Analyses of paleostress using healed and sealed microcracks in quartz from Tanzawa tonalite

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The miocene Tanzawa tonalite complex that exposed at the center of the Tanzawa mountains in the northwest of Kanagawa is located at collision zone of Izu-Ogasawara arc to Honshu arc. Paleostress of E-W compression during cooling of the tonalite complex (7Ma) was inferred from syn-plutonic dykes (Kanemaru and Takahashi, 2005). The present stress field in the Tanzawa area was investigated by in-situ stress measurement or focal mechanism of earthquake (Tsukahara and Ikeda, 1986). Measurement of microcracks orientation is powerful tool for the estimation of paleostress, as well as rock strength and fluid pathway (Takeshita and Yagi, 2001). Microcracks are formed perpendicular to sigma 3-axis of the stress. In this work, paleostress in the Tanzawa tonalite complex was estimated from the orientation of healed and sealed microcracks in quartz from the Azegamaru type tonalite.

Method: Twenty nine oriented samples were collected at Murokubo river in the north part, Mizunokisawa river in the west part, Shiraishisawa river, Yokisawa river, Inugoeji forestry road, Nishisawa river and Nakagawa river in the east part, and Omatasawa river in the middle part of the Azegamaru type body. Three orthogonal thin sections were prepared from the oriented samples. Strike and dip of intra-granular microcracks in quartz grains were measured with a universal stage. Poles to microcracks were displayed as contour diagrams. The data was corrected to avoid duplicate measurement along three thin sections.

Results: Both healed and sealed microcracks predominantly strike N-S strike at the north part, NE-SW strike at the west part, NNE-SSW strike at the east part, and NW-SE strike at the middle part of the Azegamaru type body. In average, healed microcracks strikes NNE-SSW and dip steeply, whereas sealed microcracks dip high angle and subsidiary subhorizontal. Densities (total crack length / total quartz area) of both microcracks vary in the location in the Azegamaru type body. It was observed that the density of both microcracks in the east part was higher than that in the west part of the body.

Interpretation: Regional stress field during the formation of the healed microcracks has not changed dramatically until the formation of the sealed microcracks. Farther more the preferred orientations of both microcracks almost coincide with the results obtained by in-situ stress measurements using a stress relief method in the Tanzawa mountains (Geological Survey of Japan, 1980). Accordingly sigma 1 of NNE direction has been not changed till now. High density of microcracks in the east part of the body is presumably related to the N-S fault in the east part of the body.