Fault System Evolution

Erik Olson and Michele Cooke
Department of Geosciences, University of Massachusetts

Millions of people live above the evolving Puente Hills Thrust system of the Los Angeles basin. The early system was composed of the nearly vertical Whittier and Chino strike slip faults. Over time the blind thrust faults, Coyote Hills, Santa Fe Springs, and the Los Angeles sequentially developed. By modeling the Puente Hills Thrust system at different periods in time it is possible to assess various factors that may control the development of each subsequent fault. Three factors, strain energy density, energy release rate, and Navier-Coulomb stress, are used assess the propagation of the fault system. In each model, the strain energy density always has the greatest concentration on the western of edge of the youngest fault. Additionally, the area of high strain energy density envelopes at least a portion of the plane of the next expected fault. The energy release rate is in agreement with the strain energy density values in predicting growth of the next fault. The Navier-Coulomb stress was used to estimate the future fault orientation. By combining all of these factors we are able to predict the location of each subsequent fault in the models. Therefore by examining these factors in a fault system which is still evolving it may be possible to extrapolate the location of future faulting. This extrapolation would be useful in the circumstances of long term nuclear waste storage, where the development of a new fault over a few thousand years would be potentially hazardous.