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The destinations of subducted crustal materials and their implications for evolution of the core, mantle and crust.

Miles F.Osmaston, The White Cottage, Sendmarsh, Ripley, Woking, Surrey GU23 6JT, UK; +44-1438-224138.

Recent study of oceanic plate evolution suggests that the asthenosphere may not be moving independently of the lithosphere above, so could be the locus of concealed heat which would later become available at subduction interfaces.

High-pressure studies indicate that, both in the upper mantle transition zone (TZ) and in the lower mantle, silicate melts of crust-derived composition will be denser than the local solid mantle. So any subduction interface melts in the TZ will gravitate towards the core, enhancing seismic Vp as they go. Meanwhile, the mantle part of the subducted plate (plus any interface residues) can recycle within the upper mantle.

At shallower depths (say <400km), when subduction of a fairly young oceanic plate **stops**, wholesale melting of interface material may be expected, starting at the deep end, lasting for some tens of Ma, and producing a wide, high-volume spread of crustal magmatism. Advected heat will be very great, increasing with source depth.

The resulting post-subduction magmatism (PSM) has been identified (with the detailed support of Phanerozoic examples and the general support of many Archaean ones) as the likely origin of major syn- to post-tectonic silicic/granitoid events generally and hence of the hitherto puzzling episodicity of Archaean continental growth.

This supports the occurrence of subduction-like processes very early in Earth history, so the Earth may have evolved as follows:- **About 4.56Ga:** Whole-earth convective overturn; magmatic FeO reduced by a short-lived thick primordial atmosphere and subducted (with FeS) to form the core, with minimum percolation; ocean water formed. **3.8-2.8Ga:** Regional interruptions of intra-oceanic subduction cratonise, by PSM, strips of crust 200-500km wide. **2.8-2.5Ga:** Whole-mantle overturn is now too thermally effective; interruptions and cratonic additions become increasingly frequent (= rapid crustal growth) and lead to:- **2.2(?)Ga-present:** Separate upper mantle overturn, which continues to deplete it, re-enriching the lower mantle with melts from subduction zones.