The detailed structure of cracks and faults in rock samples

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The crack growth in rock samples under confining pressure has been indirectly investigated by means of velocity and amplitude of elastic waves (e.g., Lockner et al., 1977; Yukutake, 1989). Though they can be measured during experiments, microscopic structures cannot be detected because of a small number of sensors. The detailed structure of faults and cracks was investigated by using medical X-ray CT scanner (Kawakata et al., 1999). Recently developed micro- focus X-ray CT scanning system has a higher resolution than medical X-ray CT scanner, and it is expected that more detailed images can be obtained.

To understand the microscopic structure of cracks and faults in rock samples, Okuno et al. (2008) got internal images of fracturing rock samples using a micro-focus X-ray CT scan. They used cylindrical Westerly granite samples (50 mm in diameter and 100 mm in height) that were triaxially compressed under dry conditions at an ambient temperature with a confining pressure of 80 MPa or 100 MPa. The resolution of the CT scanning system was as high as 53 micron for radial axis and 100 micron for cylindrical axis. The X-ray beam radiated from the system was polychromatic (consists of photons at different energies), and polychromatic X-ray products an artifact called beam hardening effect. Then, they could not evaluate absolute CT values, and calculated relative CT values to image microscopic structures such as step-over. Also, they tried to correct beam hardening effect, but they could not effectively correct effect around the sample edge.

In this study, we improve the correction of beam hardening effect. We multiplied cosine taper for the edge of simulated images of beam hardening effect, and successfully obtained effectively corrected images, and we could evaluate absolute CT value. Also, we estimated the spatial distribution of fault thickness, and found that the fault should be thicker around sample surface than that in sample interior, which was consistent with Kawakata et al. (2000).