

The Wilson Lecture

Over the past century our description of the movement and deformation of the Earth's outer layer evolved from the hypothesis of Continental Drift (Wegener 1912) into Seafloor Spreading and then to the theory of Plate Tectonics. Canadian geophysicist J. Tuzo Wilson (1908-1993) was pivotal in advancing the Plate Tectonics theory, as fundamentally unifying to the Earth Sciences as Darwin's evolution theory is to Life Sciences. Wilson was 55 to 60 years old when he made his most important contributions to plate tectonic theory. Plates are bounded by trenches (convergence) and oceanic ridges (divergence), but in 1965 Tuzo proposed a third type of plate boundary that connect oceanic ridges and trenches and offset the crust horizontally (transform-fault boundary). A year later in a paper entitled "Did the Atlantic close and then re-open?" Tuzo also argued that plate tectonic processes must have been operating before Pangea, and his succession of rifting, crustal subsidence and ocean opening, subduction initiation and ocean closure, and finally continent-continent collision was later dubbed the 'Wilson Cycle'. The 'Wilson Cycle' concept also spurred an intensive search for older supercontinents and as many as five supercontinents have now been proposed.

Plate Tectonics is a kinematic theory with three types of plate boundaries and does not explain the presence of hotspot magmatism far away from plate boundaries. In 1963 Tuzo suggested that Hawaii and other volcanic island chains could have formed as a plate moved over a stationary "hotspot" in the mantle. He anticipated a heat source in the upper mantle but we now consider that plumes that source hotspots and that have sourced ancient large igneous provinces and kimberlites have been derived from the edges of two stable thermochemical reservoirs at the core-mantle boundary. Linking surface and lithospheric processes to the mantle is extremely challenging and is only now becoming feasible due to better constraints on deriving ancient longitudes before the Cretaceous, much improved seismic tomographic images, better understanding of the dynamics of true polar wander and recent advances in mineral physics. Dramatic improvement in computational capacity and numerical methods that efficiently model mantle flow while incorporating surface tectonics, plumes, and subduction, have emerged to facilitate further study. CEED is capitalizing on these recent advances so as to generate a new Earth model that links plate tectonics with mantle convection through time, and which includes elements such as stable thermochemical reservoirs in the deepest Earth with plumes that rise from their edges. Tuzo Wilson pioneered plate tectonics and hotspots and our annual distinguished CEED Lecture is therefore named "The Wilson Lecture".

The 2014 Wilson Lecturer (May 19th at 15:00 in the Geosciences Department, Auditorium A) is Professor [Linda T. Elkins-Tanton](#), Director of the Carnegie Institution for Science's Department of Terrestrial Magnetism, and a member of the CEED advisory board. Her research focusses on the evolution of terrestrial planets and the relationships between Earth and life on earth.