Geochemical and geochronological exploration of multiple plutons in southwest Japan

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The large landmass of felsic continental crust, consisting mostly of granitic rocks, is one of the most remarkable features of the Earth. Therefore, studies on granitic rocks will provide essential insight for understanding the chemical evolution of our planet. Large volume of granitic rocks occurs in southwest (SW) Japan, and are classified into four series based on temporal and spatial distribution of plutonic bodies, from south (rear-arc) to north (fore-arc), as Outer, Ryoke, Sanyo, and Sanin. Here, a new set of precise geochemical and geochronological data from these four series are presented. U-Pb zircon geochronology revealed that the age of granitic rocks becomes younger from Ryoke (96 Ma) through Sanyo to Sanin (40 Ma), consistent with previous K-Ar and Rb-Sr ages [1]. The ferric/ferrous iron ratios in whole rocks ranges from 0.5 to 3, suggesting that magmatic differentiation occurred at similar redox condition, probably at the crustal depth. Systematic changes in radiogenic isotopic compositions are clearly noticable; $(^{87}Sr/^{86}Sr)_i$ and $(^{207}Pb/^{204}Pb)_i$ decrease, while, ε_{Ndi} and ε_{Hfi} increase from Ryoke to Sanin. The observed syetematic trend could be attributed to varaible degree of crustal protolith involvement, during magma formation. Major-element compositions of the granites are similar to partial melts of basaltic materials [2], indicating that primary magma was derived from melting of subducted slab. However, all suites of SW Japan granites do not exhibit the adakitic signature such as high Sr/Y [3]. It is inferred that melting occurred at shallower depth in the absence of residual garnet. The possible circumstance for melting of basaltic protolith is subduction of migrating oceanic ridges, supplying heat and materials [4]. Reconstructed paleogeography of Eastern Asia [5] suggested that the Kula-Pacific ridge has subducted into SW Japan during late Cretaceous time, coincident in time with the granitic magmatism.

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