

12.005 Lecture Notes 18

Dislocation in Elastic Halfspace Model of the Earthquake Cycle

Interseismic: Slip below depth D

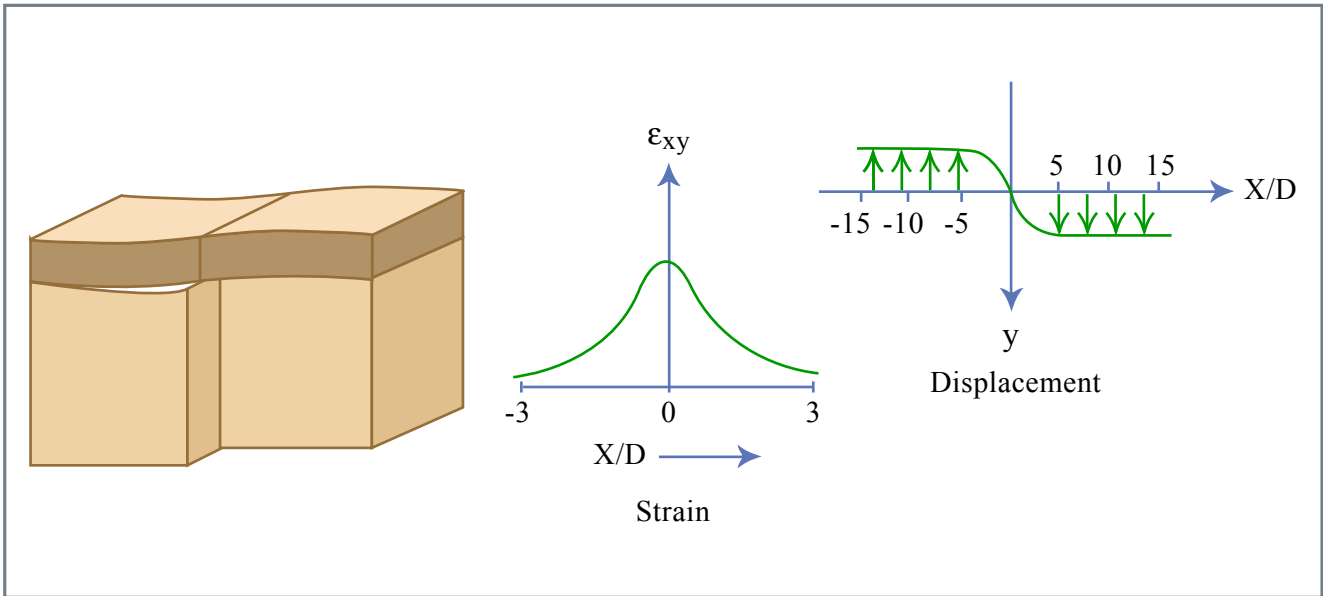


Figure 18.1
Figure by MIT OCW.

Coseismic: Region above D “catches up”

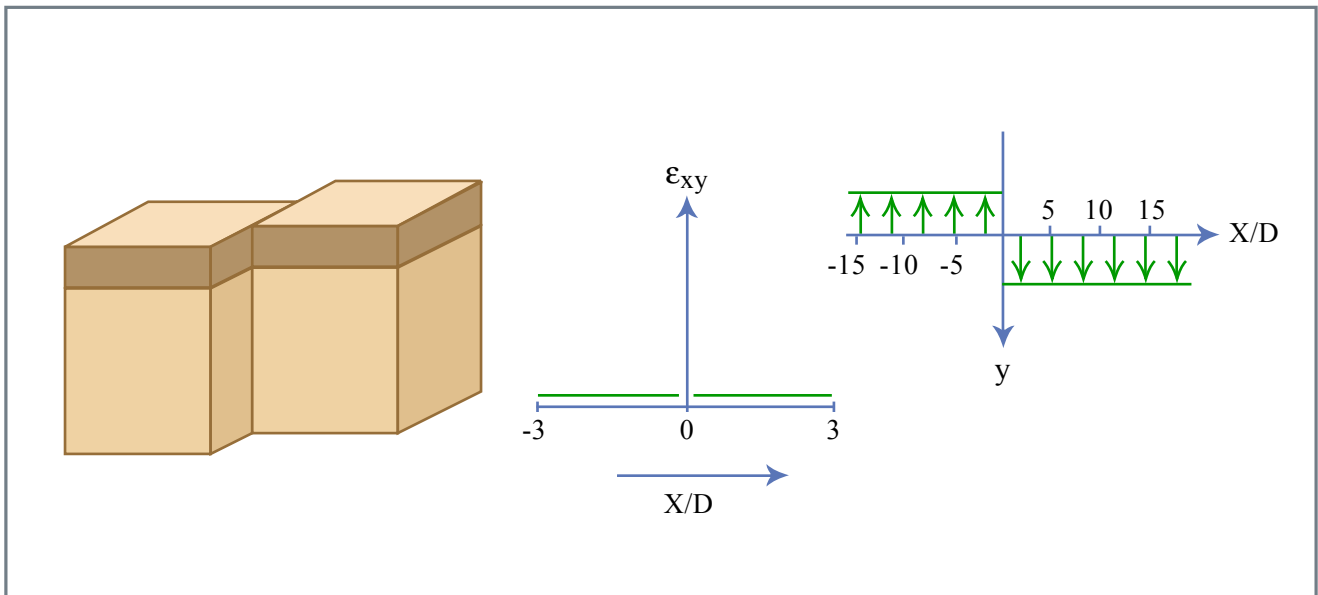


Figure 18.2
Figure by MIT OCW.

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).

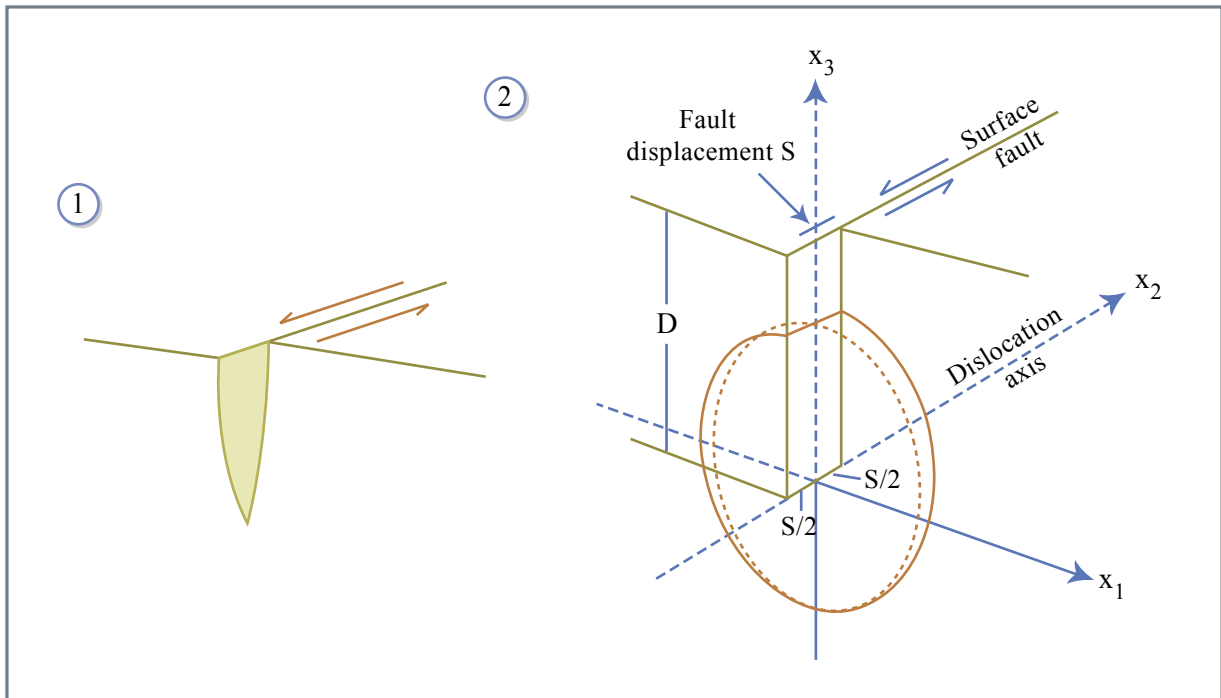


Figure 18.3. Section across a mathematical model of a transcurrent fault.

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.

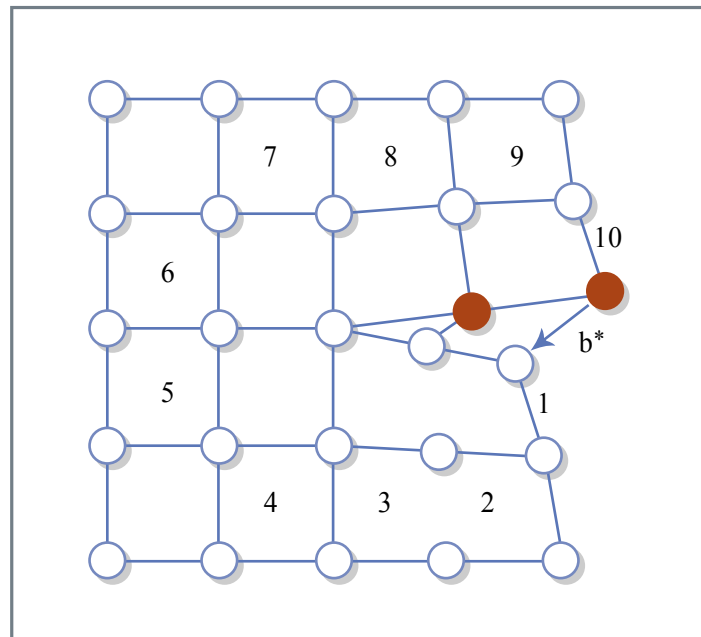


Figure by MIT OCW.

Figure 18.4. 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:

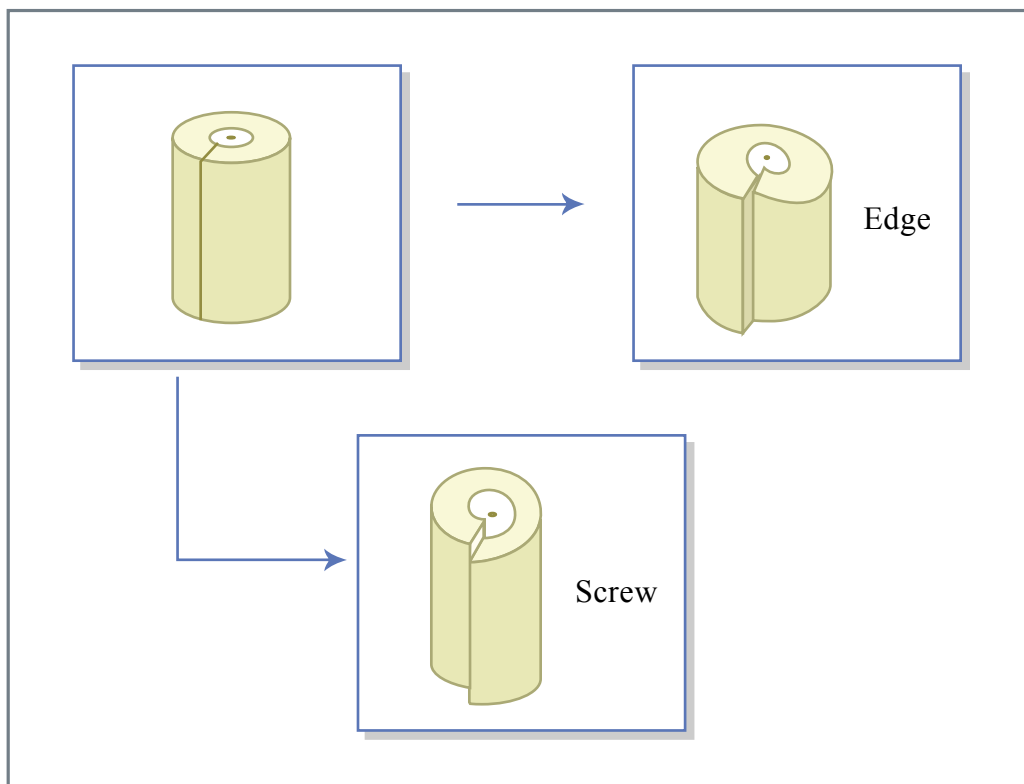


Figure 18.5

Figure by MIT OCW.

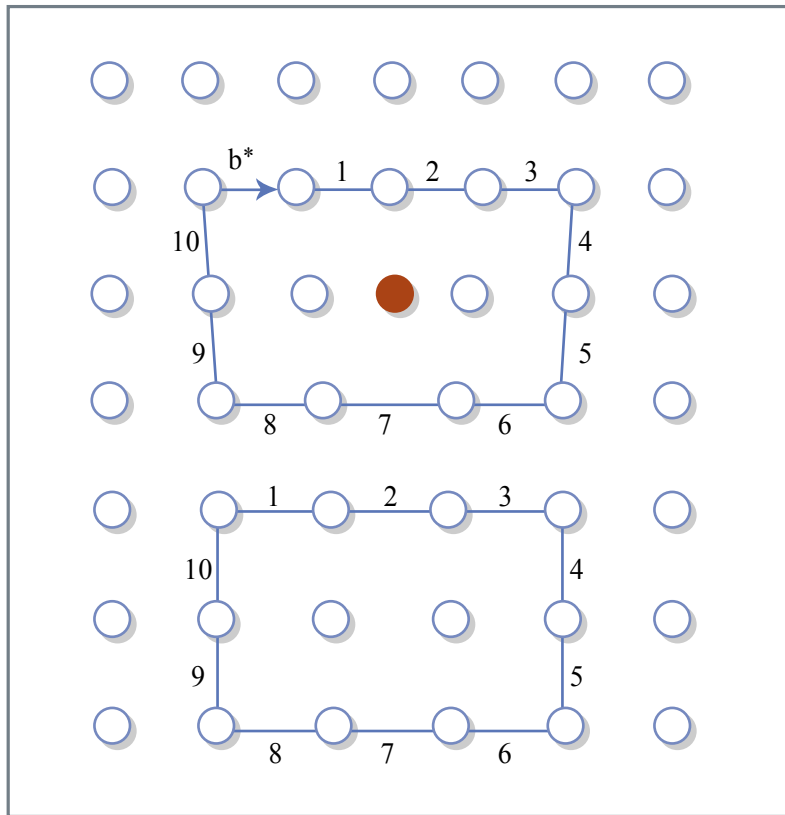


Figure 18.6 Side view of an edge dislocation in a cubic lattice.

Figure by MIT OCW.

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

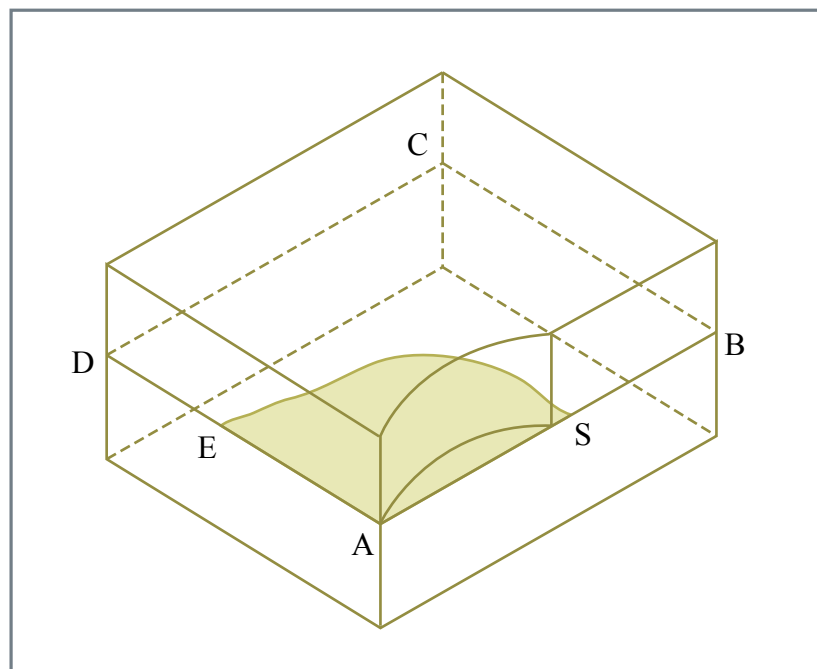


Figure 18.7 A dislocation.

Figure by MIT OCW.

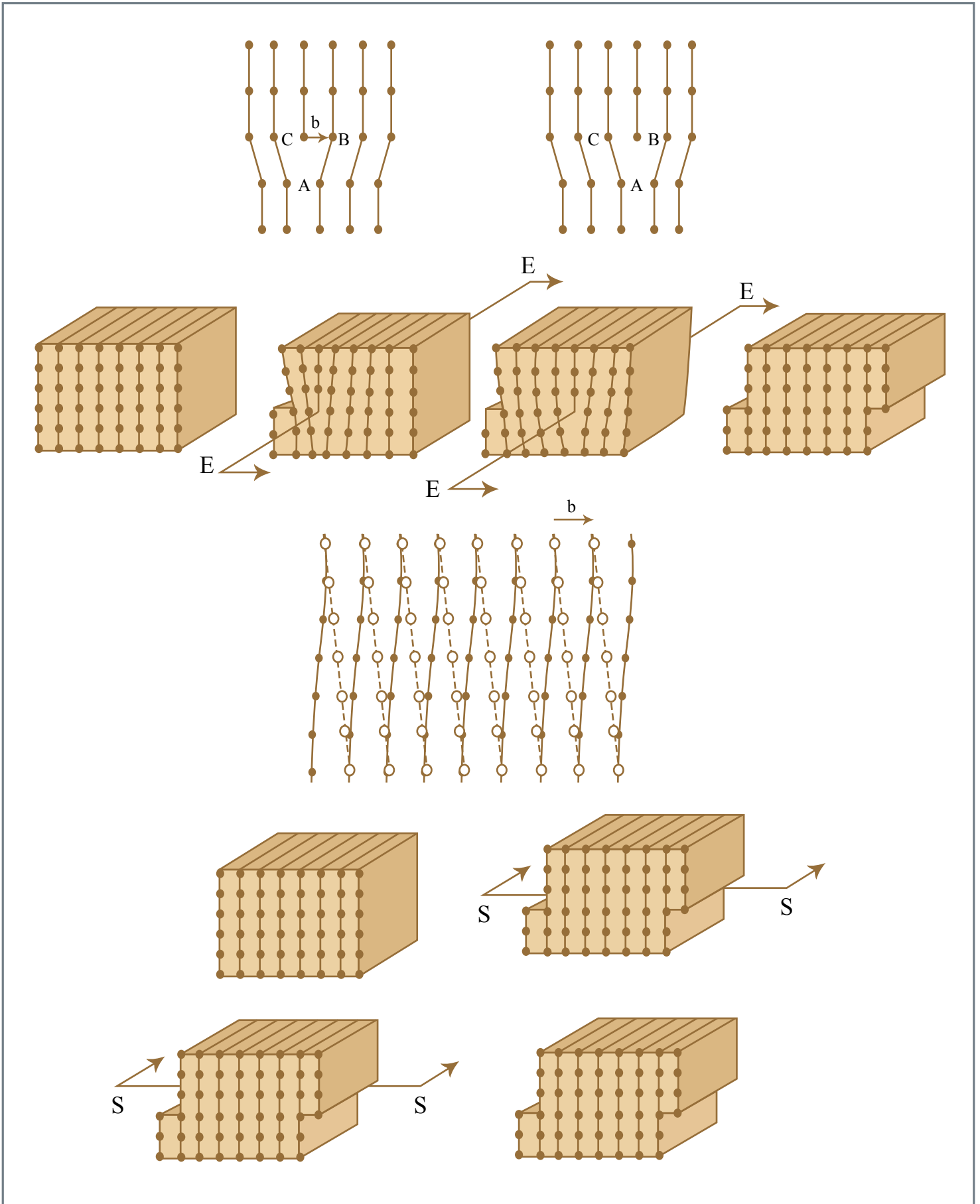


Figure 18.8 Upper group: Slip by propagation of an edge dislocation EE. Lower group: Slip by propagation of a screw dislocation SS.

Figure by MIT OCW.

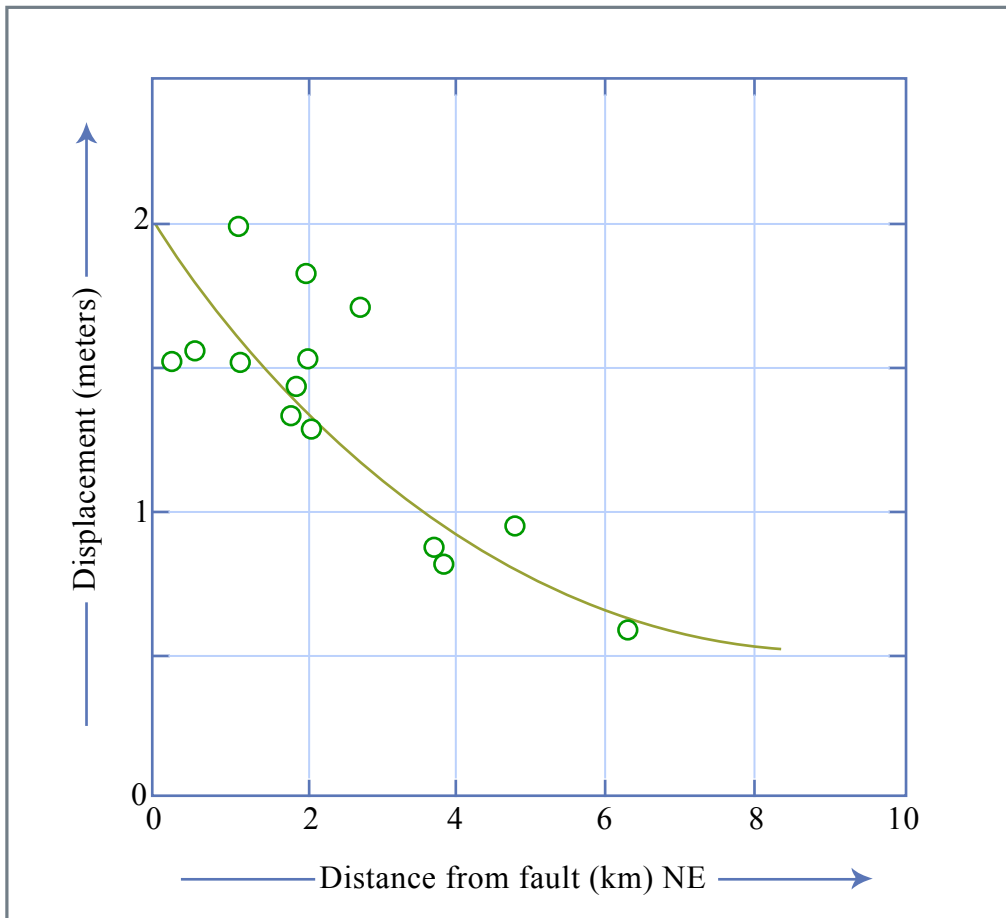


Figure 18.9 Displacement as a function of distance from a transcurrent fault.

Figure by MIT OCW.