Speaker: Eldon Gath – Los Angeles Basin Active Tectonics

Southern California – site of San Andreas transform zone, transpressive tectonics

**Southeast LA basin:**
- Santa Ana Mountains – uplifted granitic terrain
- Puente Hills – blind thrust, uplifted hills over ramp

**Seismic Risk** –
- Main strand of San Andreas = high rates of strain and earthquake potential
- SE LA Basin > 5 million people

**Methods of Analysis**
- Marine terrace chronology, determination of terrace ages and uplift rates
- Fluvial basin growth rates, in actively uplifted highlands
- Fluvial basin ages
- Field / photo mapping of erosion surfaces, fluvial terraces
- Modelling of uplift rates and tectonic process

**Marine Terraces**
- Dated with corals: 80,000 yrs old (lower terrace), 120,000 yrs old (middle terrace), 300,000 yrs old (high terrace)

  Terraces are extrapolated to high sea level stands, wave-cut bench erosion

  Modern wave-cut features along coastal zone: coseismic uplift of modern wave-cut platform ~1.5 m uplift per seismic event, approximately Magnitude 7.0 earthquakes, recurrence interval on order of 1000-2000 yrs.

**Puente Hills Blind Thrust**
- Low-angle thrust
- Uplifted geomorphic surfaces
  - Digital elevations models show “fill terraces” and “strath terraces”
  - Terraces dated on basis of soils development / chronology
- 3 terraces identified, uplift rate on order of 0.4 mm/yr

**Whittier Fault**
- Fault trenching studies:
  - Strike-slip fault – right-lateral offsets on stream channels (~300 m average)
  - 2-3 mm/yr slip rate
  - 2 seismic events recorded in last 3900 years

**Drainage basin relations vs. degree of stream offset**
- As distance of stream offset increases (due to strike-slip faulting), the area of the drainage basin upstream from the segment also increases (i.e. older, larger basins have more net offset over time)

  Stream offset = proxy for no. of earthquakes over time, > no. of earthquakes, > amount of stream offset.

  The largest drainage basins are ~700,000 years old
Puente Hills Summary

Uplift rate ~0.4 mm/year
A no. of active fault zones, right-lateral offset 2-3 m / 1000 years

Santa Ana Mountains Area (granitic terrain)

Fluvial fill and strath terraces record uplift in region
Soil chronosequences used to determine terrace age (80,000 and 120,000 yr surfaces)
Uplift rate ~0.3 mm/yr

More Techniques:
Field mapping of terrace elevations
Fault trench studies

Dating technique: Optical Spin Resonance (OSL), measure of time since burial of sediment (applicable to quartz sand), useful back to ~100,000 yrs ago

Hazards Implications for Active Faulting in SE LA basin:
Damage to water treatment plants, pipelines, reservoirs (all under-designed)