The concept of time is central to geology. Determining the age of rocks and sediments and creating a time scale allows geologists to sequentially order events in Earth history, according to both relative and absolute age. By knowing age, geologists can also estimate the rates of planetary processes, whether they be nearly instantaneous events, such as catastrophic meteorite impacts, or protracted changes, such as evolution and continental weathering. One way to determine the age of marine deposits, and to correlate them globally, is based on variations in the ratio of two isotopes of strontium, $^{87}\text{Sr}/^{86}\text{Sr}$. The ratio in seawater, at any point in time, is faithfully preserved in sediments (e.g., microfossils) that form penecontemporaneously. Over the last 40 million years, the seawater ratio has increased because riverine input of the heavier isotope $^{87}\text{Sr}$ has exceeded the contribution of $^{86}\text{Sr}$ from mid-ocean ridges. This observation is based on mass spectrometer measurements of the $^{87}\text{Sr}/^{86}\text{Sr}$ in independently-dated (e.g., by magnetostratigraphy) marine sedimentary sequences. We constructed a reference curve of seawater $^{87}\text{Sr}/^{86}\text{Sr}$ variation through the past 7 m.y. based on planktonic foraminifer samples from ODP Site 758 in the Indian Ocean [Clemens et al., 1993; Farrell et al., 1995] (see figure), and calibrated it to numeric age based on the site's magnetostratigraphy. This curve provides a way to date strontium-bearing marine deposits (often carbonates) when other means are untenable. For example, scientists trying to unravel the history of global sea level change by studying mid-ocean atolls and continental margin sediments use this curve for chronostratigraphy. Paleoclimatologists studying rapid climate change recorded by geochemical variations in the annual bands in corals heads that grew in short, specific intervals in the Pliocene, use the curve to anchor these floating chronologies in that epoch. Others, studying climate evolution in the Antarctic use the curve to unravel complex stratigraphic relationships. In short, if you’ve got the $^{87}\text{Sr}/^{86}\text{Sr}$, you’ve got the time.

References: