NASA Geodynamics Program review conference: Goddard SFC, Feb 6 1980

RECORD OF PLATE BOUNDARY AND NON-PLATE BOUNDARY TECTONICS IN THE PAST

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The crustal rock record may be interpreted, following J. T. Wilson (1968), to be the result of sequences of ocean opening and closing on different sites at different times. The evidence for this in the form of relics of rifts, rifted continental margins, shreds of oceanic crust and mantle, and island arcs, is used to map sutures, the sites at which major oceans have been removed by subduction, and at which collision has occurred between major continental fragments. The crustal record of orogenic belts back to 2.2 Ga ago is wholly explicable in these terms, including collision-generated "basement reactivation" events consisting of short-lived, widespread terminal episodes of regional metamorphism and deformation with voluminous calc-alkaline magmatism. The history of randomly located rifting-ocean-collision sequences has segmented and dispersed the fragments of orogenic belts and is an effect that becomes more pronounced with age. Collision-generated "reactivation" affecting large areas of foreland to collision sites has resulted in overprinting and erasure of large parts of older orogenic belts; this also affects older orogenic belts more than younger ones. Young sedimentary platform cover in many places obscures the details of orogenic belts generated by ocean opening and closing. Progressive extraction of basalt from the mantle at spreading ridges, and its subduction to generate island arcs, implies the growth of continents fundamentally by volcanic arc accretion through time. Since radiogenic heat production has declined significantly through the Earth's history, such growth is likely to have been faster in the early part of that history, but a significantly smaller area of continent in early times, coupled with rift segmentation and collision "reactivation", all combine to make the record fragmentary and obscure. Unreactivated crustal fragments older than 2.5 Ga are mostly of rock assemblages implying rapid island arc growth and hence subduction, but some fragments give evidence of continental-type collision and "reactivation". Less total area of continent and faster and/or more extensive plate motion (greater lengths of spreading ridges and subduction zones) explains this apparent difference and also allows dissipation of the higher radiogenic heat production in early times. Non-plate margin volcanics and tectonics are greatly subordinate now and in the crustal record to plate-margin phenomena. Examples similar to the present day are recognizable back to about 2.5 Ga ago. The poor record prior to this time may explain their apparent absence from older rocks.

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