Early Neoproterozoic subduction-related arc magmatism in the central-western Korean Peninsula and its tectonic implication

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We report the petrology, zircon U–Pb ages, geochemistry, and Hf isotope data from the Early Neoproterozoic igneous complexes (gabbro–diorite–tonalite–granite) in the southwestern margin of the Hongseong–Imjingang Belt in the central-western Korean Peninsula. Various gabbro–tonalite or diorite–tonalite composites indicate the possibility of remelting and magma mingling in the deeper mafic to intermediate levels. The gabbro, diorite, and tonalite yield zircon U–Pb ages of the Early Neoproterozoic intrusions of 913 Ma, 909 Ma, and 903–899 Ma, respectively. By contrast, subsequent granitic dykes, yielding ages of 898–895 Ma, could have formed as a result of a shallow plutonic system. The samples of the igneous complexes show compositional variation in major elements within the subalkaline series, and are characterized by large ion lithophile element (LILE) enrichment, negative Nb–Ta troughs, and depletion in P and Ti anomalies similar to the continental arc setting. The initial $^{176}Hf/^{177}Hf$ ratios and $\varepsilon Hf_{(t)}$ values obtained from zircon crystals are in the ranges of 0.282132–0.282268 and –2.7 to 2.3 for gabbro, 0.282010–0.282363 and –6.4 to 6.0 for diorite–tonalite, and 0.282071–0.282285 and –5.0 to 2.6 for granitic dykes, suggesting juvenile crust production with mixing of older crust materials. By contrast, ca. 1.15 Ga xenoliths of the migmatized metasedimentary rocks were recognized in the Early Neoproterozoic igneous complexes. Various gabbro–diorite–tonalite composites were likely formed from assimilated partial melting between gabbroic rock and ca. 1.15 Ga metasedimentary rocks based on petrological, geochronological, and Hf isotopic results. In combination with previously published U–Pb ages and geochemical results for the Late Paleoproterozoic to Early Neoproterozoic rift-related rocks in and around the central-western Korean, the Early Neoproterozoic arc magmatism from this study provides clear evidence for tectonic transition from disruption of the Columbia supercontinent to amalgamation of the Rodinia supercontinent during Late Mesoproterozoic, followed by its disruption during Late Early Neoproterozoic in age.