G061-P009 Time: May 29 17:00-18:30

Lattice strain analysis of quartz obtained from gauge of Nojima fault

Shigenobu Yamada[1], Nobuyuki Aikawa[2], Hiroo Nemoto[1], Koichi Nakagawa[3]

[1] Geosciences, Osaka City Univ., [2] Geosciences, Osaka City Univ, [3] Geosci., Osaka City Univ.

1. Introduction:

When we discuss about dynamics of fault rupture, it is important to consider the fault zone that is characterized by fault gauge. The minerals composed of the fault gauge have the lattice strain due to plastic deformation. In this study, we find out the lattice strain, dislocation density, differential stress, CI (Crystallinity Index) of the quartz in the fault gauge of Nojima fault.

2. Sampling:

Samples were collected for analysis from two locations- Hirabayashi and southern part of Origataniike. Samples were collected from 4 and 3 outcrop sites in Hirabayashi and southern part of Origataniike, respectively. The quartz in fault gouge from those locations was compared with the quartz in granodiorite obtained from 1395 m depth of Toshima 1800 m observation well. The hexagonal columnar quartz from Minas Gerais in Brazil was used as a standard sample.

3. Methods of lattice strain analysis:

Based on size, the samples were divided into three fractions: less than 75 micrometer, 75-125 micrometer, and 125-250 micrometer and the quartz was separated.

The operating condition of the X-ray powder diffractometer is as follows: RIGAKU RAD-1A, Cu radiation- 30 kV 10 mA, measuring method- fix time, scanning rate- 0.02deg/10sec, slit- 1 deg - 0.15 mm - 1 deg, measurement degree- a set of five peaks at 66.5 - 69.5 deg, d (220) at 76.5 - 79.0 deg.

Half bandwidth was obtained by PEAK FIT (SPSS, 1997), which was corrected by standard sample. The lattice strain was calculated from which differential stress was estimated. CI was calculated by proportion of the intensity at a set of five peaks.

4. Results:

Half bandwidth of the quartz of fault gouge and that of granodiorite was compared for X-ray profile of d (220). It is found that the half bandwidth of quartz in gauge is significantly broader than the quartz in granodiorite.

The calculated lattice strain shows that the smaller the grain size of the quartz of fault gauge, the larger the strain. The lattice strain of quartz from granodirite is 3.883, and the differential stress is 54.7 MPa. The largest lattice strain and differential stress in the gauge samples is obtained from less than 75 micrometer sized quartz sample of Hirabayashi (lattice strain: 7.724, differential stress: 116 MPa). The smallest lattice strain and differential stress in the gauge samples is obtained from 125-250 micrometer sized quartz sample of southern part of Origataniike (lattice strain: 4.572, differential stress: 65.2 MPa).

CI, as calculated from five peaks of granodirite, is 9.22. The largest CI in the fault gauge samples is from 125-250 micrometer sized quartz sample from southern part of Origataniike (CI: 9.13). The smallest CI in the gauge samples is from less than 75 micrometer sized quartz sample of Hirabayashi (CI: 7.45). The CI is higher when the grain size is smaller and the strain in quartz is high.

5. Discussion:

The strain in the quartz from fault gouge is high in comparison to that of the quartz sample from granodiorite. The smaller grain size of the quartz exhibits larger lattice strain. The lattice strain in quartz in the fault gauge is resulted from the fault movement. For future works, we need to compare the lattice strain of other mineral in fault gauges. In order to study the detailed relationship between the grain size of mineral and lattice strain, it is necessary to divide the samples into narrow grain size intervals.