Name ________________________________ Date _________ Block ________

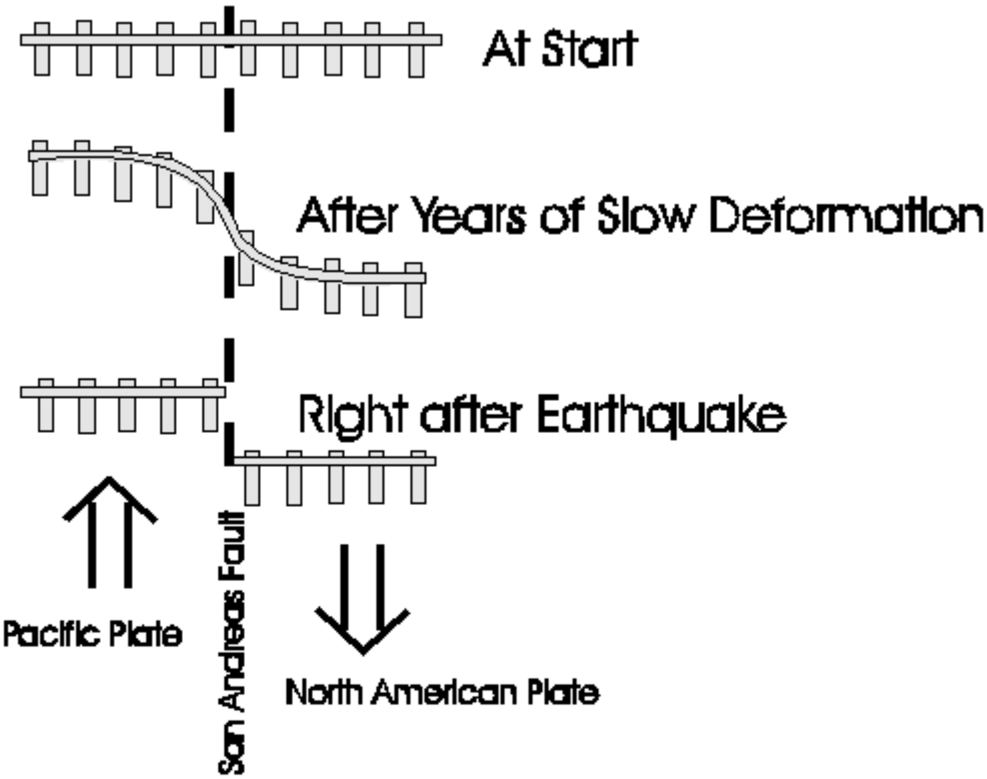
Elastic-Rebound of a Fault Block

Background Information

The Earth's outer, hard shell is very thin as compared to the radius of the Earth, about 80 km as compared with 6380 km. That's similar to comparing the thickness of an apple's skin to its radius. During the past 35 years, scientists in the fields of geophysics, geology, and oceanography have discovered that this hard outer shell is broken into about a dozen major "plates" that are slowly sliding about with respect to each other.

Tectonic earthquakes are caused by a sudden slippage along the boundary (fault) between two plates. The type of motion that occurs between two plates is used to classify faults as strike-slip (one plate slides past another), thrust (one plate slides under another) or normal (plates that are pulling apart from each other). Although one might expect earthquakes at the base of the plates, where they slide over the materials of the Earth's mantle, the high temperature and material properties at 80 km depth are such that plates slide along without generating earthquakes on their lower surfaces.

Typical rates of plate motion are a few cm per year. Why then, might someone ask, do destructive earthquakes occur in which many meters of fault slip happen so quickly that the vibrations are recorded by seismographs all around the world and are sometimes strong enough to destroy nearby buildings and bridges? This is where friction and elasticity come into play. Since the shallow portions of the plates are relatively cool, two plates cannot flow past each other, but rather the faults that form their boundaries tend to stick or lock up for years or centuries at a time. Each year the portions of plates near locked faults deform elastically by a few more cm. The more the plates are bent and deformed, the greater the force is on the fault (shear stress). Eventually the force is sufficient to make the plates break free of one another and the elastic energy that has been stored up is released as frictional heating on the fault and ground vibrations. (seismic waves). This process of faulting is called stick-slip or elastic rebound.



The initial force on the fault must be able to overcome static friction. Once the fault starts slipping, then slip will continue until the force drops below the resistance of sliding friction. The force available to keep the fault slipping decreases as the distorted plates return to their original shape.

Materials:

Small block of wood
Large block of wood
Thin rubber bands tied together, approx. 16 cm length
Carpet

Diagram of Set Up:

Data Tables:

Location of leading edge of rubber band (cm) (Plate motion)	Location of leading edge of block (cm) (Fault slip) **Small- countertop**	Location of leading edge of block (cm) (Fault slip) **Small- carpet**	Location of leading edge of block (cm) (Fault slip) **Large- countertop**	Location of leading edge of block (cm) (Fault slip) **Large- carpet**
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Graph Your Data:

Conclusion:

1. How would the results be different if a string were used instead of a rubber band?

2. In a real fault what role does the rock play in producing movements along the fault?

3. Does the probability that the block will slip during the next interval of time depend on the history of the past block movements? Explain your answer.

4. Compare and contrast this lab with the elastic-rebound process that generate earthquakes in the Earth.

5. Which situation do you think is more dangerous? A section of the fault that has slow consistent movement along it OR one that has showed very little movement with a little bit of deformation along the surface. Justify your answer.