Planetary Evolution, Habitability and Life

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The habitability of planets as a potential for extraterrestrial life has received increasing interest in recent years, in particular in view of the increasing number of detected extrasolar planets. Planetary habitability (for life as we know it) is usually thought to require water on (or near) the surface and a sufficient supply of energy and nutrients. The request for water on the surface leads to the concept of the habitable zone where stellar radiation and atmosphere greenhousing keep the surface temperature within the stability range of liquid water. A magnetic field is argued to serve to protect an existing atmosphere against erosion by the stellar wind and thus to help stabilize the presence of water and habitability. Magnetic fields are generated in the cores of terrestrial planets and thus habitability is linked to the evolution of the interior through magnetic field generation and volcanic activity. Many believe that plate tectonics is a most important element of habitability providing the renewal of surface rock as a basis for the food chain, cooling the deep interior to drive the geodynamo and closing the loop on essential feedback cycles such as the continental crust production cycle, the water cycle and the long-term carbonate silicate cycle. We will discuss the role of plate tectonics and life to keep these cycles operating.