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SEISMIC COUPLING AT SUBDUCTION ZONES - ITS MECHANICAL CAUSE AND FAR-REACHING GEOLOGICAL CONSEQUENCES

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The phenomenon known as seismic coupling, first recognized by Kanamori more than 20 years ago, has increasingly emerged as a tendency for the subduction interface slip to become locked by some kind of asperity, then sheared off by a major interface slippage, to be followed by a 'normal-fault' event and the re-locking of the interface. Seismic coupling is primarily confined to zones where the subducting plate is <70Ma old. The big question has been 'How do the repeated asperities arise?' The seismicity present to considerable depths within downbending plates led me to outline a step-faulting mode of downbend (IGC92, IASPEI94) in which repeated increments of step-fault throw generate locking asperities at the interface. The shearing of these asperities would have the effect of transferring hanging-wall material to the downgoing plate and thus of advancing the hanging-wall-controlled position of interface downbend beneath the margin.

This contribution will elaborate upon this model (including the provision of outer rises without elastic support) and illustrate the huge tectonic significance of the resulting basal subduction tectonic erosion (STE) that has emerged from my study of subduction orogens and collision orogens, now ranging in age from the present to the Archaean. STE is to be seen as one of the great tectonic processes of the Earth and, as such, intensive study of its seismological manifestation - seismic coupling - is well warranted, hopefully also leading to improved understanding of seismic hazard. A highly STE-specific form of tectonic melange, generated by it, will also be illustrated.