j22 Continental margins, cratons, orogens in terms of plate tectonics < Gk. *oro,* mountain >

Continental margins are of two types: tectonically active (example: Pacific), and passive (examples: Atlantic[1] and Gulf).[2]

Convergent and transform fault plate boundaries are "orogenic belts" in which occur complex histories of sedimentation, volcanism, thrusting, and folding. The term "mobile belt" (an oxymoron) is used for *past* belts of such tectonism inferred from the geological evidence of a miogeocline or a eugeocline or both (***Figure j22.1***). A miogeocline accumulates terrigenous quartz sand and clay and marine carbonates on a passive subsiding continental margin and later, during orogeny, flysch (dark-gray beds) and then molasse (red beds) from an emergent, seaward, volcanic arc. A eugeocline accumulates continental rise and deepsea turbidites & graywackes,[3] cherts, and volcanics. During orogeny these are subject to metamorphism and the emplacement of batholithic igneous rocks.

A craton is a large area where strata nonconformable on ancient crystalline basement rocks retain their original horizontality, which aids the reading of their history. *But* the rock record in these "platform sediments" is very incomplete because of numerous paraconformities and disconformities. The distinction between craton and mobile belt is really an artifact of how geologists have studied the fossiliferous sedimentary rocks of the Phanerozoic. The craton itself should not be thought of as an area that resists all deformation. It is by definition an area that has not been subject to fold deformation, but it can have been subject to great horizontal movements of blocks which is deformation by strike-slip (synonyms: wrench, tear, and transcurrent) faulting. The oceanic lithosphere behaves mechanically as a system of rigid plates with tectonic activity restricted to narrow zones between them. The continental lithosphere is less rigid and, as John Haines in 1982 emphasized, its deformation can be spread over hundreds to thousands of kilometers in horizontal extent.[4] The deformation of the continental lithosphere, by strike-slip faulting has been found by S. J. Bourne in 1998 to keep pace with subcrustal horizontal shear flow.[5]

A passive continental margin (comprised of continental shelf, continental slope, continental rise and abyssal plain) is non-volcanic, subsiding, and free of mountain building. The sediments in a shelf area show abundant evidence of shallow-water deposition but, characteristically, they accumulate to great thicknesses. Traced landward, these sediments become much thinner where they overly the craton as platform sediments. Seaward of the shelf, abyssal terrigenous turbidite sediments accumulate as a wedge, which is thickest below the continental rise and thins, from there, beneath the abyssal plain. In plate tectonic theory, continental rifting precedes passive margin subsidence and begins with continental grabening (due to extensional deformation) and plateau-basalt style volcanism (basaltic dike and sill intrusion). In plate tectonic theory, a passive margin can become an active margin when subduction begins along it or because an ocean between it and a land, beneath which the seafloor is subducting, closes.[6] Orogenic and mobile belts are long, relatively narrow regions of tectonic present and past activity respectively that delimit cratons. Both have thick and rather complete columns of strata. *But* the rock record in them is hard to read because of folding, faulting, unconformities, metamorphism and igneous intrusion. ❏

Figure j22.1 [7]
Cross section of an idealized orogenic belt where ocean-closing subduction to beneath a continental margin is compressively deforming a geosyncline.