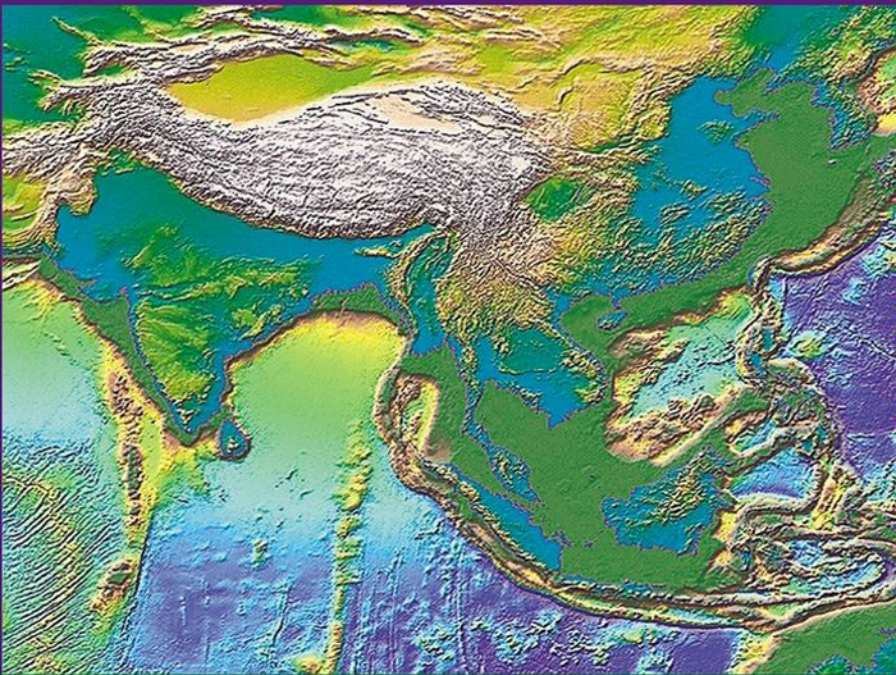


THIRD EDITION

# Global Tectonics



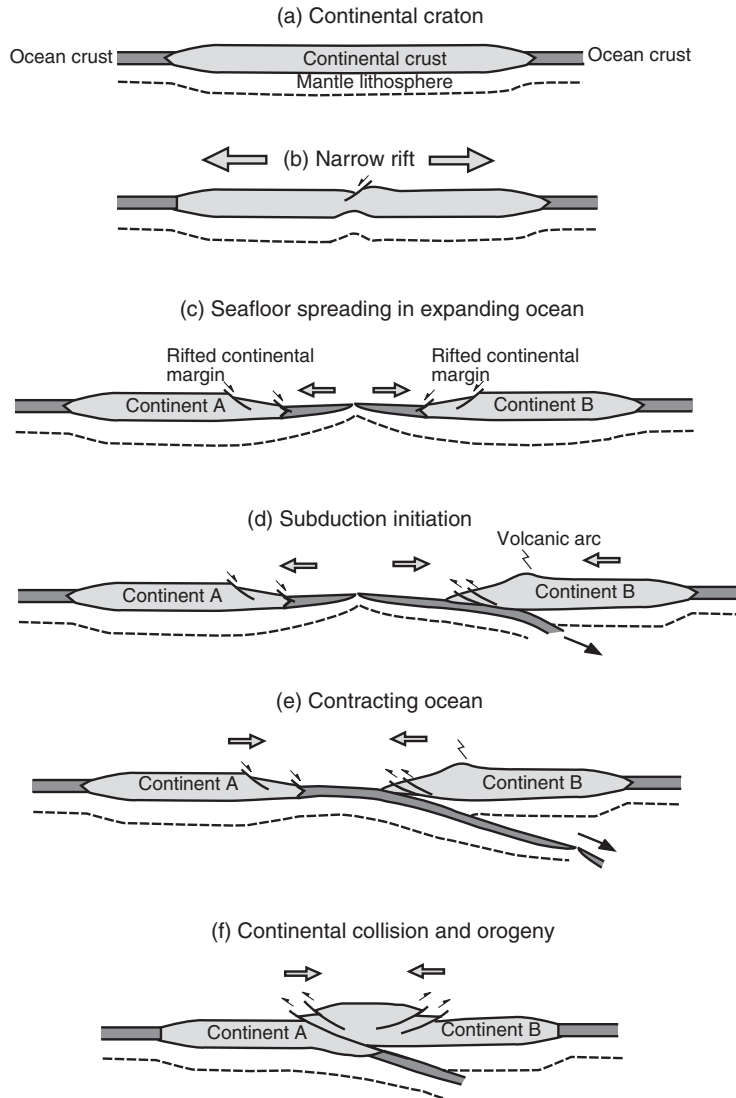
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## 7.9 THE WILSON CYCLE

The transition from intracontinental rift to ocean basin has occurred repeatedly on Earth since at least the Late

Archean (Section 11.3.5). The relatively young Mesozoic-Cenozoic age of the current ocean basins implies that there have been many cycles of ocean creation and destruction during the Earth's history. Very little remains of these ancient oceans, although their existence is implied by continental reconstructions (Figs 3.4, 3.5) and by fragments of ancient ocean crust that are preserved as ophiolite assemblages (Section 2.5) in orogenic belts



**Figure 7.41** The Wilson cycle showing: (a) continental craton; (b) formation of a narrow rift; (c) initiation of seafloor spreading and formation of rifted continental margins in an expanding ocean basin; (d) initiation of subduction; (e) a closing ocean basin; (f) continental collision and orogeny.

(Section 10.6.1). This periodicity of ocean formation and closure is known as the *Wilson cycle*, named after J. Tuzo Wilson in recognition of his contributions to the theory of plate tectonics (Dewey & Burke, 1974).

Figure 7.41 shows a schematic illustration of the various stages in the Wilson cycle beginning with the initial break-up of a stable continental craton (Fig. 7.41a) and the thinning of continental lithosphere. Rifting (Fig. 7.41b) is followed by the development of a thinned, rifted continental margin and eventually gives way to sea floor spreading as the two continents separate across an expanding ocean (Fig. 7.41c). The termination of basin opening may occur in response to plate collisions, which could trigger subduction at one or more rifted margins (Fig. 7.41d). Basin closure also may compensate for oceanic lithosphere that is newly formed elsewhere. The contracting ocean is a consequence of subduction at one or both continental

margins (Fig. 7.41e). This phase will continue until the two continents collide and the ocean basin closes completely (Fig. 7.41f). Continent–continent collision leads to the formation of a Himalaya-type orogen (Section 10.1) and the exhumation of deep crustal rocks. At this time subduction zones must initiate at other continental margins in order to maintain constant global surface area. The forces associated with these new subduction zones place the continent under tension and, if other conditions are extant (Section 7.5), the rifting process begins again. Present day analogues of the oceans shown in Fig. 7.41 are: Fig. 7.41c (expanding oceans) = the Gulf of Aden, Woodlark Rift, and the Atlantic Ocean; Fig. 7.41d,e (contracting oceans) = the Pacific Ocean. Chapters 9 and 10 provide discussions of the processes that operate during the destructive part of the Wilson cycle as ocean basins close and continents collide.