Granite subduction: arc subduction, tectonic erosion and sediment subduction

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Geologists have long believed that the granitic crust (TTG- Tonalite-Trondhjemite-Granodiorite) once formed on the surface must have survived through the whole history of the earth without any subduction because of its buoyant nature. Thermal considerations (Fyfe, 1978; Armstrong, 1981; 1991) for the formation of continental crust suggest that major continental growth must be Hadean to Archean, because of its higher mantle temperature, which brought extensive amounts of melt to fractionate, finally TTG magma. Hence, Fyfe (1978) and Armstrong (1981) speculated that presumably more than 100% of the present continental crust must have been formed on the Hadean-Archean Earth.

On the other hand, the proposed growth curves of continental crust, while highly variable, show some evidence for only are ca. 20% by the end of Archean (Rino et al., 2008). To explain the observed growth curve, the possible extensive subduction of continental crust must have occurred through time, although the physical processes have not been addressed in detail.

Moreover, from the recent study of active subduction zone along the Circum-Pacific subduction zone, mainly by seismological methods, tectonic erosion and even sediment subduction (e.g. Scholl, 2005) have been identified as common processes. We summarize the geological aspects of the western Pacific region to evaluate the processes of oceanic arc subduction, tectonic erosion and sediment trapped subduction. Thereafter we extend the observations in the western Pacific to Archean dynamics, and consider whether or not intra-oceanic arcs subduct in the deep mantle, and briefly discuss the fate of subducted continental crusts.