A preliminary Nd isotopic study of metamorphic rocks in the Gyeonggi massif, Korea

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We have carried out a preliminary Nd isotopic study of the basement and supracrustal rocks of the Gyeonggi massif whose protoliths are considered to be sedimentary. The basement rocks, including Geyonggi Metamorphic Complex and Seosan Group, widely vary in their $^{147}Sm/^{144}Nd$ ratios (0.051 – 0.179), whereas the supracrustal rocks, including Chuncheon Supergroup and its equivalent to the west, show a relatively narrow range (0.047 – 0.108). On the basis of the depleted mantle model of Goldstein et al. (1984, EPSL), the present-day εNd ($\varepsilon_{Nd}(0)$) values of the basement rocks range from –5.0 to –34.1, and the depleted mantle model (T_{DM}) ages from 1.8 Ga to 4.2 Ga. On the other hand, the supracrustal rocks range in $\varepsilon_{Nd}(0)$ values from –18.4 to –28.3, and in T_{DM} ages from 1.8 Ga to 2.4 Ga which are apparently younger than those of the basement rocks. Hence, these T_{DM} ages confirm the traditional lihtostratigraphy between the basement and supracrustal rocks.

The distribution of T_{DM} ages from both basement and supracrustal rocks show a major peak at 2.0 – 2.5 Ga with subordinate peaks at 1.5 – 2.0 Ga and 2.5 – 3.0 Ga, suggesting that much of the crustal formation has completed during the Late Archean to Early Proterozoic time throughout the Gyeonggi massif. Moreover, T_{DM} ages older than 2.5 Ga indicate that the Archean crustal components are significant in the Gyeonggi massif. This result is consistent with the recent discovery of inherited zircon components exceeding ca. 2.5 Ga in age (Cho et al., 1999, PSK abstract). However, a few samples showing high T_{DM} ages older than 3.0 Ga have relatively high $^{147}Sm/^{144}Nd$ ratios in the range of 0.133 – 0.179, although their $\varepsilon_{Nd}(0)$ values do not differ from others. Thus, the >3.0 Ga T_{DM} ages could be an artifact resulting from the increase in Sm/Nd ratios during intracrustal differentiation (e.g., crustal partial melting) subsequent to the primary metamorphism, and as a consequence our Nd data do not warrant the presence of the Early to Middle Archean crusts in the Gyeonggi massif.

It is further noted that Nd isotopic data of the Gyeonggi massif could be interpreted as being compatible with those from either Sino-Korean or Yangtze cratons. In the Sino-Korean craton, Late Archean rocks are widespread and predominant in conjunciton with a limited exposure of ca. 3.8 Ga crust. On the contrary, the major crustal formation in the Yangtze craton took place in the Proterozoic time, together with very minor Late Archean activity. However, recent finding of > 3.2 Ga crust in the Yangtze craton (Qiu et al., 2000, Geology) indicates that the Archean crust could be more extensive than previously thought. Hence, at present, the Nd isotopic data alone do not firmly constrain the terrane correlation of the Gyeonggi massif with the Chinese cratons.