The Pelona and related schists of Southern California represent continental detritus deposited, subducted to depths of ~30 km, and accreted during a major Late Cretaceous-Early Tertiary collisional event. Emplacement of the schists coincided with the termination of magmatism along a ~500 km segment of the California continental arc, the disappearance and probable subduction of the forearc and western portions of the arc, and the loss of the mafic lower crust and root of eastern portions of the arc. Conceptual models of schist emplacement differ in detail, but generally involve a dramatic flattening of subduction. In order to better understand the stresses, accretion rates, and emplacement histories of the schists, we constructed a two-dimensional, finite element, kinematic-thermal model of flat subduction initiation using the program Pecube (Braun, 2003). Solutions were found using the neighborhood algorithm inversion scheme of Sambridge (1999).

The inversion uses 13,500 models with 10 parameters. A misfit function is defined using constraints available from the literature on upper plate cooling rates in the San Gabriel Mtns. (~15°/m.y.). Numerous models are able to satisfy the thermochronologic data using reasonable parameter values. Shear stresses in acceptable models fall between 0.5 and 35 MPa. Acceptable accretion rates were between 0.5 and 1 mm/yr. Future models will also incorporate constraints on the inverted metamorphic gradient in the Sierra Pelona.

The inversion suggests that the thickest exposures of schist were built over 4-8 m.y. as material was scraped off 300-600 km of lower plate. In two less widely accepted alternative tectonic models, the schists represent either transpressional basin or forearc Great Valley deposits. Both alternative basin types are too narrow (<100 km) to produce the observed schist thicknesses.