d7 Plate tectonic theory < 1960s, kinematic >

One of the values which science has made natural to us is originality. —Jacob Bronowski.[1]

In the last century, the discovery of radioactivity, precise sonic bathymetry that adds to older sounded-images, recent advances in geophysics that includes remote sensing from artificial Earth-orbiting satellites, and availability of fast-computer data processing, has indicated a unifying theory named "plate tectonics" in 1970 for interpreting much of Earth's physical and biological history.[2]

Earthquakes are frequent in narrow zones about extensive regions in which earthquake events are rare. In fact, earthquake epicenter distribution frequencies delineate "plates" that within their areas behave rigidly and "plate margins" where numerous earthquakes are inferred to result from plates in motion jostling against each other.

In the theory of plate tectonics, Earth's elastic (brittle) lithosphere, which rests on a plastic (yielding) asthenosphere, is broken into several large and, in places, small shell fragments (***Figure d7.1***) that are in motion with respect to each other. On the spherical Earth, these "plates" (originally called "blocks" by Jason Morgan in 1967 and Xavier Le Pichon in 1968, and "paving stones" by Dan McKenzie in 1967) have (*see* Topic *g10*) three ways to move at their contacts: horizontally apart; horizontal sliding past each other; and, where they move horizontally toward to meet head on or obliquely (transpression), one either bends down (subducts) or up (obducts) against the other's edge.

Plate tectonic theory formulated in the late 1960s from tested geotectonic information subsumes the following earlier theories: Wegener's (1912) "horizontal displacements of continental blocks," viz, *continental drift*; proposed mechanisms (beginning 1919) of mantle convection due to radioactive heating;[3] and, Hess' (1960) sea-floor spreading (*see* Topic *d8*). These are dynamic theories but being based on meager information they were too simplistic to remain viable. Plate tectonic theory describes the dimensions, shapes, and movements of lithospheric plates. As such, it is a kinematic theory.[4] A dynamic theory would also describe the forces that move, break, and bend the plates. This has not yet been achieved but much effort is given over to it (*see* Topic *g14*). ❑

Figure d7.1 [5] Seven large and nine smaller named tectonic plates are shown in outline. There are hundreds of minor plates, especially at convergences. Plate boundaries are: tensional (double line with spacing indicating rate), transform fault (single line), and head-on compressional to oblique transpressional (solid heavy line is for accretionary margins and heavy line with interior white line is for erosional margins).