Faults: the product of earthquakes

Reading: Bolt Ch 3

What are faults?

A fracture in rock, with movement across it.

still active?

http://earthquakes.berkeley.edu/eps20
Still active?

Mapped faults in CA and NV

Alquist-Priolo Earthquake Fault Zones
- Active within last 11,000 years
- "Zone" is within 50 feet of mapped fault

...more on the "Resources" website

Red – most recently active
Bay Area Faults

Faults: red
Earthquakes: yellow

Earthquake probabilities

http://earthquakes.berkeley.edu/eps20
Still active?

Kuangfu Middle School
1999 Chi-Chi earthquake, Taiwan
...up to 9 meters vertical offset
Still active?

Movement along the fault:
San Francisco 1906 about 6 meters in places

What is an earthquake?
...the release of built-up stress along faults

1. Stress builds up due as tectonic plates move past one another

2. Friction along the fault prevents slip, elastic deformation instead

3. Stress exceeds rupture strength, fault slips ... earthquake

♫ Elastic rebound theory: developed in the Lawson Report
The earthquake cycle

- Major earthquake
- Seismic quiescence
- Aftershocks
- Seismic quiescence
- Aftershocks

Still active? Geomorphology

Wallace Creek Central California

http://earthquakes.berkeley.edu/eps20
Still active?
Geomorphology

- push-up ridge
- compression
- divergent
- sag pond
- convergent

Still active?
Trenching

How quickly is the San Andreas moving?

Trench the river channels to Wallace Creek and use radio-carbon dating to determine when the channel was active.

Total offset = 130 m
Oleost material = 3800 yrs

$\text{slip rate} = \frac{130}{3800} = 3.4 \text{ cm/yr}$
Three types of faults

Normal Faults – dip-slip

Extensional environments
- Subsidence, basin formation
- Strike and dip
- Hanging wall and foot wall

Strike and dip

how we describe the geometry of a plane in three-dimensional space

Dipping surface along lake shore

⇒ surface of the lake makes a horizontal line along the surface – the strike line

⇒ the angle between the strike line and north is the strike angle (measured clockwise from north)

⇒ the dip angle is the angle between a vertical line down the face of the surface and horizontal
Three types of faults
Reverse Faults
- dip-slip

Before

After

Compressional environments
- Mountain building

e.g. 1999 Chi-Chi earthquake, Taiwan

Three types of faults
Strike-slip Faults

Right- or left-lateral?

Translational environments
- e.g San Andreas and Hayward Faults
- Right- and left-lateral
Oblique slip  ...the earth is not that well behaved

San Andreas, 1906: up to 6m horizontal, a few meters vertical in some places
⇒ primarily strike-slip

Both strike-slip and dip-slip

Faulting in the Corinth Canal

What kind of faulting?

What kind of tectonic environment?
reverse faults ➔ mountains

normal faults ➔ subsidence

North Anatolian Fault