# Lower crustal anatexis and petrogenesis of granitoid in intra oceanic island arc, Asago body of Yakuno ophiolite, Southwest Japan

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The upper Paleozoic Yakuno ophiolite in the Asago body, southwest Japan exposes a 3.0 km-thick middle to lower crustal section of intra-oceanic island arc, which is composed of metabasites (metagabbro and schistose amphibolite) of MORB-like affinity and granitoid intrusives of island arc affinity. Mafic migmatite develops in the lower crustal section, whereas the granitoid intrusives forming plutons and dykes develop in the middle crustal section. Metamorphic grade of the lowest horizon of the crustal section reaches granulite facies, where the pressure and temperature conditions are inferred to be 3.5-5.5 kbar (assumed to be the same as those for emplacement of the granitoids) and 850-860 centigrade, respectively, high enough to cause dehydration melting of amphibolite. The dehydration melting led to the formation of migmatite with intermediate to felsic leucosomes. Upward migration paths of the leucosome (i.e. melt) can be traced. In particular, morphological changes of the migmatite with increasing structural level directly represent the melt segregation process. Small-scale primary melt formed at the lowermost horizon (metatexite migmatite), which moved upward, accompanied by increasing degree of melt segregation (melt-enriched migmatite), and finally led to the formation of plutons.

Major element compositions of leucosome, metabasites (mesosome) and melanosome in migmatite indicate that the leucosome was derived from the partial melting of metabasites, leaving the melanosome as residuum. Trace element compositions of calculated model melt support this result. Major and trace element compositional variation of the melt components indicates that the leucosome can become a source of the intrusives of medium-silica content ($SiO_2$ content less than 67 wt%; medium-Si intrusives), whereas chemical compositions of the intrusives of high-silica content ($SiO_2$ content more than 72 wt%; high-Si intrusives) and those of the leucosomes do not overlap. A calculated model melt indicates that the medium-Si intrusives form at a melting degree of more than 60%. On the other hand, high-Si intrusives form at an extremely low melting degree of less than 10%. Compositional range of $K_2O$ content in the high-Si intrusives is 0.1-3.9 wt%. Experimental data indicate that the high-Si intrusives of low $K_2O$ content (0.1-1.5 wt%), such as tonalite and trondhjemite (high-Si and low-K intrusives) can form from the partial melting of tholeiitic metabasites. However, remelting of the rocks of calc-alkaline affinity is the most likely process for the formation of the high-Si intrusives of high $K_2O$ content (2.3-3.9 wt%), such as granodiorite and granite (high-Si and high-K intrusives). Histograms of $SiO_2$ and $K_2O$ of intrusives clearly show bimodal distributions, which suggest that the high-Si and high-K intrusives in the Asago area formed from remelting of emplaced medium-Si intrusives and/or leucosome.

Namely, different stages of anatectic events are assumed in the Asago body. Firstly, the high-Si and low-K intrusives (tonalite and trondhjemite) formed at a stage of low melting degree. Secondly, the medium-silica content of intrusives, (quartz diorite, tonalite and trondhjemite) formed at a stage of high melting degree. Thirdly, the high-Si and high-K intrusives (granodiorite and granite) formed from remelting of emplaced medium-silica content of intrusives. Thus, these are though to be the most major processes for the formation of the granitoids in an oceanic island arc.