Steno's three principles concern sedimentary rocks

Because they form at Earth's surface, sedimentary rocks provide most of our information about the history of life and environments on Earth. It is therefore important that we understand their distribution and their age relationships. The study of stratified rocks and their relationships in time and space is known as **stratigraphy**.

In the seventeenth century, Nicolaus Steno, a Danish physician who lived in Florence, Italy, formulated three sensible axioms for interpreting stratified rocks. Steno's first principle, the principle of **superposition**, states that in an undisturbed sequence of strata, the oldest strata lie at the bottom and successively higher strata are progressively younger (Figure 1-8A). In other words, in an uninterrupted sequence of strata, each bed is younger than the one below it and older than the one above it. This is a simple consequence of the law of gravity, of course, as is Steno's second principle, the principle of original horizontality.

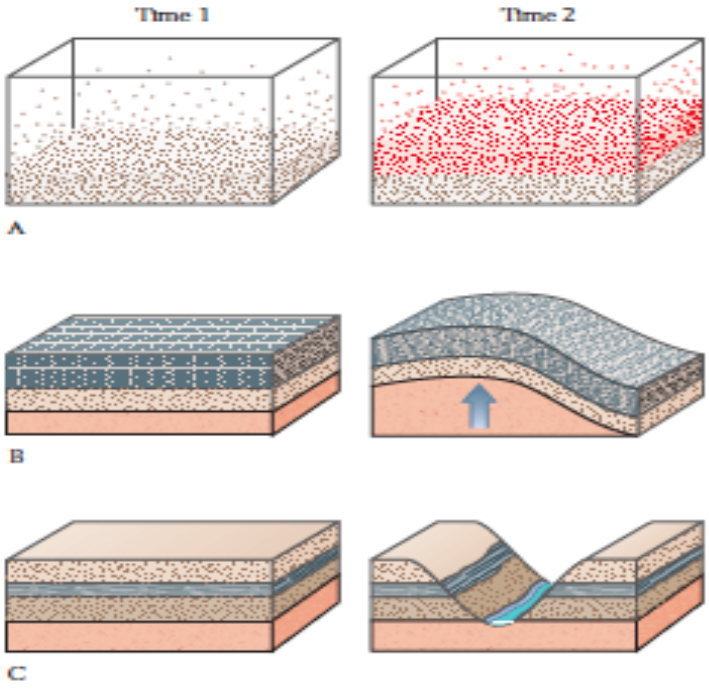

FIGURE 1–8 **Steno's three principles.** A. The principle of superposition: at time 2, sediment builds up on top of other sediment that was deposited earlier, at time 1. B. The principle of original horizontality: by time 2, strata that were horizontal at time 1, shortly after being deposited, have been uplifted and tilted. C. The principle of original continuity: by time 2, strata that were continuous at time 1 have been divided into two bodies of strata by a river that has cut through them.

The principle of **original horizontality** states that all strata are horizontal when they form. As it turns out, this principle requires some modification. We now recognize that some sediments, such as those of a sand dune, accumulate on sloping surfaces, forming strata that lie parallel to the surface on which they were deposited. Sediments seldom accumulate at an angle greater than 45° to the horizontal, however, because they slide down slopes that are steeper than that. Therefore, a reasonable restatement of Steno's second principle would be that almost all strata are initially more nearly horizontal than vertical. Thus we can conclude that any strongly sloping or folded stratum was tilted by external forces after it formed (Figure 1-8B).

Steno invoked his third principle, the principle of **original lateral continuity**, to explain the occurrence on opposite sides of a valley (or some other intervening feature of the landscape) of similar rocks that seem once to have been connected. Steno was, in effect, pointing out that strata are originally unbroken flat expanses, thinning laterally to a thickness of zero or abutting the walls of the natural basin in which they formed. The original continuity of a stratum can be broken by erosion, as when a river cuts downward to form a valley (Figure 1-8C).