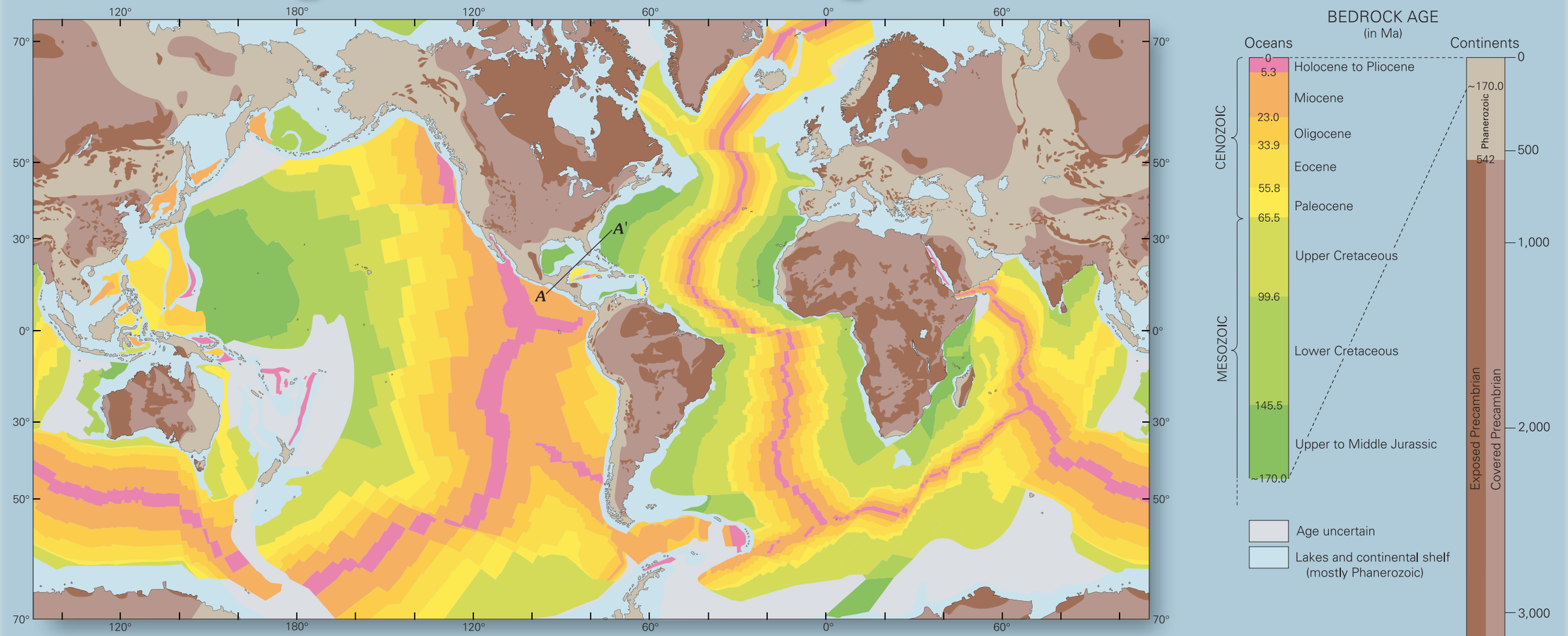
# IV. Bedrock Ages Show Oceans Far Younger Than Continents




(Adapted from Müller and others, 1997; Goodwin, 1991; Bouysse and others, 2000, used with permission of UNESCO/CCGM)

Newly created crust becomes progressively older, colder, and denser as it is carried away from divergent plate boundaries (generally the youngest oceanic rocks on the planet). Dense oceanic crust is ultimately recycled into the upper mantle at subduction zones. In contrast, less dense continental crust tends to "float," so that, over geologic time, much of it escapes this recycling process. Thus, as this map shows, the oldest bedrock of the sea floor (~170 Ma) is far younger than most continental bedrock. Precambrian rocks, older than 542 Ma, form the interiors of most continents and the cores of old continental mountain ranges, such as the Appalachians, Caledonides, and Urals. The yellow-green color boundary—between the Upper Cretaceous and Paleocene—represents oceanic crust that is 65 Ma, the age of the Chicxulub impact in eastern Mexico (see inset VI). This event caused massive extinctions. About 59 percent of the present-day oceanic crust has formed since Cretaceous time, when dinosaurs last roamed the land.

During the recycling process, subducting plates can remain largely undeformed to great depths before heating up, losing their physical identity, and ultimately being assimilated into the weak, slowly flowing mantle. An example is a profile (*A*–*A'*, center of map) across Central America (fig. 1), where the deep part of the subducting Cocos plate in the eastern Pacific Ocean projects beneath the Atlantic Ocean, offshore from North Carolina. Over geologic time, the positions of the continents and their associated subduction plate boundaries have shifted dramatically (compare Late Jurassic, K/T Boundary, and Last Glacial Maximum paleogeographic maps below). During the last 100 million years of eastward subduction under the Americas, the positions of the active plate boundaries have gradually shifted westward by more than 1,000 km.

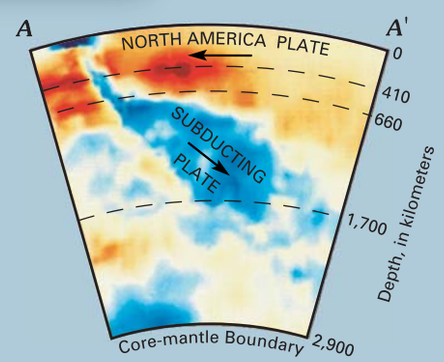



***Figure 1.***—Computer image of seismic-wave speeds along profile *A*–*A'* across Central America. Seismic waves pass more quickly through colder, denser rocks (blue tones) and more slowly through warmer, less dense rocks (yellow to red tones). The inclined blue-colored zone extending to 2,000 km depth is interpreted to represent the northeastward subduction of the Cocos plate and its predecessor beneath the southwestward-moving North America plate. Modified from Kárason and van der Hilst (2000). Used with permission of American Geophysical Union.

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