

Name: _____

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(not your student, e-mail or SS no)

Geology 109 -- In-Class & Homework Exercise 1 – Geologic Time & Rates

One thing that is initially hard for non-geologists to grasp is the immensity of geologic time. The earth is about 4.5 *billion* years old. Thus to a geologist a thousand years is but the blink of an eye, a hundred thousand years is yesterday, a million years is last week. Small incremental yearly changes in the earth's surface, barely perceptible over a human lifetime, or a handful of lifetimes, lead to major changes in the earth's surface when continued for a sufficiently long time: mountains are built, canyons eroded, continents shifted. The object of this exercise is to help you develop an appreciation of the size of geologic time and the rates of geologic processes.

The *rate* (or, more precisely, the *time rate*) of a geologic process is given by dividing the amount of change by the time span over which it occurred, that is

$$\text{time rate} = (\text{amount of change})/(\text{time it took for the change})$$

The *total change* over some period of time is determined by multiplying the time rate by the period of time involved, that is:

$$\text{total change} = (\text{time rate}) \times (\text{length of time})$$

1. Rate of offset of Hollister drainage ditch by San Andreas Fault:

The concrete drainage ditch in the photograph crosses a strand of the San Andreas Fault in Hollister, CA. The ditch is 24 years old and creep on the fault has offset the walls of the ditch by 8 inches (20 cm).



- a. What is the rate of movement on this branch of the fault in inches per year and centimeters per year? Show your calculations.

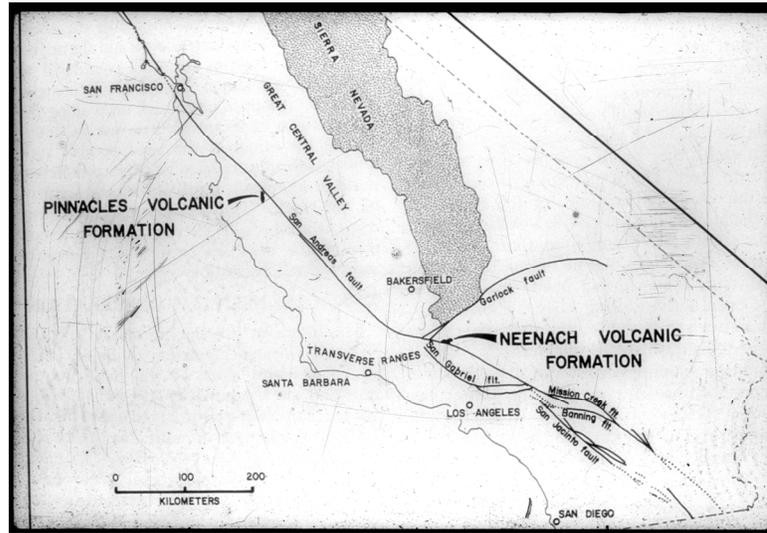
Rate : _____ in/yr = _____ cm/yr

- b. If this movement is continued for 1,000,000 years, how much offset will have occurred? Give your answer in both miles and kilometers. (Start out by computing the offset in inches and in centimeters. Then convert to miles and kilometers. (Note: 1 mile = 5280 ft = 63360 in; 1 km = 100000 cm))

offset : _____ mi = _____ km

2. **Offset of Pinnacles and Neenach volcanics:**

The Pinnacles and Neenach volcanics are 23 million-year-old bodies of rhyolite that lie 195 mi (315 km) apart on opposite sides of the San Andreas Fault (see map below). They are indistinguishable in age, appearance, mineralogy, and trace-element geochemistry. They are, in fact parts of a single volcanic mass that has been split by the San Andreas Fault.



- a. What is the rate of movement on the fault in inches per year and centimeters per year? Show your calculations.

Rate : _____ in/yr = _____ cm/yr

3. **Los Angeles and San Francisco:**

San Francisco lies on the east side of the San Andreas Fault, while Los Angeles lies on the west side 560 km south . The two cities are currently moving toward each other at about 3 cm (1.2 in) per year. If the fault continues to move at this rate, how many years will it take until San Francisco and Los Angeles are side-by-side neighbors? Show your calculations.

_____ years