Tectonic modification of the Mojave Desert region during Laramide shallow-angle subduction

Alan D. Chapman
Macalester College

SCEC Community Rheology Model Workshop
9/9/2017

N. America at ca. 85 Ma
(R. Blakey)
Modern shallow-angle subduction

Recognizing an ancient shallow-angle subduction system
“The schist:” A sheet or belt?
Sun et al., 2017, GRL

How did it happen?

Liu et al., 2010, Nat. Geosci.

LLNL model at 871 km

oceanic plateau collision
Immediate effect of such collision?

Thickening; Replacement of Sierran “root” with “the schist”

Saleeby et al., 2013
Lasting effects of such collision?

Late Cretaceous-Early Cenozoic pulse

Farallon Plate

Schist

Arc + N. American craton crust

100 km

Chapman, 2017, IGR
Pre-Laramide simplified W. Mojave column

- Seismic Moho
  - Garnet-pyroxenite batholithic residues (~35 km)
  - Sierran mafic cumulates (~10 km)
  - Sierran felsic intrusives (~30 km)

Sources: Jones and Phinney, 1998; Ruppert et al., 1998; Ducea and Saleeby, 1998; Fliedner et al., 2000; Cheadle et al., 1986; Malin et al., 1995; Saleeby et al., 2003; Chapman et al., 2012)
Present simplified W. Mojave column

Sierran felsic (2.6-5.5)

Hi T schist (6.2-6.5)

Lo T schist (6.8-7.0)

Sub-oceanic mantle lithosphere (>7.5)

Sierran mafic (5.5-6.1)

Seismic=Petrologic Moho

Sources: Cheadle et al., 1986; Malin et al., 1995; Pellerin and Christensen, 1998; Chapman et al., 2012)
Before.

Sierran felsic intrusives

Sierran mafic cumulates

Garnet-pyroxenite batholithic residues

Seismic Moho

Petrologic Moho

After.

E. Sierran felsic

Hi T schist

Lo T schist

Seismic=Petrologic Moho

Sub-oceanic mantle lithosphere

?
Summary
- Late Cretaceous plateau subduction
- Removal of forearc, arc, SCML; replaced with schist sheet
- Tectonic preconditioning: Gravitational collapse, slab window-related extension/magmatism, routing of SAf?