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Subduction of Continental Crust and the Origin of Syntectonic, Late Tectonic, Post Tectonic and Possibly Anorogenic Granites

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The subduction of continental crust into the mantle followed by rapid eduction provides a mechanism for generating and preserving the high and ultrahigh pressure (HP/UHP) metamorphic terranes that characterize many mountain belts. Several HP/UHP terranes show a high-temperature metamorphic overprint accompanied by partial melting of the slab. Melting occurs by dehydration melting and adiabatic decompression and is likely to occur in terranes that exhume slowly so that temperature rises as pressure decreases. Here I consider slabs that are not exhumed, but rather stay trapped in the mantle as a result of 1), pervasive eclogitization causing a terrane to become too dense to rise buoyantly through the mantle, 2), shallow subduction angles resulting in too much frictional resistance along the upper boundary to allow normal fault movement; 3), a thin slab geometry that cannot generate sufficient body forces to over come frictional resistance along its lower and upper boundaries; 4), early melt extraction during exhumation, which would increase the density of the residue; and 5), continued strong orogenic compression preventing extrusion of the slab into the crust. The inevitable re-establishment of normal geothermal gradients, possibly abetted by heat produced by shear heating, radioactive decay, and the advection of hot mantle, will ultimately result in slab melting. The generated magmas will intrude the overlying plate to form late-, post- and possibly an-orogenic granitoids, depending on the time it takes for a slab to heat up to the solidus. The magmas generated will have variable geochemical characters depending on 1), P-T conditions, 2), the chemistry/mineralogy of the slab, 3), the length of traverse through the overlying mantle wedge, and, 4), the degree to which the melts interact with the mantle. Slabs that either

delaminate or melt the more sialic upper continental crust will leave the denser mafic lower crust trapped in the upper mantle, which could ultimately generate Proterozoic anorogenic anorthosite-mangerite-charnockite-rapakivi-granite suites. The lack of preserved HP/UHP terranes in a mountain system does not necessarily preclude continental subduction during its evolution.