Mantle Convection Speed

Estimates of the speed with which Earth's mantle moves range from 1 to 20 cm/year with an average of about 5 cm/year in the case of plate motions to as much as 50 cm/year in hotspots such as the Hawaiian Islands (see *Plates, Plumes, And Paradigms* (2005) edited by Gillian R. Foulger, James H. Natland, Dean C. Presnall, and Don L. Anderson, in my Google Books library).

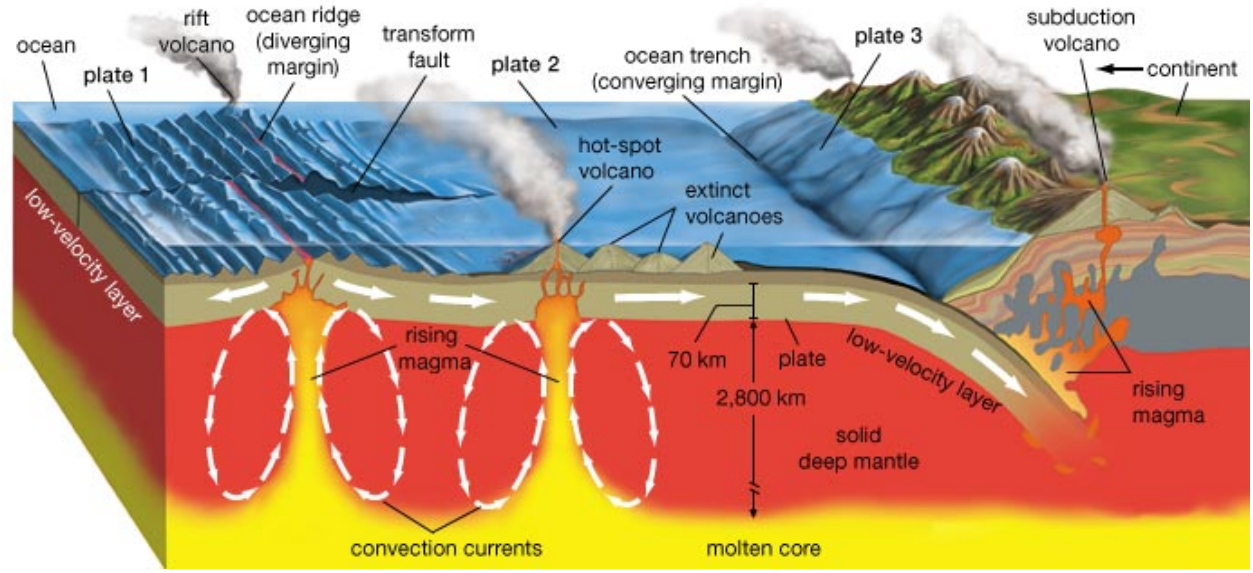

Image credit: *plate boundary: relation to volcanoes*. [Art]. Retrieved December 8, 2008, from Encyclopædia Britannica Online: http://search.eb.com/eb/art-3266

$5\ \frac{\text{cm}}{\text{year}} \times \frac{1\ \text{year}}{8766\ \text{hr}} = 0.0006\ \frac{\text{cm}}{\text{hr}}$ is the average speed of mantle motion.

A typical wristwatch (mine) is 3 cm in diameter, so has a circumference of $\pi d = \pi \times 3\ \text{cm} = 9.4\ \text{cm}$.

The hour hand moves a distance of $9.4/12 = 0.79\ \text{cm}$ in one hour.

The Earth's mantle moves slower than this by a factor of

$$\frac{0.79\ \text{cm/hr}}{0.00057\ \text{cm/hr}} = 1400\ .$$

Even if the highest speed of 50 cm/year is used, the mantle still moves slower than the hour hand by a factor of 140.

Using a range of 1 to 50 cm/year for the speed of the convecting mantle, it would take 11 million to 560 million years for a single circuit of one of the convection cells shown in the figure above to be completed.