Name:_____

Chapter 8 Notes Continued

The Geologic Time Scale

The eon called the Phanerozoic takes up less than 15% of Earth's history and includes the following eras: Cenozoic - recent life, the age of the mammals
Mesozoic - middle life, the age of the reptiles
Paleozoic - ancient life, the age of the invertebrates

Eras are subdivided into periods and the periods of the Cenozoic into epochs

The names of periods and epochs are for the place where rocks of that age were well exposed and that time unit was consequently first defined.

The first divisions were done from faunal succession, then radiometric dating (of dikes, etc. that cut through the sedimentary layers) gave numerical ages

Precise dates for the Phanerozoic is difficult because
- sed. rocks and fossils can't readily be dated so had to approach it indirectly by determining age limits and making correlations
- radiometric dating has some uncertainty (between 1 and 10%)

The Precambrian includes the 4 billion years of time before the Phanerozoic. There were basically no fossils to give a basis for divisions so it was divided into two parts (Archean and Proterozoic) almost arbitrarily. There was widespread igneous activity and mountain building but no single event of global impact.

See the Geological Time Scale, page 164 in text.

How old is the Earth? - A better answer.

No rocks have been preserved unchanged on Earth but we believe the sun, moon, meteorites, etc. formed at the same time:
moon sample ~4.6 billion years old
meteorite sample ~ 4.5 - 4.6 billion years old
gives us that the earth is ~4.55 billion years old

Oldest earth material is 4.3 billion years. Oldest rocks on each continent between 3.6 and 3.9 billion years. Why none at 4.55 billion years old?
- radiometric clocks start when rocks cooled (maybe was molten for long time.)
- rock cycle has been acting since the beginning, changing most rocks at least once

Earth's History - Quick Summary

Universe
- Big Bang occurred ~~10-20~~ 13.7 billion years ago, still expanding, ~~open/closed~~?

Stars
- Matter not uniformly distributed so clumps join together due to gravity, star is born
- stars burn up their fuel, create heavier elements, supernovae (blow up), spread heavy elements through space
- our earth and sun are made up of matter that likely was cycled through several generations of stars

Solar System
- our sun is middle aged, 5 billion years old, 5 billion years to go
- cloud of dust and gas condensed, most mass condensed to form sun, rest into planets
- composition of planets depends on how close they are to sun, higher T materials nearest sun (Fe, etc.), "gases" (solid H, He, lighter elements) farther out

Earth
- dust ball condensed; heated by collisions of particles, compression by gravity and radioactive elements so most of the Earth was melted
- slowly cooled, heavy iron sunk, light elements rose making the core, mantle, crust 4 billion years ago (differentiation)
- as cooled, water condensed in atmosphere
- early atmosphere contained almost no oxygen, blue-green algae and formation of limestone supplied oxygen
- many changes have occurred since earth formed - continents moved, volcanoes, mountains, erosion, . . .

Life on Earth

0.5 million yrs ago	modern, rational Homo Sapiens, major impact in short time!
3-4 million	the most primitive humans developed
65 million	mammals become dominant (dinosaurs decline)
150 million	warm blooded animals fly (birds)
200 million	dinosaurs and 1st mammals
400 million	insects, amphibians and reptiles onto continents
400-500 million	animals with backbones (fish) and land plants
600 million	marine animals with shells widespread
4 billion	1st multicelled, soft bodied, oxygen breathing creatures, poorly preserved, few fossils
4.6 billion yrs ago	formation of the earth

algae + fungi 4by.

The practical aspects of learning this is that energy sources come from old plants and animals. If you know the time they lived then you know where to mine.

Dating and Geologic Process Rates
Continents move ~ 4 cm/yr relative to magnetic poles
Uplift rates ~ 1 cm/yr in mountain ranges, erosion rates similar
Must be cautious about extrapolating present process rates into past or future!
read page 170