SEDIMENTARY BASIN DEVELOPMENT ABSTRACTS

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Terranes and Resources

Continents increase in mass because new material is added (primarily fragments of volcanic islands, seamounts, and hydrogenous and biologic sediments), formed in oceanic settings. Admixed with this material are continental fragments and piles of terrigenous sediment; both of these affect continental recycling but not net growth. Terranes are fault-bounded fragments found in orogenic belts. The rate of accretion calculated for the Circum-Pacific region since the breakup of Pangea during the early Mesozoic is 2-2.5 km^3/year, or as much as 80 m^3/sec. An average global growth rate needed to account for the entire mass of continents (7.6×10^9 km^3) since the early Archean (3.8×10^9 years) is 2.0 km^3/year; however, the flux of continental growth remains a topic of great controversy.

Although ocean crust contributes little to the mass of continents, the generative cycle creates the "conveyor belt" that leads to the formation of sialic material, which leads to the accretion and dispersive kinematics resulting in the growth and shaping of continents. The isochrons deduced from magnetic stripes in the modern oceans (about 300×10^6 km^2 in area) indicate an average age for ocean crust of only 70 Ma. Oceanic crustal rocks form at a rate of 800 m^3/sec, assuming a 6-km thick crust. If plate tectonic processes have been operative since 3.8 Ga, even at modern rates, as many as 27 world-ocean crusts would have been born at spreading centers and lost back to the mantle in subduction zones.

The processes linking tectonics, sedimentation, and resources are not clearly understood, but as we learn more about the geologic and physical properties of terranes, as well as their kinematics and dynamic histories, our prospecting perspicacity should improve. Some explanations are already available. Campeche, the Persian Gulf, and Prudhoe Bay are all passive-margin sequences tectonically overrun by foreland thrust and fold environs. Southern California and the western Australia offshore represent dispersive settings—transcurrent and orthogonal rifting, respectively. Sumatra and Java display compressional features, resulting from the subduction of the India-Australia plate; these features are superposed over expansion rifts formed when India collided with southern Asia. Other untested conditions may also have petroleum accumulations.