Late Cenozoic kinematic model from offset geophysical anomalies

a. Late Cenozoic cumulative displacement and estimated slip rates on faults in south-central coastal California
b. Late Cenozoic tectonic model for south-central coastal California
c. Implications for active tectonics in the DCPP vicinity.

Vicki Langenheim
Bob Jachens, Russ Graymer, Joe Colgan, Carl Wentworth and Rick Stanley
San Gregorio-Hosgri Fault

A major player in the San Andreas system?

Offset estimates range

<5-10 km*
>90-100 km**

*Hamilton (1984)
Sedlock and Hamilton (1991)
Sorlien et al. (1999)
Underwood & Laughland (2001)

**Hall (1975)
Graham and Dickinson (1978)
Clark et al. (1984)
Dickinson et al. (2005)
Why potential-field data?

Sensitive to density and magnetic contrasts across faults that have significant vertical and horizontal offsets

Geometry and cumulative offsets of faults over their lifetime

Areally extensive and generally consistent datasets

Span the onshore-offshore transition

Important for San Gregorio-Hosgri fault, which lies mostly offshore
Isostatic Gravity Map

Point Arguello negligible offset
MINOR STRIKE-SLIP OFFSET ON HOSGRI FAULT

Shortening accommodates about 3.5 km of post 4-6 Ma right-lateral slip on the Hosgri fault.
Merged Aeromagnetic Map

Less than 10 km
Well dated at 17–18 Ma (Stanley et al., 1996)

Point Sal section

San Simeon section

Preliminary detrital zircon data 18–20 Ma (Colgan)

CA-TIMS U-Pb zircon ages of 165.580 ± 0.038 Ma

From Mattinson & Hopson (2008)
122-128 km
86-89 km
Less than 10 km
Northward increasing slip

Even more to the north---175 km from SCM to Gualala postulated by Jachens et al. 1998
Summary of offsets along the fault

LONG-TERM SLIP RATES

15-18 mm/yr

12-15 mm/yr

10-12 mm/yr

7-9 mm/yr

0 mm/yr

QUATERNARY SLIP RATES

6-9 mm/yr

2-3 mm/yr

<2 mm/yr

SUMMARY
The Western Transverse Ranges have rotated clockwise ~90° as an intact block since 16 Ma. Strike-slip faults within the central Coast Ranges do not—and never have—cut through the Western Transverse Ranges.
∆=21-27 km

175 km

38-42 km

148-154 km

122-128 km

86-89 km
Does all 38-42 km make it to SGSSHF?

1) Moderate dip of Reliz Fault?

2) <23 km offset of schist in drillholes

3) Higher elevations N of Jolon
175 km

148-154 km

$\Delta = 20-32$ km

122-128 km

86-89 km

25-30 km on West Huasna
Δ = 33-42 km
86-89 km
122-128 km
148-154 km
175 km

Δ = 33-42 km
86-89 km
Increasing slip to the north along the San Gregorio-Hosgri fault

Mimics Quaternary slip rates, but long-term rates are at least 2x greater

Rinconada-Reliz and West Huasna faults can add slip to the San Gregorio-Hosgri fault

Offsets on structures south of San Simeon have not been determined, but offset increase between Point Buchon and Point Sal suggests cumulative long-term slip rate of 3-4 mm/yr distributed on multiple structures?
Fault geometry and cumulative offsets in the central Coast Ranges, California: Evidence for northward increasing slip along the San Gregorio-San Simeon-Hosgri fault
Lithosphere published 2 October 2012, 10.1130/L233.1
http://lithosphere.gsapubs.org/cgi/content/abstract/L233.1v1?papetoc