

# 12.520 Lecture Notes 16

## Dislocation in Elastic Halfspace Model of the Earthquake Cycle

### Interseismic: Slip below depth D

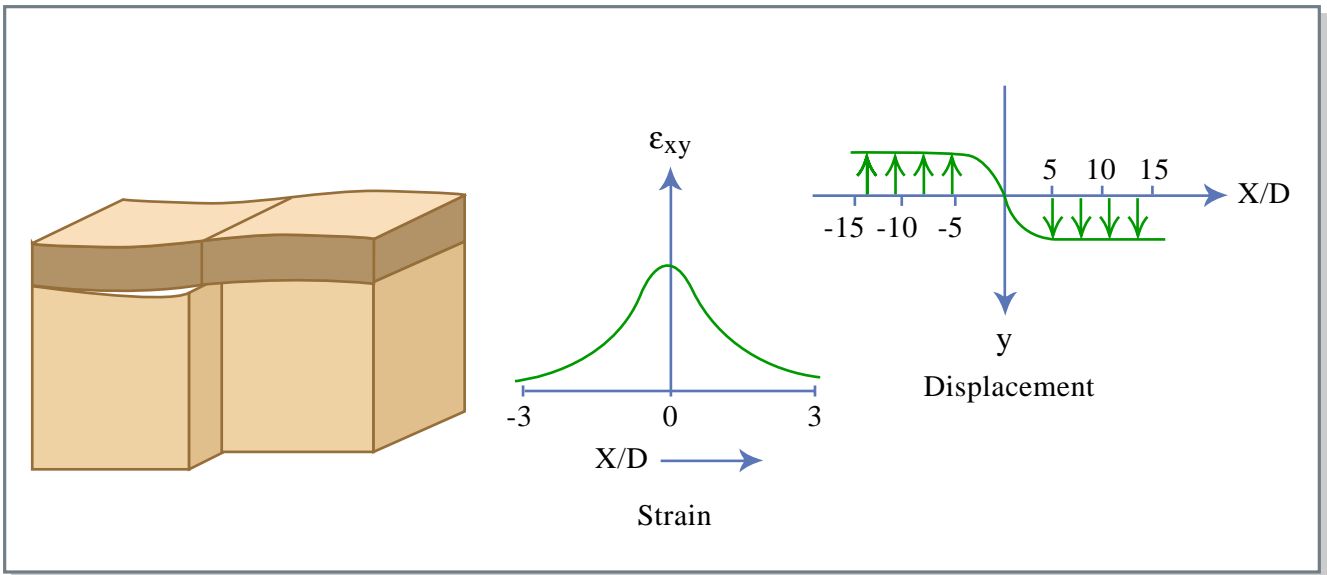


Figure 16.1

Figure by MIT OCW.

### Coseismic: Region above D “catches up”

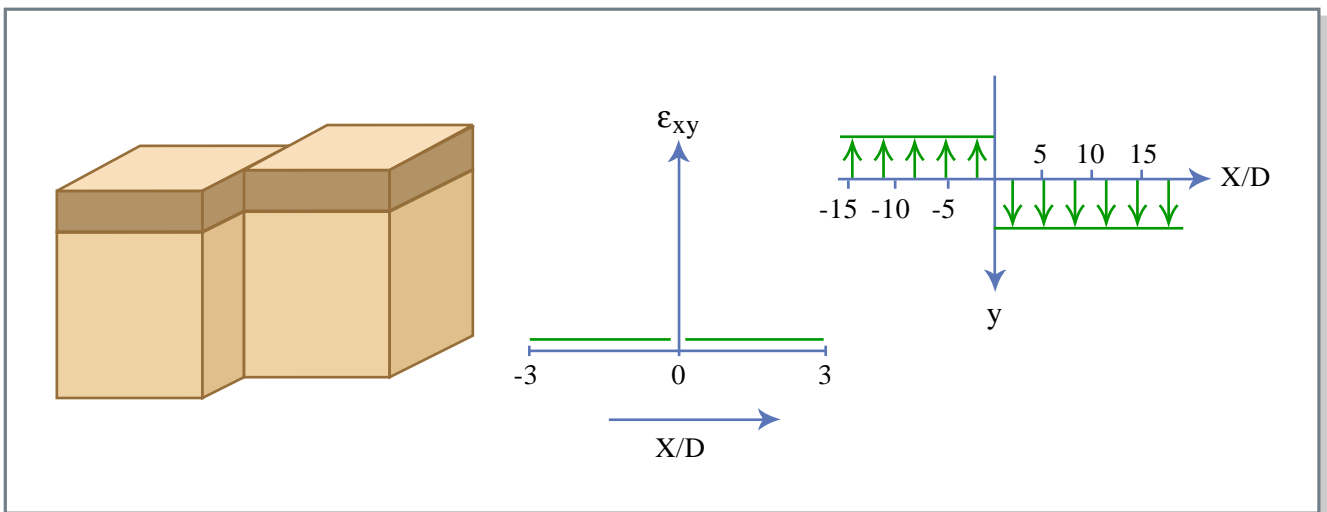


Figure 16.2

Figure by MIT OCW.

## Displacements from Earthquakes, Fault Slip, etc

Consider a strike-slip fault with displacement  $S$ , independent of depth – A screw “dislocation” – i.e., a slip discontinuity. Original ring (dashed) becomes helix (solid).

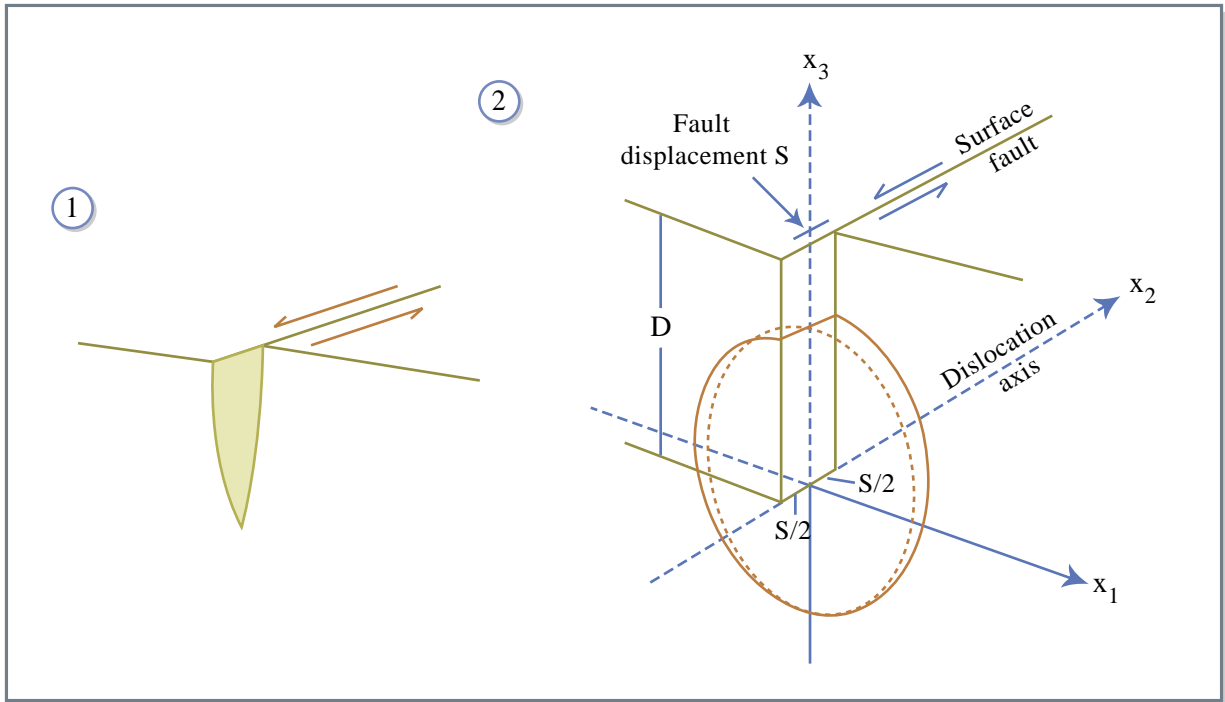


Figure 16.3. Section across a mathematical model of a transcurrent fault.

Figure by MIT OCW.

“Dislocations” are used to describe defects in crystals, as well as fault motions. A crystal disrupted by a screw dislocation is shown in the figure below.

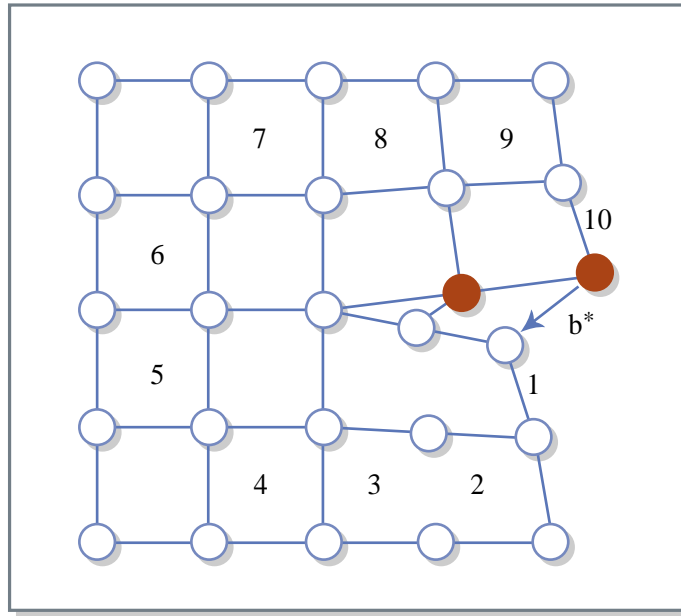


Figure by MIT OCW.

Figure 16.4. A screw dislocation in a cubic lattice constitutes a deformation that is out of the plane of atoms illustrated. The two atoms denoted by solid circles are essentially part of a second plane. The Burgers circuit indicated by the numbered steps naturally moves into this second plane. Therefore in order to close the circuit the Burgers vector  $b^*$  must be perpendicular to the plane of atoms shown.

Types:

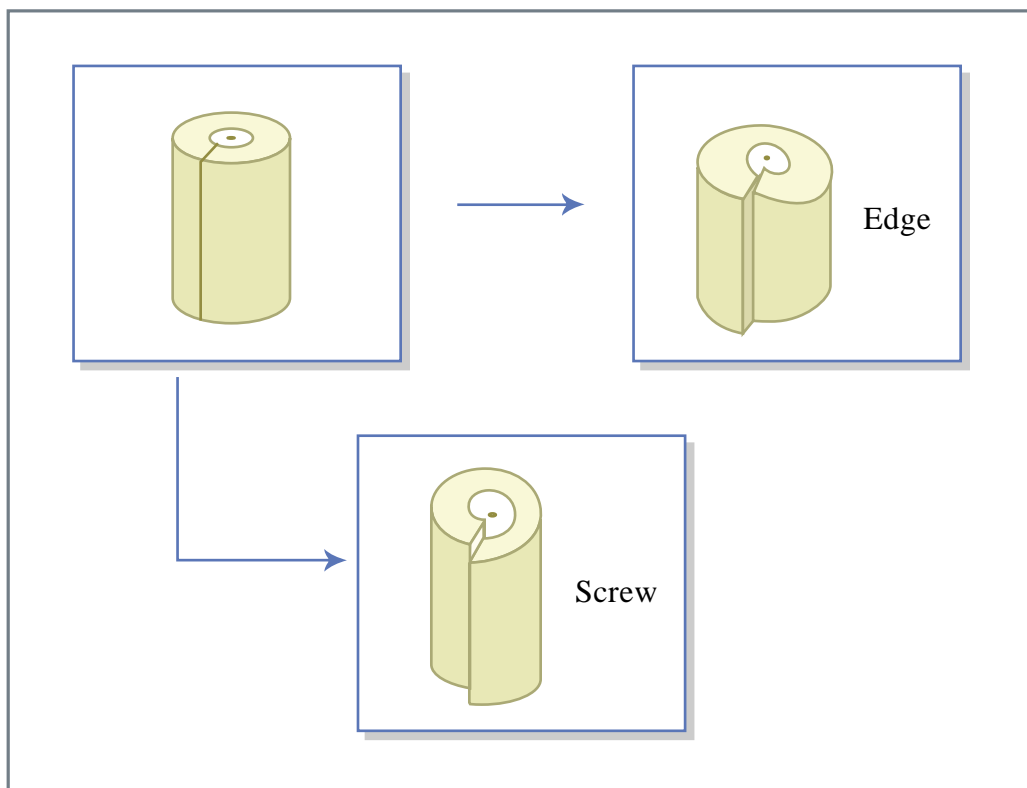


Figure 16.5

Figure by MIT OCW.

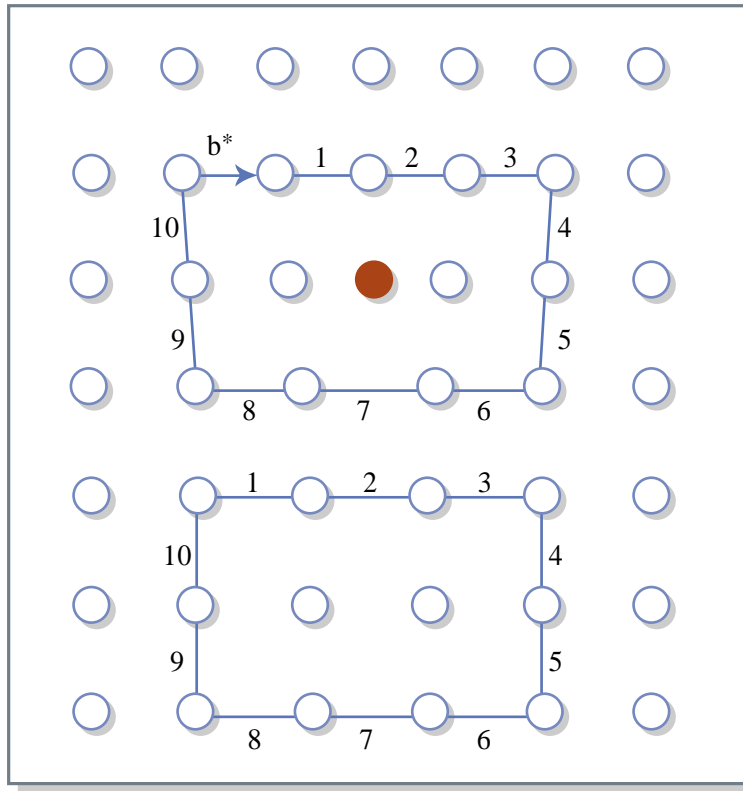


Figure 16.6 Side view of an edge dislocation in a cubic lattice.

Figure by MIT OCW.

Dislocation motion helps crystals deform (don't all have to slip at one time). Also helps Earth deform!

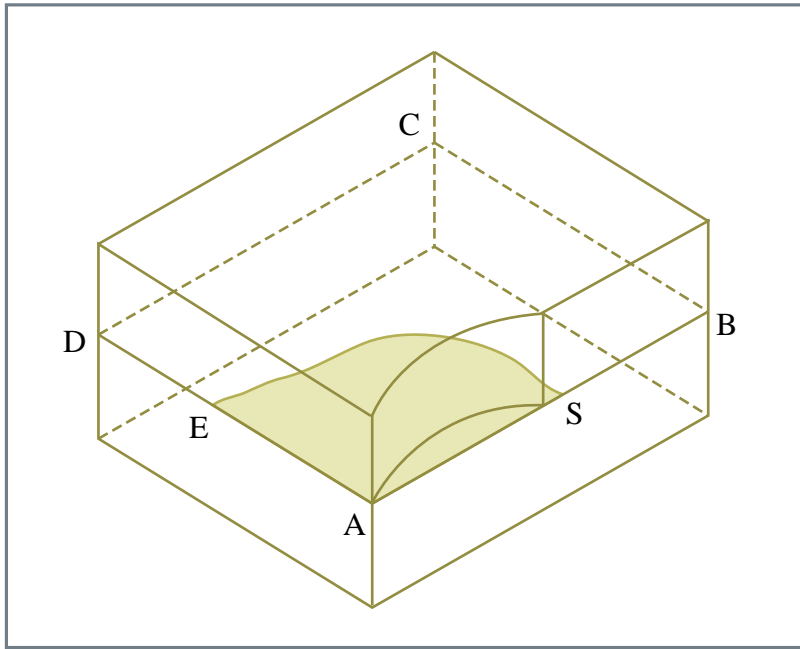


Figure 16.7 A dislocation.

Figure by MIT OCW.

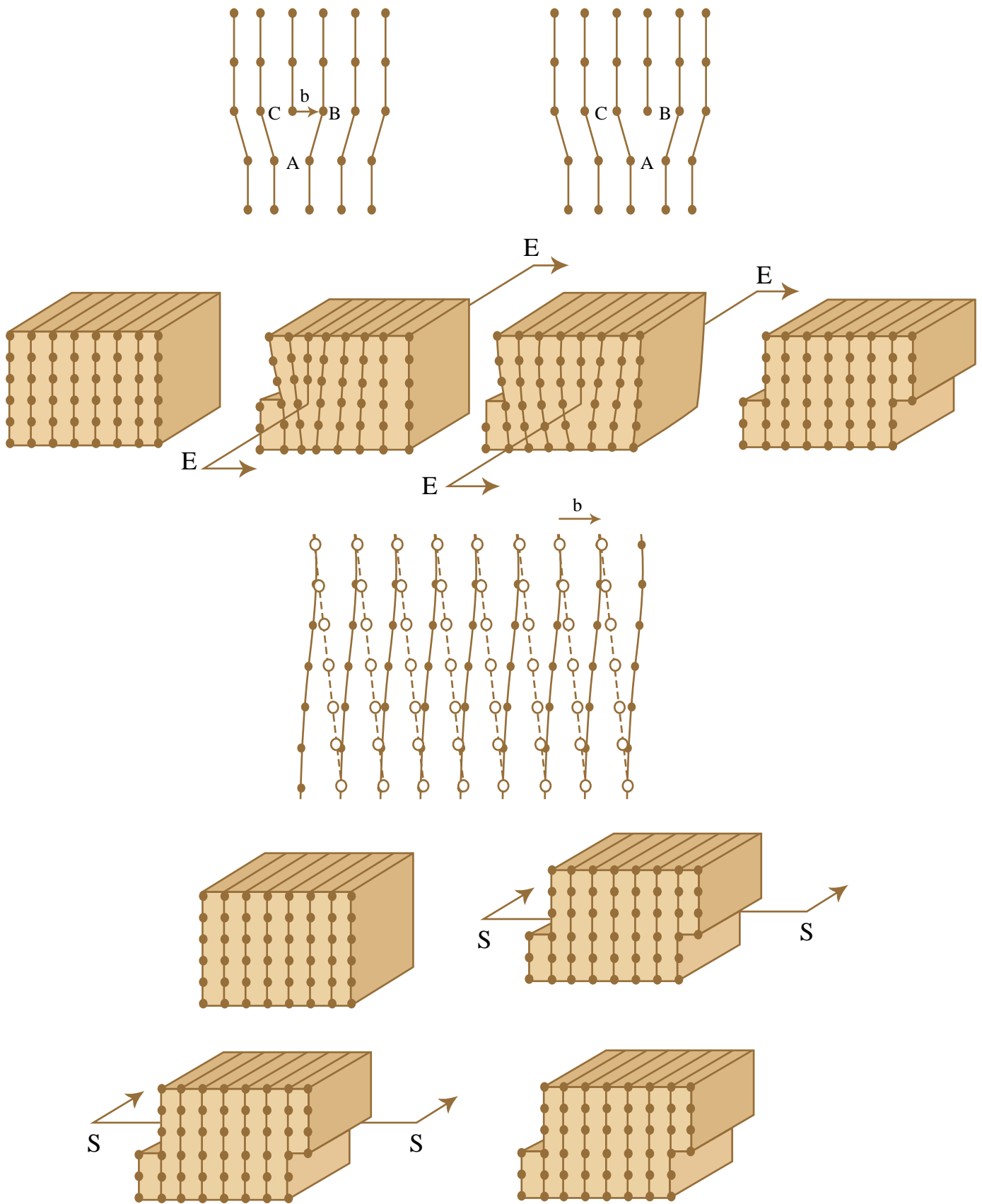


Figure 16.8 Upper group: Slip by propagation of an edge dislocation EE. Lower group: Slip by propagation of a screw dislocation SS.

Figure by MIT OCW.

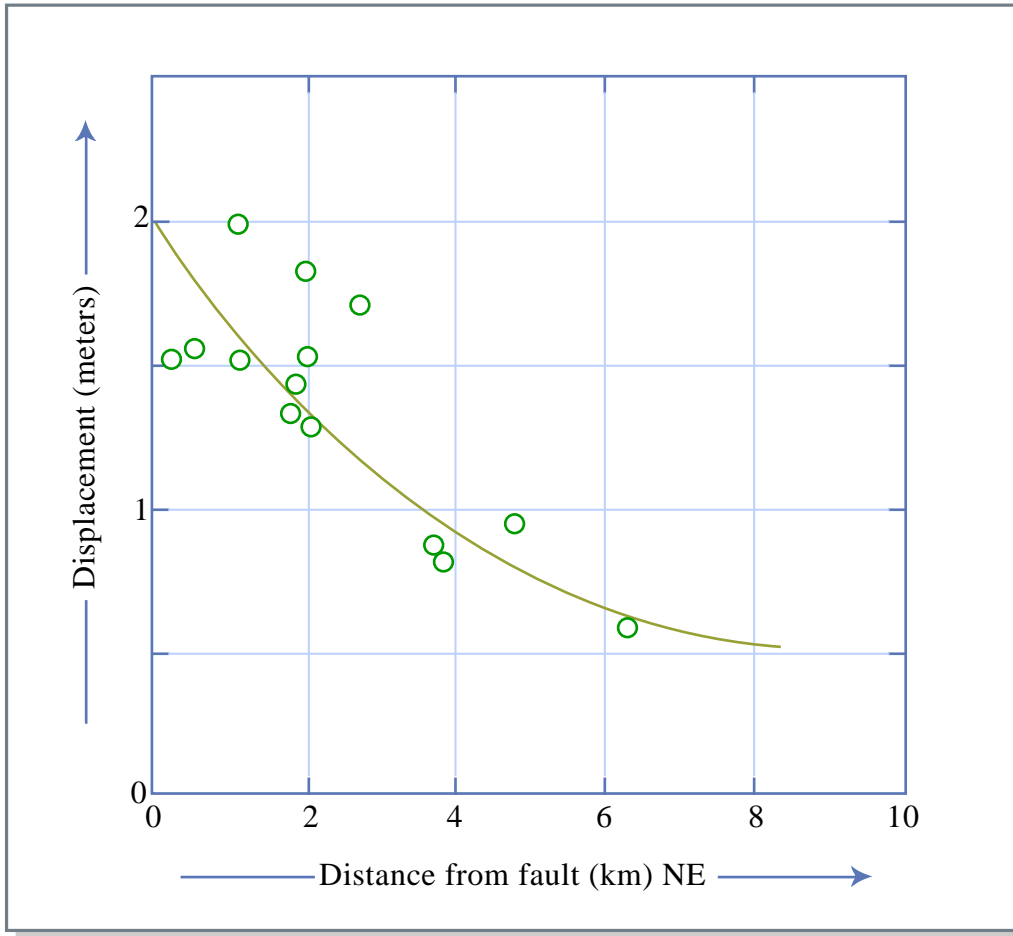


Figure 16.9 Displacement as a function of distance from a transcurrent fault.

Figure by MIT OCW.