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大陸地殻の形成とその沈み込み：セッション説明
The formation and subduction of continental crust: session scope

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Previous studies of Archean geology, geochemistry of detrital materials and comprehensive investigations of subduction zones have provided great insights into the evolution of continental crust and mantle, but simultaneously raising another questions, thus offering new perspectives. Especially, subduction of continental material into the mantle is a key to better understand the evolution of continents and mantle. Here I briefly overview continental growth and destruction models ever proposed, and introduce for the session scope.

There is a long-standing controversy when and how continents formed. Recent active studies on U-Pb and Lu-Hf systematics of detrital zircons reveal the processes of crustal evolution on a global scale from the Hadean to the present. They propose that the formation of continental crust started from 4.4 Ga and that at least 70% volume of the existing continental crust were produced from the mantle before 2.5 Ga. Moreover, considerations of thermal evolution for the Earth mantle have proposed that rapid continental growth happened in the Hadean to Archean because higher mantle temperature in the Hadean to Archean must produce extensive amounts of TTG magma and that presumably more than 100% of the present continental crust must have been formed on the ancient Earth. However, Archean crust is preserved only in small portion (-10%) of Earth surface, and vestiges of Hadean crust are only Acasta gneiss complex and Jack Hills detrital zircons. To explain little preservation of ancient crust, it is suggested that the small areal preservation of Archean crust is a result of reworking of older crust and/or long term subduction of Archean TTG into the mantle.

Subduction and recycling of differentiated material into the mantle are of considerable significance for making mantle heterogeneity. Continental crust has been returned to the mantle at subduction zones, in the styles of sediment subduction, subduction erosion, arc subduction and continental subduction. Geophysical and geological investigations at modern subduction zones document that the amount of subducting continental material versus arc produced at the subduction zone have been balanced, resulting in no volumetric growth of continental crust, probably from Archean to present. Applying Cenozoic recycling rates of continental crust into the mantle (2.5-3.7 km{sup}3{/sup}/yr), a volume of crust equal to the standing inventory of -7 x 10{sup}9{/sup} km{sup}3{/sup} can be removed from the surface during past 1.9-2.8 G.y. However, the above-mentioned estimates still remain unclear because the supply rate of juvenile crust from the mantle and subducted continental material into the mantle in the ancient Earth are poorly constrained.

Previous isotopic and trace element studies of OIBs have suggested the presence of long-lived recycled components related to ancient continental crust stored in the deepest mantle. However, subducted granitic material is expected to be trapped at the bottom of the upper mantle. Because, subducted granitic material is no longer buoyant over a depth of 250 km in the mantle. Thereafter, continental material will be buoyant again compared to surrounding mantle at the base of the transition zone. However, there is no geophysical observation for the accumulation of the granitic material at the mantle transition zone. There has been controversial what produces anomalous seismic-wave velocity and density changes at depths of 400 to 700 km. Recent experimental and theoretical studies suggested that the PREM velocities are higher than those of both adiabatic pyrolite and piclogite in the lower part of the mantle transition region. Subducted granitic material can produce anomalous velocity and density discrepancy in the lowermost transition zone.

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