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PHANEROZOIC SUBDUCTION AND THE TTG-MAGMATIC CONSTRUCTION OF ARCHAEAN CONTINENTAL CRUST

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My studies of the evolution of Phanerozoic subduction zones (e.g. IGC1992, IUGG1995), noting their impact upon the geology above them, clearly indicate the presence of two major non-arc processes. (1) Subduction tectonic erosion (STE). In STE the young-plate (<70Ma) downbend mechanism is able to nibble away the hanging wall at the downbend, shallowly and rapidly advancing the downbend position beneath the upper plate by hundreds of kilometers, rendering the margin susceptible to imbrication. STE implies young-plate buoyancy, achievable if a substantial thickness of LVZ material forms an integral part of the plate. This, in turn, provides the heat for (2), post-subduction magmatism (PSM). Here the cessation of subduction gives time for the LVZ heat to soak through the former slab and induce wholesale melting of its subduction interface crustal material, resulting in a several-100km-wide belt of silicic/granitoid magmatism (examples given).

The granitoid (TTG) intrusion of Archaean greenstone belts appears consistent with PSM into an extensively STE-undercut margin, as subducted plates would certainly have been young and hot. Key to the much-debated tectonic location and magmatic origin of greenstone belts seems to be my recognition (IGC1992) that Phanerozoic subduction has commonly started in the oceanic domain, reaching continental margins by repeated STE and imbrication. Thus at least the initial forearc is oceanic-crusted, having formed a passive margin made by the MOR process before subduction began. In the same way, Archaean greenstone belts may indeed have originated as oceanic crust.