.4 $\pm$ 1.2 ns/yr. For the 7 stations to the east this is 22.0 $\pm$ 0.9 ns/yr.
We estimate a total slip budget of 12.3 $\pm$ 0.2 mm/yr across the width of the GPS network, in a profile trending NE from the southern Sierra Nevada, through Yucca Mountain to the Nevada - Utah stateline (station LIND to station ECHO). There is little evidence for extension across the central Basin and Range stations, with a dilitation rate of only -0.3 $\pm$ 0.6 ns/yr, but the Basin and Range stations exhibit a right lateral shear strain of 8.7 $\pm$ 0.4 ns/yr. We estimate a total slip budget of 11.6 $\pm$ 0.2 mm/yr across a profile through the ECSZ stations (at latitude $\sim$ 36\deg$N), from the Sierra Nevada to Las Vegas (station LIND to station APEX).
We attempt to establish the distribution of slip across the ECSZ faults using elastic displacement models to create model profiles that are compared with the measured velocity profiles. Across the stations in our network at $\sim$ 36\deg$N it is possible to produce a reasonable profile fit by allocating $\sim$ 3.9 mm/yr slip rates to the Owens Valley, Panamint Valley-Hunter Mountain and Death Valley - Furnace Creek fault systems, with locking depths of 8, 12 and 16 km respectively. Across the central part of our network, at the latitude of Yucca Mountain, it is difficult to produce an adequate model fit to the GPS results. This difficulty is a result of the sharp decrease in velocity estimates at stations to the east of Yucca Mountain. A possible cause of this change in velocities could be a local fault at Yucca Mountain or Bare Mountain. The addition of such a fault, with a slip rate of $\sim$ 0.5 to 1.0 mm/yr, produces a modeled profile that better fits the GPS results. The addition of such a fault also increases the modeled strain rates to levels closer to the measured strain rates, although not enough to completely explain the

discrepancy. We therefore suspect that the models are not sophisticated enough to explain the deformation profiles, or that postseismic deformation (from the 1999 Hector Mine earthquake or 1992/2002 Little Skull Mountain earthquakes) is affecting the strain field at Yucca Mountain. Postseismic deformation from the 1999 Hector Mine earthquake would not be unlikely, since we observed a coseismic offset in the timeseries for this earthquake, although there is no clear evidence for postseismic deformation in the timeseries. Interseismic deformation on the faults of the Mojave Desert may also be affecting results.

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