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From leucosome to a pluton? : An answer from Southwest Japan

T. Nakajima (1), Y. Orihashi (2) and T. Danhara (3)

(1) Geological Survey of Japan, Japan, (2) ERI, University of Tokyo), (3) Kyoto Fission Track Co., Ltd., Japan (tngeoch.nakajima@aist.go.jp / Fax: 81-29-861-3742 / Phone: 81-29-861-3957)

Leucosomes in migmatites are anatectic melt pools. They have various sizes from millimeter scale to tens of centimeters, but usually not exceeding the outcrop scale. The leucosomes we see on the outcrops are mostly not in-situ melt pockets but the pools of segregated, connected and integrated melts of a larger size. Since old days, “missing link” between leucosomes and granitic plutons has been debated because those anatectic melts must contribute to form a granitic magma but there is no documentation of a transitional stage between them.

The Southwest Japan is a large-scaled arc-type Cretaceous granitic province comprising volcano-plutonic San-yo belt in the back-arc side and plutono-metamorphic Ryoke belt in the fore-arc side. The Cretaceous granitoids intrude Jurassic accretionary complexes and their metamorphic equivalents up to migmatite grade.

The U-Pb age determination was carried out using LA-ICP-MS on the zircons from the leucosomes and melanosomes of migmatites, and associated granitic plutons of the Ryoke belt. The results are,

1) Both leucosome and melanosome have a lot of inherited zircons.

2) The inherited zircons make beautiful discordia lines with ca.100 Ma and 1900 Ma of lower and upper intercepts, respectively.

3) No data plots on the concordia lines between 280 Ma and 1600 Ma.

4) The younger age data plots around 70-280Ma on and near the concordia line.

5) On the other hand, the granitic rocks have small amount of inherited zircons.

6) The amount of the inherited zircons correlates to the degree of peraluminous chemistry of the granite.

Therefore, it is concluded that leucosomes are not integrated to be a granitic pluton.

This conclusion is concordant with the facts so far recognized, such as,

1. The granites of the Ryoke belt are mostly of I-type.
2. The 87Sr/86Sr initial isotope ratios of the Ryoke granites are 0.707-0.711, while the leucosomes and melanosomes are 0.715-0.718 which are similar to the metamorphosed and unmetamorphosed Jurassic accretionary complexes.

Considering that most of the Circum-Pacific granites are of I-type, major source of arc granite magma is derived from mafic rocks in the lower crust. In the granitic magma, upper crustal recycled components are certainly involved but they are highly diluted by the lower crust derived more juvenile magma. The problem “from leucosome to a pluton” would be significant for the formation of continental crust when basic migmatite to tonalitic melt in the lower crust is concerned.