Melting condition and origin of arc magmas beneath the Sengan region, Northeastern Japan

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Subduction zone processes play important roles in the evolution of the crust and mantle, yet are poorly constrained at present. Recent geophysical and geological studies suggest that there are periodical structures with about 50km wavelength in the mantle wedge and crust beneath Northeastern Japan (Tamura *et al*., 2002). In this study, we investigate 3-D thermal and compositional states of the mantle wedge and crust beneath the volcanic front of Northeastern Japan, based on the compositional variations of volcanic rocks collected from 28 Quaternary volcanoes in a volcanic region, the Sengan region (30km-30km).

Volcanoes in the Sengan region are divided into two groups. Compositional variations of the first group can be reproduced by fractional crystallization from a basaltic magma, based on thermodynamic calculation using MELTS (Ghiorso and Sack, 1995). These volcanoes are mainly distributed on the outer rim of the cluster. Magma mixing between high-MgO andesite and dacite associated with fractional crystallization is observed in the second group, based on AFC calculation and mineralogy. The second group is distributed at the central part of the volcanic cluster associated with voluminous welded tuff and granitic pluton. Major element compositions of these voluminous silicic rocks show a similar range to those reported for partial melts of amphibolite (e.g; Beard and Lofgren, 1991).

Melting conditions in the mantle wedge have been estimated to minimize the difference between the composition of partial melt calculated at a given *P*, *T*, H_2O-content (Ghiorso *et al*., 2002) and that estimated from the observed volcanic rocks, assuming olivine maximum fractionation. The estimated mantle condition shows that the mantle beneath the central part of the cluster has a higher H_2O-content than that beneath the outer rim. It is suggested that mantle-derived wet magma had supplied heat and H_2O to the crust and induced crustal melting/magma mixing at the central part of the volcanic cluster. On the outer rim, basaltic magma ascended to the surface without causing crustal melting.

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Radiocarbon analysis in tree rings of Yaku-cedar by AMS for investigating secular variation of atmospheric $^{14}C/^{12}C$ ratios

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Atmospheric radiocarbon is produced in the stratosphere by cosmic ray reaction with nitrogen ($^{14}N(n,p)^{14}C$). The produced ^{14}C enters into the carbon cycle in the air, and it is absorbed photosynthetically by plants. Therefore, by measuring $^{14}C/^{12}C$ ratio in tree rings, it is possible to obtain information on the secular change of cosmic ray intensity.

In this study, we have used an old cedar tree (1680 year-old) from Yaku island (Kagoshima Prefecture, Japan). Samples (about 20mg) were collected from annual tree rings, and then α-Cellulose, which is immovable constituent and recorded $^{14}C/^{12}C$ ratios at the time of the absorption, was extracted by treatments with acid and alkaline. The obtained α-Cellulose (about 3mg) was oxidized to CO_2 and purified with a glass vacuum line. Then it was reduced to pure graphite which was used as a target (about 1mg) for the determination by Accelerator Mass Spectrometry (AMS).

Using a small sample size, as mentioned above, we could measure $^{14}C/^{12}C$ ratios with reasonable precision and accuracy by AMS at MALT. Results obtained at this time are shown in Fig.1 (for the period 524-775 A.D.) together with the IntCal04 data. The values were not on the straight-line, which is extrapolated from the year 1950 with the half-life of ^{14}C, suggesting there were considerable variations of the ^{14}C production. Some periods (e.g. around 660A.D.), in which $\Delta^{14}C$ values were higher than those of IntCal04, were observed. Since IntCal04 was mainly composed from western data, our results from Yaku-cedar should be useful to understand secular variation of $^{14}C/^{12}C$ ratios in Japan.

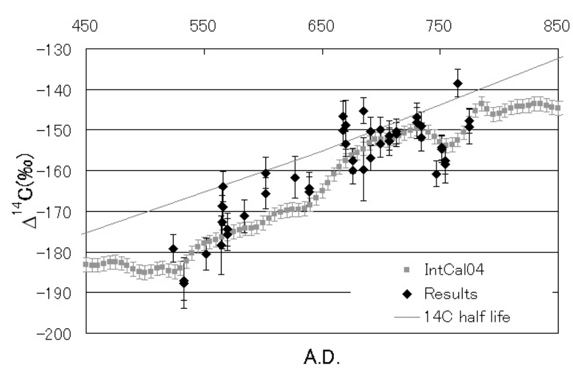

Figure 1. Results together with the IntCal04 values.

Reference

IntCal04: *Radiocarbon*, **46**, 1029-1058 (2004)