
COURSE CHANGE FORM
DROP
HAMPSHIRE GAZETTE
THURSDAY, SEPT 23 2010
Stanford Law School
Palo Alto, CA
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Amherst College
Amherst, MA 01002

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RELATIVE AGES AND GEOLOGIC HISTORIES OF ROCK SEQUENCES

In reconstructing the geologic history of any region a geologist applies a limited number of fundamental principles. In doing so the geologist relies upon two different but correlatable time frames, *absolute* and *relative*. The *absolute* age of either a rock unit or a geologic event, which can be determined from radioactive minerals, from enclosed fossils, or from magnetic anomalies (chiefly in oceanic crust), is expressed in millions of years before the present (e.g. "5 Ma"), with the names of geologic ages (e.g. "Devonian"), or with anomaly numbers (e.g. "Anomaly 3 time") - respectively. The *relative* age of a rock unit or event simply involves determing whether one occurred before or after another. Such ages are expressed as "A is older than B"; "A preceeded B"; or "C occurred first". The basic principles of relative dating of rock sequences in geologic histories are:

Principle of Original Horizontality: Sedimentary rock layers (or *strata*) were originally deposited as horizontal sheets of sedimentary particles that had, under the influence of gravity, settled to the bottom of rivers, lakes and oceans. Strata that do not retain their original horizontality have been displaced by movements of the Earth's crust.

Principle of Superposition: In any undisturbed sequence of strata, those which are lowest in the sequence were deposited first and are oldest. The youngest stratum is at the top of the sequence.

Principle of Cross-cutting Relationships: Any feature - fault or intrusive body - that *cuts across* a rock unit is younger than the rock unit it cuts. Any cross-cutting feature is younger than the youngest unit it cuts, and older than any unit that *directly overlaps* the cross-cutting feature. Intrusive igneous rocks may produce narrow baked (metamorphosed) zones along their contacts with units they intrude.

Principle of Inclusions: Any part of a rock body that is incorporated into another rock body demonstrates that the rock body providing the fragments is older than the unit in which they are included. This is true for conglomeratic clasts in a sedimentary unit or for xenoliths in an intrusive igneous unit.

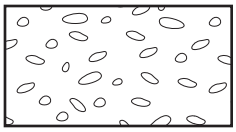
Principle of Unconformities: Unconformities are surfaces that represent a gap in the depositional record. That is, they are surfaces on which sediment was not deposited for a period of time. They include surfaces that have suffered erosion following uplift, before deposition resumed. Unconformities are commonly represented by wavy lines to distinguish them from regular depositional contacts.

EXERCISE:

You are provided with three cross-sections which represent the geology of three different regions. You are to determine the sequence, or relative ages, of all of the rock units in each cross section. Write the letters of the rock units, in order from oldest at the bottom to youngest at the top, in the blanks on each sheet. Insert the relative age of any geologic event (eg. faulting, erosion, tilting) shown in the geologic cross section at its proper place in your sequence of rock units.

COMMONLY USED GEOLOGIC SYMBOLS

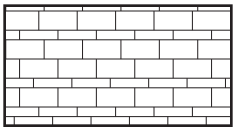
Sedimentary Rocks



CONGLOMERATE

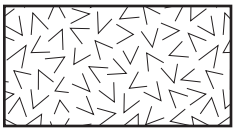
SANDSTONE

MUDROCK

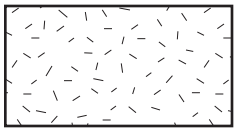


LIMESTONE

Igneous Rocks

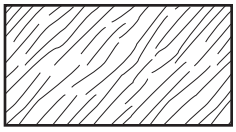


BASALT



GRANITE

Metamorphic Rocks



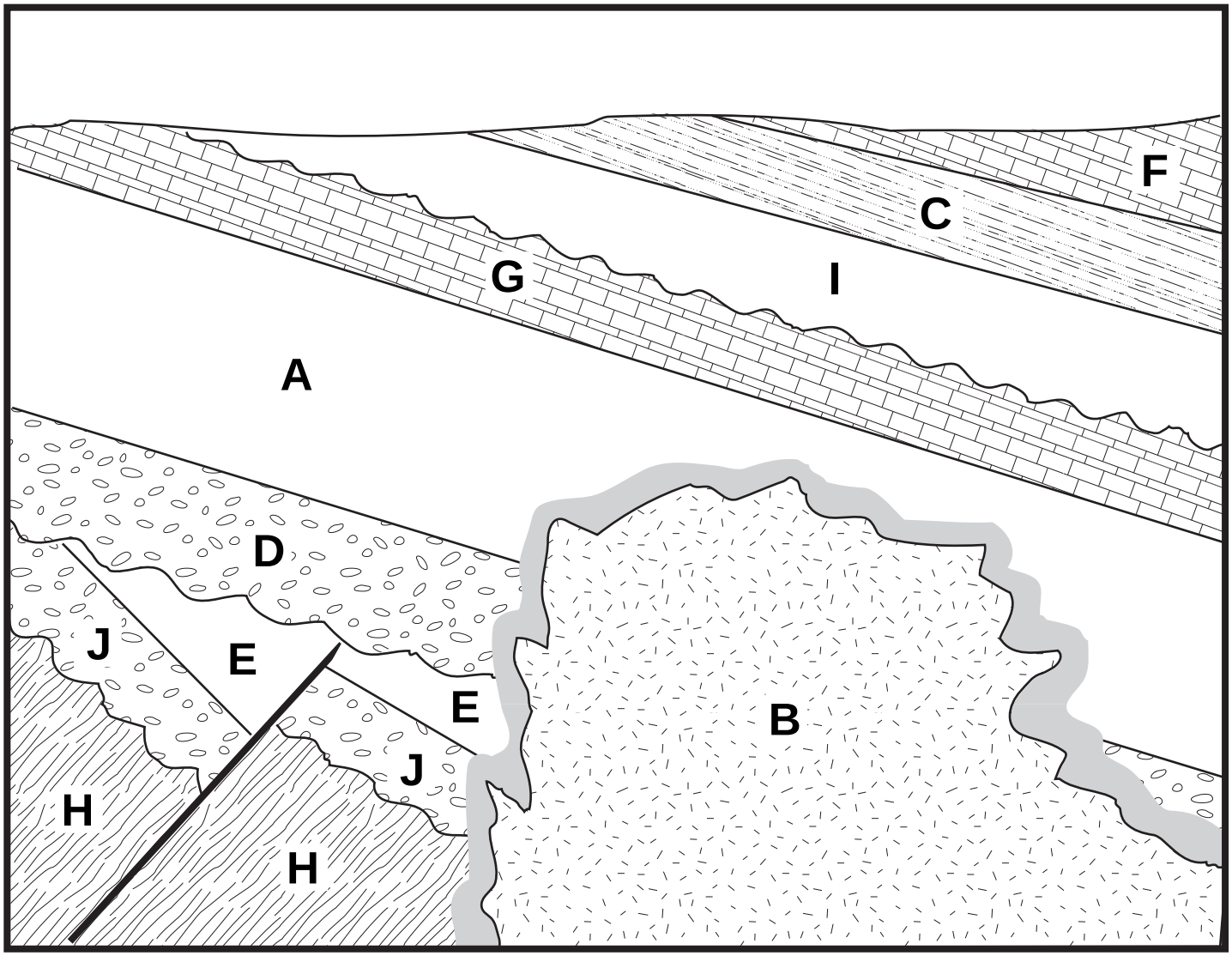
SCHIST

CONTACT

FAULT

UNCONFORMITY
(erosion surface)

BAKED HALO
(contact metamorphism)



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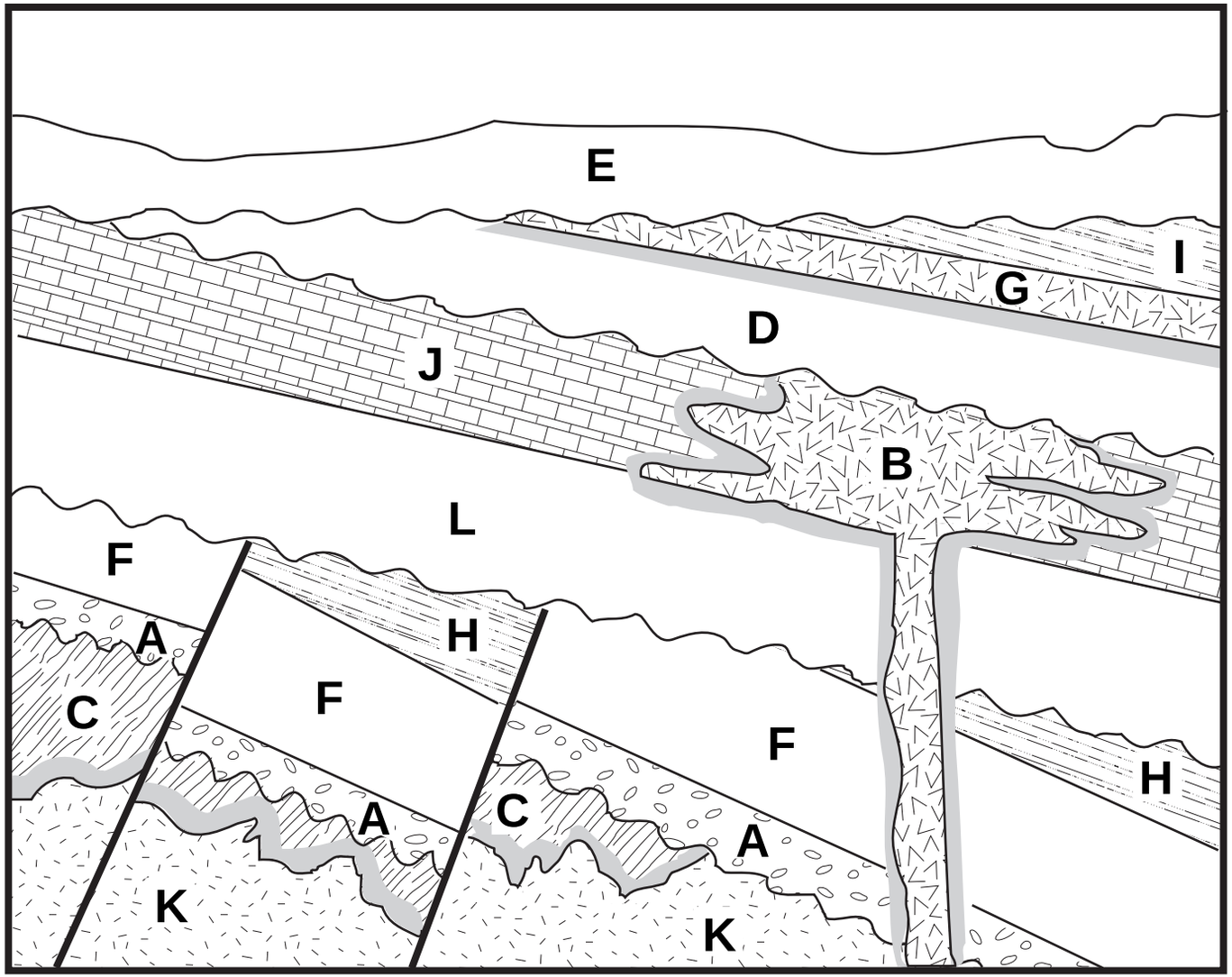
OLDEST: _____

Be sure to insert the relative age of all geologic events (e.g. faulting, tilting, folding, erosion) between the lines at the appropriate place in this sequence of rock units.

QUESTION: Is it possible to determine the relative age of units B and G?



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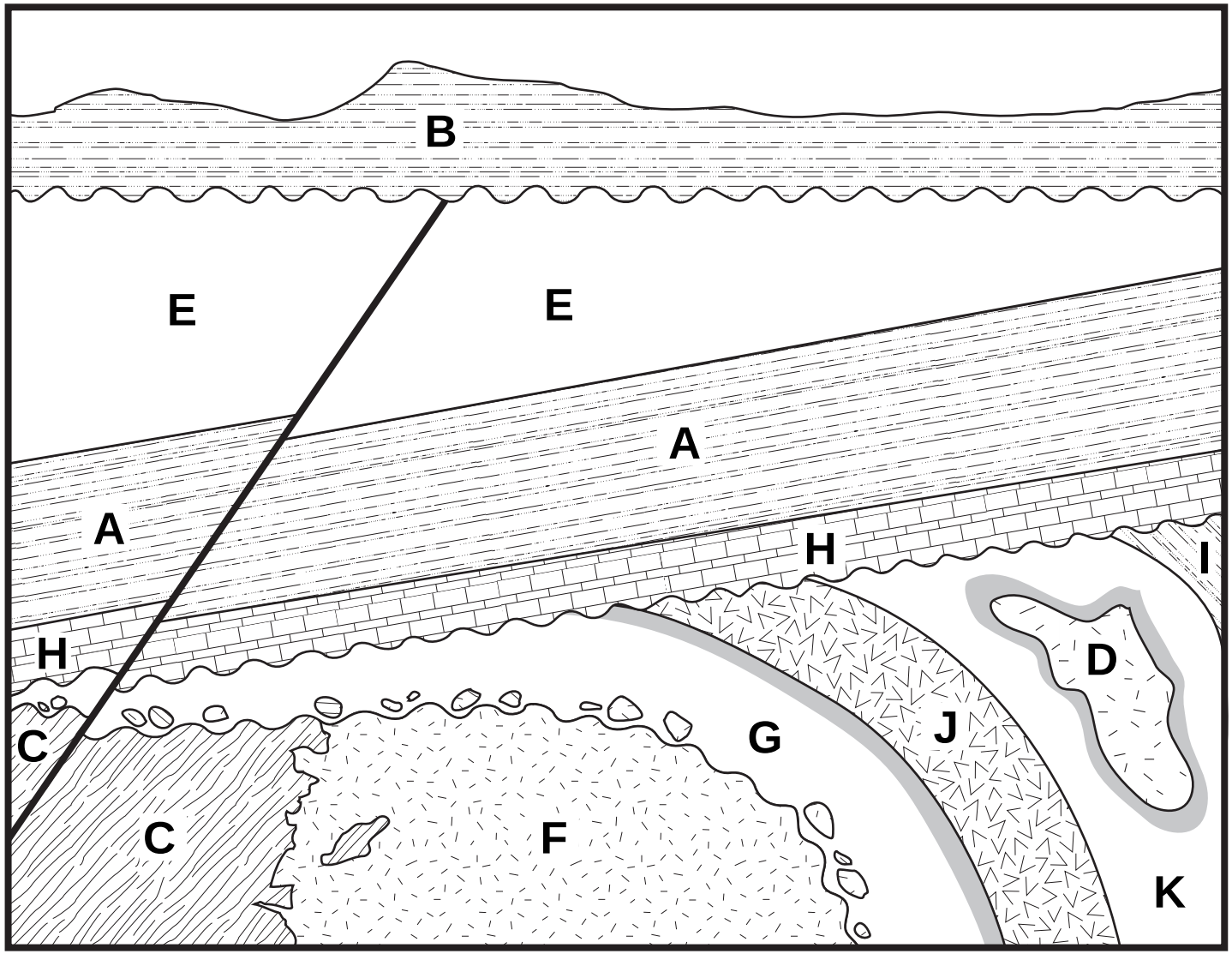
OLDEST: _____

QUESTION: Is unit G a sill (intrusive) or a flow (extrusive)? What evidence can help you to discriminate?

Be sure to insert the relative age of all geologic events (e.g. faulting, tilting, folding, erosion) between the lines at the appropriate place in this sequence of rock units.



YOUNGEST: _____

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OLDEST: _____

Be sure to insert the relative age of all geologic events (e.g. faulting, tilting, folding, erosion) between the lines at the appropriate place in this sequence of rock units.