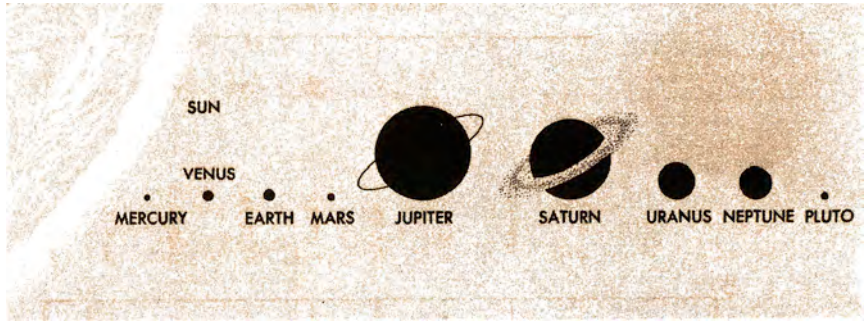


FIGURE 3.5

The relative sizes of the planets in relation to a portion of the Sun



differences were critical. The full importance of these differences may not be apparent until we discuss in later chapters how the Earth obtained its atmosphere, water, and land. But three critical key differences of the Earth's materials must be listed at this point, because they are so basic to the understanding of the Earth's unique development. The Earth received from the nebular cloud:

1. *A large component of metals, especially iron.* Later in the Earth's history this iron formed into a central core with important electrical and magnetic effects. This iron core with its solid inner and fluid outer components transformed the planet into a giant magnet. The magnetic effects reach out into space itself, helping to shield the Earth from cosmic radiation and the solar wind. The solar wind consists of blasts of ionizing radiation, rich in high-energy protons, that spread in all directions from the Sun. The Earth's neighboring planets of Venus and Mars appear to lack magnetic effects.
2. *A slightly higher amount of radioactive elements.* The decay and heat generation of these radioactive elements were of great importance in the early remelting of the Earth. Today, these elements are believed to be the heat source which keeps the upper layer of the mantle plastic and viscous. The importance of this hot semi-molten layer to renewing the lands of the Earth will become apparent in Chapter 5.
3. *A slightly higher component of water-forming (hydrous) compounds.* From these compounds an extensive supply of water would later be added to the planet's surface. Water is not only the basic component of life, but also is of great importance in protecting our planet from extremes of heat and cold. In addition, water appears to have been a critical component that facilitated the later remelting of the Earth (see chapter 4). Water continues to lubricate the Earth's dynamic, ongoing geological processes. Without water the Earth would be a lifeless planet.

Besides its material makeup, the Earth's distance from the Sun is highly important. On Venus, for example, in a position closer to the