Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SVC52-P08 Room:Convention Hall Time:May 21 17:15-18:15

Dike length and maximum width estimated by open fracture amount observed from its tip

KUSUMOTO, Shigekazu[1*], GESHI, Nobuo[2]

[1]Graduate School of Science and Engineering for Research, University of Toyama, [2]Geological Survey of Japan, AIST

In previous studies on estimation of magma overpressure from open fracture amount of dike (e.g., Delaney and Pollard, 1981; Pollard and Segall, 1987) and/or of regional stress field from aspect ratio (Length/Width) of dike (e.g., Gudmundsson, 1983), well known simple and famous equation given by Sneddon and Lowengrub (1969) has been applied. However, if we apply the equation to dike data observed in field and estimate an overpressure, it needed to know center or a total length of dike before analysis. In general, it is difficult to know them, and it would be commonly that a part of dike could be observed in field. In fact, for examples, the other tips of dikes shown by Geshi et al. (2010) have not been found in spite of outcropping on very ideal caldera wall in the Miyake-jima, Japan, and their length and maximum width have not been known yet. In this case, it is difficult to estimate the magma overpressure from open fracture amount of dike.

In this study, we suggest procedure estimating a total length of dike from open fracture amount observed from its tip. We employ the coordinate system that the origin of coordination put on the tip of dike. We rewrote the equation in this coordinate system, and estimate a total length and maximum width of dikes from their open fracture amounts by means of the non-linear least squares method.

Numerical tests we carried out gave excellent results, and we expected that our procedure would be applicable to field data. Then, we applied our procedure to non-feeder dikes observed on caldera wall in the Miyake-jima, Japan. As a result, it was estimated that a total length and maximum width of dikes distribute in between 80m and 270m, and in between 0.3m and 2.4m, respectively. Average aspect ratio (width/length) was estimated as 0.0083. The correlation between aspect ratio and dike length was negative. If Young's modulus and Poisson's ratio of parent rock would be assumed to be 1 GPa and 0.25, it was estimated that all magnitudes of the overpressure of magma were less than 10 MPa. Because this value is less than extensional strength of general rock, these non-feeder dikes might be arrested in the mountain.

[References]

Delaney and Pollard, 1981. U.S. Geol. Surv. Prof. Pap., 1202; Geshi et al., 2010. Geology, 38, 195-198; Gudmundsson, 1983., Jour. Struct. Geol., 5, 623-626; Pollard and Segall, 1987. Fracture Mechanics of Rocks edited by Atkinson, Academic Press; Sneddon and Lowengrub, 1969. Crack Problems in the Classical Theory of Elasticity, Wiley.

Keywords: Dike, Length of dike, Maximum width of dike, magma overpressure