RECORD OF PLATE BOUNDARY AND NON-PLATE BOUNDARY TECTONICS IN THE PAST
Kidd, W. S. F., and Burke, Kevin
Department of Geological Sciences, State University of New York at Albany
Albany, NY 12222

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,
ripped 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 "base-
ment reactivation" events consisting of short-lived, widespread terminal epi-
sodes of regional metamorphism and deformation with voluminous calc-alkaline
magnetism. 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 over-
printing 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 exten-
sive 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.

(ejected)