

Plate Tectonics and Life: If they are unique to Earth, why are they?

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Earth is the only terrestrial planet perceived to have plate tectonics operational since at least Archean times. Do orbital properties have something to do with the initiation of plate tectonics? A cursory look at Earth's orbital periodicity might imply that there is some sort of geometric symmetry in its rotational period about its axis and revolutionary period around the Sun. Earth is the only planet in the Solar System, which has an orbital period that is roughly equal to 360 rotations about its axis, the number which is equal to 2π radians in mathematical parlance, and represents the angle subtended by the circumference of a circle. During its one rotation, Earth travels approximately one degree (or $\pi/180$ radians) in its orbit and therefore completes one revolution around the Sun in 360 odd days. Though this is just a geometric coincidence known since Babylonian times, of all probabilities, one requirement for the initiation of plate tectonic movements could have been this correspondence in orbital periodicity vis-à-vis rotational periodicity about a planet's axis. When this condition is fulfilled, the planet might evolve in a similar path as Earth did eventually resulting in plate tectonics with the planet preconditioned for emergence and sustenance of life. Considering Mars for instance, the distance travelled in its orbit during one rotation is much less than a degree in the orbit and therefore it takes over 680 Martian days around the Sun. Mars is known to be tectonically dead and so are other terrestrial planets. As an extension to this hypothesis, regarding habitability in exoplanets, it may be stated that apart from a planet's position in the galactic habitable zone its possibility of hosting life will also depend on its periodicity around its star.