

Taylor Summary of OSU Geosciences Seminar April 15, 2003

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

Puerta 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 $\sim 100,000$ yrs ago

Hazards Implications for Active Faulting in SE LA basin:

Damage to water treatment plants, pipelines, reservoirs (all under-designed)