Crustal evolution in the Gyeongsang Arc, southeastern Korea: Geochronological, geochemical, and Sr-Nd-Hf isotopic perspectives from granitoid rocks

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A loosely assembled patchwork of Cretaceous to Paleogene (91–27 Ma) granitoid plutons comprising the platform of the Gyeongsang Arc in southeastern Korea represent a high-flux pulse of magmatism in Northeast Asia. The plutons are composed of dominantly magnesian, high- to medium-K calc-alkaline granites-granodiorites exhibiting typical geochemical characteristics of subduction zone magma, and less abundant ferroan alkaline granites. Paleoproterozoic to Paleogene xenocrystic cores are occasionally observed in the zircon grains from the granitoids. The whole-rock Sr-Nd and zircon Hf isotopic compositions of the granitoids are distinctly more primitive than those of inland granitoids distributed outside of the Gyeongsang backarc basin. An important role of relatively young, most likely Paleozoic juvenile crust in the formation of the Late Cretaceous granitoids is suggested by the time-εHf trend of high-εHf zircons that converges toward data points of the Late Permian Yeongdeok adakite composing the arc basement. The asthenospheric mantle input is highlighted by significantly high (>+17) εHf(t) values of some zircons from the early Eocene alkaline plutons. Subsequent reworking of the rejuvenated crust yielded granitoid plutons possessing slightly but recognizably higher εNd(t) and εHf(t) values than the older plutons. These isotopic features demonstrate that the Cretaceous-Paleogene calc-alkaline granitoids in the Gyeongsang Arc are not “juvenile” despite their mostly positive epsilon Nd and Hf values, but are basically a product of crustal reworking. The Sr-Nd-Hf isotopic compositions of Late Cretaceous granitoids in the Gyeongsang Arc are comparatively more primitive than those in adjacent accretionary terranes such as Southwest Japan and Fujian province in southeastern China, reflecting differences in the formation age of the basement on which the arc system was built.