The Sumikawa metamorphic xenolith and the Awataki gneiss: crustal metamorphism in the Uetsu area, northern Japan

Toshiaki Shimura[1], Ritsuko Okuda[2], Toshiko Kawai[3], Shin-ichi Kagashima[4]

[1] Dept. of Geology, Niigata Univ., [2] Geo- and Biosphere Sci., Niigata Univ., [3] Graduate Sch.Sci.& Tech.Niigata Univ., [4] Graduate School of Science and Technology, Niigata Univ.

The Tanagula Tectonic Line (TTL) is one of the large tectonic line in Japan. The TTL subdivide the pre-Tertiary basement rocks to two units, the SE Japan and the NE Japan. The Uetsu area, the northern extension area of the TTL, Cretaceous-Tertiary plutonic-volcanic rocks are widely distributed. However the position of the TTL is at issue (e.g. Takahashi, 1999; Takiguchi and Tanaka, 2001). Metamorphic rocks are not much but occur as the xenoliths in the granitoids and also occur as the contact metamorphic rocks around the granitic suites. The P-T-t-D path of these metamorphic rocks may reveals the tectonics of the Japanese island and eastern Asia of the Cretaceous age.

The Iwafune granitoid suites (100-90Ma) occur in the north-western part of the Asahi mountains. It is thought to be an S-type granitoid on the petrochemical criteria (Agency of Natural Resources and Energy 1982; Kagashima 1999). The Sumikawa granodiorite (20Ma) intrudes into the Iwafune granite as a small stock. The Sumikawa granodiorite is thought to be M-type or I-type. Various types of metamorphic rocks occur as xenoliths in the Sumikawa granodiorite body (Otsuka & Shimazu 1981; Kawai et al., 1999; Shimura et al., 2002). The Sumikawa xenoliths are subdivided into pelitic rocks, mafic-intermediate rocks, and calc-silicate rocks. P-T-t-D path of the pelitic granulite xenoliths has been determined by the petrological studies (Shimura et al., 2002). These are,

SM1 stage: isobaric heating (ca. 700MPa).
SM2 stage: crustal partial melting (ca. 90Ma). Evolution of granulite facies rocks in the lower crust and ascent of the granitic magma.
M3 stage: highest P-T condition, spinel + quartz assemblage (600-700MPa and 870-900C).
SM4 stage: cooling and decompression with simple shear.
SM5 stage: intrusion of the Sumikawa granodiorite body (20Ma).

On the other hand, the mylonitized Bakeana granodiorite suite and the massive Ohibara granodiorite suite (54.2Ma) are distributed in the northern part of the Asahi Mountains (Agency of Natural Resources and Energy 1982; Research Group of the Asahi Mountains, 1987). The Bakeana granodiorite encloses metamorphic rocks (the Awataki gneiss, (Konda, 1972)) which also mylonitized. The Awataki gneiss can be subdivide to two groups; (1) the aluminous gneiss group and (2) the biotite gneiss group. The aluminous gneiss group shows leucocratic lithofacies and is aluminosilicate (andalusite and/or sillimanite) bearing rocks. The biotite gneiss group is biotite bearing or cummingtonite-biotite bearing rocks. The aluminous gneiss are thought to be originally peraluminous granite, because it encloses biotite gneiss, and also sometimes it remains igneous textures. P-T-t-D path of the Awataki gneiss has been determined by the petrological studies. These are,

AW1 stage: primary metamorphism of the biotite gneiss.
AW2 stage: intrusion of the peraluminous granites (precursor of the aluminous gneiss).
AW3 stage: syn-tectonic intrusion of the Bakeana granodiorite (Late Cretaceous) and primary contact metamorphism of the aluminous gneiss (250MPa, 700C). Syn-metamorphic sinistral simple shear deformation.
AW4 stage: decompression? with sinistral simple shear deformation.
AW5 stage: intrusion of the Ohibara granodiorite (54.2Ma). Secondary contact metamorphism of the aluminous gneiss (100MPa, 700C).

If the both area were grouped in a geological unit, the crustal event of the Uetsu area is thought to be as the following,

Stage I: isobaric heating
Stage II : high-temperature metamorphism and evolution of granitic magma in the lower crust (100-90Ma?)
Stage III: ultrahigh-temperature metamorphism?
Stage IV: crustal uplifting with sinistral simple shear deformation.
Stage V: intrusion of massive granitoids (Paleogene)

The features of the P-T-t path of metamorphic rocks and the igneous activities are different with that of the Abukuma belt, but similar with that of the Ryoke belt.