• ANTHRO 1100
Check last question... did you put talus?

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Stratigraphy

The Law of Superposition
deposition - erosion
erosion and deposition
erosion and deposition
Bed load

erosion and deposition
erosion and deposition

Braided Stream
erosion and deposition

meandering river
Headward erosion
delta deposit
Fe & Ni solid inner core

Fe & Ni liquid outer core

Si & Mg-rich mantle liquid outer core

Si & Al-rich crust

Temperature/pressure (meltpoint) gradient
Ethiopian / Yemeni Flood Basalts: 31-30Ma

Temperature/pressure (meltpoint) gradient

Si & Al-rich crust

Si & Mg-rich mantle liquid outer core

Fe & Ni liquid outer core

Fe & Ni solid inner core
Initiation of rift extension 10-15 Ma (Afar Rift)

Flood Basalts 30-31 Ma
Miocene initiation of rift extension ~11-15 Ma

Ethiopian Highland Flood Basalts ~30 Ma

Miocene initiation of rift extension ~11-15 Ma
Neogene/Quaternary rift basin sediments

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Neogene/Quaternary rift basin sediments
Later Pleistocene/Holocene/Recent alluvial fans

Neogene/Quaternary rift basin sediments

Miocene initiation of rift extension ~11-15 Ma

Ethiopian Highland Flood Basalts ~30Ma

Later Pleistocene/Holocene/Recent alluvial fans

Neogene/Quaternary rift basin sediments
Current depocenter
Later Pleistocene/ Holocene/ Recent alluvial fans

Later Pleistocene/ Holocene/ Recent alluvial fans

Neogene/Quaternary rift basin sediments

Miocene initiation of rift extension ~11-15 Ma

Ethiopian Highland Flood Basalts ~30Ma
Dating the Past

- Relative dating
- Absolute dating
Biostratigraphy
&
Floral series

PALYNOLOGY
Dendrochronology
Isotopes

Cl\textsubscript{4} vs. Cl\textsubscript{2}   Ar\textsubscript{40} vs. Ar\textsubscript{39}
Isotopes

$\text{C}^{14}$ vs. $\text{C}^{12}$

$\text{A}^{40}$ vs. $\text{A}^{39}$

Periodic Table of Elements

* Lanthanide Series
+ Actinide Series
Radiocarbon Dating

A. $^{14}\text{C}$ created by neutron capture

- A neutron is captured by a nitrogen-14 (seven protons, seven neutrons) atom, turning it into a carbon-14 atom.
- Proton expels $^{14}\text{C}$ with $6p + 8n$

B. $^{14}\text{C}$ decays to $^{14}\text{N}$ by $\beta^-$ decay

- $^{14}\text{C}$ decays with $6p + 8n$, emitting a $\beta^-$ particle.
- $^{14}\text{N}$ with $7p + 7n$.

Following death and burial, wood and bones lose $^{14}\text{C}$ as it changes to $^{14}\text{N}$ by beta decay.

Skinner and Porter, *The Dynamic Earth*, Figure 8.14.
Radiocarbon dating

cosmic rays

$^{14}\text{N} \rightarrow ^{1}\text{H}$

$^{14}\text{C} \rightarrow \text{CO}_2$

atmospheric gases

photosynthesis

Tree

Goat
Volcanoes
Feldspar crystal
Feldspar crystal
Potassium-argon

Argon-argon
Paleomagnetism
Climate change
Climate Change
Climate change

obliquity: varies on ~40,000 year cycle

Equinox precession

Precession of the Equinoxes (19 and 23 k.y.)

Southern Hemisphere tilted toward the Sun at aphelion

Orbital eccentricity

Eccentricity cycle (100 k.y.)
Superscripts show atomic masses of hydrogen and oxygen

1+1+16 = 18
Molecular weight of $^{16}$O water

0.2% of water, 11% heavier, evaporates more easily, precipitates less easily.

1+1+18 = 20
Molecular weight of $^{18}$O water

100% of water, 2% lighter, evaporates more easily, precipitates less easily.

Warm air cools as it rises over the ice

Precipitation from cooling air becomes progressively poorer in $^{18}$O

Evaporation

Water $^{18}$O richer

continental ice

Benthic foraminifera

Benthic $^{18}$O records continental ice volume

Ice $^{18}$O records icecap air temperature

$^{18}$O values: low high low high

Sediment core

Approximate time of fossil formation of the Zed and Munich wells

Temperature

Estimated change in depth of the Rock and Munich wells

Oxygen isotope curve as an estimate of sea level change

Pliocene

Miocene

50

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Climate forcing models
Savannah hypothesis

Turnover-pulse hypothesis

Variability selection hypothesis
Savannah hypothesis

Dart, 1920’s: Human traits like bipedality and large brains the consequences of life on the savannah
Turnover-pulse hypothesis

Vrba, 1980’s: Concentrations of speciation and extinction should be related to major climate events.
Variability selection hypothesis

Potts, 1990’s: Human traits like bipedality and large brains the consequences of selection based on a variable environment
Correlation and Causation
The Red Queen hypothesis
Present

1 million years ago
Present

1 million years ago