

Granite-series and the origin of granitic magma

*Tetsuichi Takagi¹

1. Research Institute for Geo-Resources and Environment, National Institute of Advanced Industrial Science and Technology

The distribution of magnetite- and ilmenite-series granites (granite-series) shows zonal arrangement in a regional scale, and the ratios of two series granites systematically varied by their age. The facts indicate that the genesis of granite-series is not attributed to local phenomena but is closely related to the origin of granitic magma. The compilation of previous studies on granites in Japan Arc shows that granite activities are positively correlated with the convergence-rate of oceanic plates at the time, and the maximum activity occurred during 95-85 Ma, which comprises mostly ilmenite-series granites. The ratios of ilmenite- and magnetite-series rapidly rose at ca. 110 Ma, and dropped at ca. 70 Ma. The initial Sr isotope ratios (SrI) of ilmenite-series granites systematically rose in Cretaceous, whereas those of magnetite-series were fairly stable regardless of their ages. The similar variations can be found in the initial Nd isotope ratios (NdI). The facts above suggest that the assimilation-rate of sedimentary rocks into granitic magma systematically rose in Cretaceous, and dropped at 70 Ma. The phenomena are hardly explained by lower crustal melting by the ridge-subduction or the assimilation of wall rocks during emplacement of granitic magma.

In the Sr-O isotope diagram, the plots of most granites except for part of high-Sr granites are consistent with the curves of source contamination (convex downward). The SrI-NdI diagram also indicates that most granites were formed by the assimilation-fractional crystallization processes between strongly depleted materials (= mantle materials) and sedimentary rocks. To explain the data consistently, the geological setting of which mantle materials react with sedimentary rocks during magma generation is necessary. The sedimentary rocks should be common and homogeneous materials, and should be drawn into magma source regions. The materials met the above conditions are subducted sediments. Therefore, it can be deduced that the granite-series in Japan Arc depends mainly upon the reaction-rate between primitive magma and subducted sediments. Furthermore, it is also inferable that the main source materials of granitic magma in Japan Arc are not lower crustal materials but subducted sediments reacted with mantle materials.

Reference: Takagi, T (2004) *Am. Jour. Sci.*, 304, 169-202.

Keywords: granite, Japan Arc, subduction zone