Fossil history:

This is just a brief overview. For more details, take geology (there are also a few more details in your text).

How to age fossils? After all, we want to know how old fossils are.

- relative aging - newer fossils are generally near the top in sedimentary rocks

- one finds similar fossils in the same age layers all around the world

- this can be used to construct a “history” of life on earth (geological time scale)
  - by comparing the same layers in different parts of the world, an overall relative age for various strata can be arrived at (illustrate).

- “absolute” dating - pretty good, though not necessarily 100% accurate. It does give an actual age for fossils. How?

- radioactive dating - certain elements, for example, C 14, U 238, are unstable and decay into other forms.
  - U 238 - when rocks first form (i.e., cool), they have a certain percentage of these molecules.
    - these molecules (or elements) decay at a specific and well known rate.
    - So, rock that has just formed (through volcanism, or whatever) will have mostly U 238 [Fig., not in book].
  - Over time, this changes into Pb 206.
    - By looking at the ratio of U 238/Pb 206, we can then tell how long ago the rock formed.
      - rocks with more Pb 206 are older.
    - half life of U 238 is about 4.5 billion years.
      - half life = the amount of time needed for half of the original material to “disappear”.
  - C 14 is used for more recent times. When alive, organisms have a of C 14/C 12 that is the same as in the atmosphere. When organism dies, Carbon is no longer replaced, and ratio changes
since C 14 decays into N 14. Half life is about 5.6 thousand years.

- problem - C in the atmosphere is not a constant ratio, so until recent adjustments were made for this, this technique led to some errors.

- on source of information for adjustments - tree rings back that far and can be used to reconstruct Carbon levels.

- Other isotopes can also be used, but the two above are the most popular.

- other techniques involving amino acids - see book if interested, p. 488.

A brief history of life on earth [Fig. 25.4, p. 511, & 25.7, p. 514):

Comment: Geologically, life on earth is divided into a few long “eras”, which are then divided into “periods”, which are finally divided into “epochs”. The division is usually based on changes in rocks and/or fossils as one moves through geologic history.

Precambrian - Mostly algae and bacteria. Not much going on until late in the Precambrian.

- 4.6 billion years - 540 mya.

Late precambrian - animals begin to diversify (oldest animal fossils are about 700 m.y. old)

Paleozoic - huge explosion of life - go through table.

- 540 mya - 245 mya [Fig. 25.1, p. 515]

- numerous periods - e.g., “age of fishes”, “reptiles diversify”, “land is invaded by numerous different animals”, etc.

- many groups we talked about were abundant - trilobites, ammonites, crinoids, etc.

- A brief summary of the periods:

Cambrian
   Origin of most modern animal phyla

Ordovician
   Plants, marine algae
Silurian
Jawless fish abundant, first jawed fish. Arthropods invade land.

Devonian
Diversity in bony fish (our “age of fish” from above), first amphibians and insects.

Carboniferous
Reptiles appear, amphibians dominant on land.

Permian
Reptiles diversify, mammals either originate here or in early Triassic, most modern insect orders.

Massive extinctions take place at the end of Permian (these may have been caused by several different factors - some evidence that a meteor may have been involved here (similar to the one that wiped out the Dinosaurs)).

Mesozoic - 245 - 65 mya. Basically, the age of the dinosaurs. Greatest diversity near end of Mesozoic. Three periods:

Triassic
Dinosaurs take off. Early mammals. Birds??. Turtles show up.

Jurassic
Dinosaurs dominant. Animals such as Stegosaurus, Brontosaurus (=Apatosaurus), Brachiosaurus, Allosaurus

Cretaceous
Greatest dinosaur diversity. T. rex, Triceratops, Iguanodon, Duck-bills, etc.

- an important (non-zoological) development is flowering plants. BUT, dinosaurs did adapt to deal with them (this was an old theory for dinosaur extinctions)

- Birds first show up in Mesozoic (Triassic/Jurassic)- Archeopteryx [Fig., not in book]

- of course, many people will say birds are dinosaurs!

Cenozoic - 65 mya - present
- “age of mammals” [Fig, not in book]

- mammals begin to diversify into many different groups. Soon take over most terrestrial environments, and even make it back into the water (whales, seals, etc.)

- the history of mammals is sometimes very strange - “saber-tooths” evolved about 4 times.

- “culminates??” in the development of humans.

- more recent part of Cenozoic marked by ice ages and emergence of animals that look modern.

- Divided into two Periods (Tertiary and Quaternary), which are subdivided into many epochs. You don’t need to know the epochs.

A few comments about the fossil record:

- not complete - a lot of stuff is missing

- [Fig. 25.14, p. 521] - a little subjective (what defines a family??), but gets the point across.

  - history of life is one of continuous increase in overall diversity.

  - however, this is punctuated with dramatic extinctions.

- continental drift [Fig. 25.13, p. 520]

  - explains a lot about the present day distribution of fossils (e.g., as discussed previously, why do we find closely related animals in different parts of the world)

  - Blue-ridge mountains and Scottish highlands.

  - Bering land bridge in more recent times, etc.

  - Central America - has allowed animals to move north/south.