Midterm 3

The Romance of Dating:

1820's —> Uniformitarianism

- "all geologic phenomena are the result of existing forces having operated uniformly from the origin of the earth to the present"
- study past based on what is happening in the present
- led to importance of temporal context
- earth is 4.5 billion years old

Dating —> for constructing evolutionary sequences and correlating events across continents and across the globe

- Absolute Dating - specific age in years before present
  - Carbon Dating
    - 200,000 - 50,000 years,
    - carbon14 (radioactive isotope decks into non-radioactive isotopes C12 and C13)
    - C14 has a half life of 5,730 +/- 40 yrs
    - Proportion of C12 to C14 increases with time
  - Potassium Argon Dating
    - used on volcanic tuff in East Africa
    - K40 —> Ar40 (or Ar —> Ar39)
    - half life ~ 1.3 billion yrs
  - Uranium Series
    - used on tufa, speleothems, apatite
    - U238 or U235 —> daughter isotopes
    - half life ~ 4.47 billion yrs
    - problem with diagenesis (mineral replacement)
  - Paleomagnetism
    - shifts in Earth"s magnetic poles
    - used in loess deposits (China) and cave deposits
  - Electron Spin Resonance
    - detects presence of unstable electrons trapped in solids
    - useful for sites around 100,000 - 200,000 yrs
    - large margin of error at older sites
- Relative Dating
  - Superposition
    - what is on top is more recent and what is on the bottom is older
    - must watch out for shifting in rocks
    - formations —> members —> beds
  - Faunal Dating
    - uses guide fossils or faunal seriations

        - FADs (first appearance date) vs LADs (last appearance date) —> appearances might be off
        - uses all species from fossil site to form time periods
    - Faunal Seriations
        - compare similarities among presence of species in faunal assemblages
        - ordering of sites to come up with a sequence

Bipediality and the Earliest Hominins:

Earliest Hominins: what, when, where?

- what:
    - mosaic evolution
    - wrist morphology suggests knuckle-walking retention
    - swinging gate walking style
    - reorientation of spine, limbs, and head
- bipedalism by foramen magnum forward position —> no single selective advantage
    - order hypotheses: carry things, communication, secondary sexual characteristics, appear larger, efficiency, frees hands for tools, head better supported
    - savannah hypothesis: stand up to see over grasslands —> false, grasses were low and savannah didn't spread until long after bipeds
    - efficient but slow locomotion
    - free hands to carry and throw
    - predator protection
    - thermoregulation —> less heat from sun, allows brain expansion
    - running backwards
    - threat displays
    - long distance running sexual selection and male provisioning
    - niche expansion
    - slinky hypotheses: brain folds over and neocortex becomes large
- when:
    - molecular clock suggests chimp and human ancestors diverged 5 - 7 mya
        - based on regular mutations of mitochondrial DNA
- where:
    - Africa, closest ancestors formerly inhabited

Hominin Paleoecology:

Genetic Variability Caused by:

- Global Climate
- Regional Climate & Geology
- Local Climate & Geology
- Faunal Community

- Floral Community
- Conspecifics

Environments of Early Ancestors:

- Desert - still has some plant life
- Savannah short grass - natural
- Savannah long grass - maintained artificially by being burned off
- Savannah woodland - ecotones
- Tropical forests - rich with diversity
    - Riparian forest - forest near a waterway
- Mountains - not good fossilization in mountains, lots of good resources, not many competitors

Reconstructing Past Hominin Environments:

- Global Climate
    - look at oxygen isotopes indicative of temperatures in past
- Regional and Local Climate & Geology
    - tectonics, erosion, alter landscapes, lead to cave formation
    - sedimentology
        - grain analysis
        - paleosols
        - trace fossils
- Faunal Commnity
    - reconstructing past mammalian communities
        - data from fossils (incomplete)
        - look for evidence of predators and competitors
- Floral Community
    - past vegetation
        - direct evidence
            - pollen (palynology)
            - seeds
            - phytoliths
        - indirect evidence
            - mammalian assemblages
            - indicator species
            - ecomorphology
            - degree of biodiversity
- Conspecifics
    - primate ethology

Earliest Hominins:

Plesiomorphies - primitive traits
Apomorphies - derived traits