

Estimation of the paleostress directions using “new dyke method” from the microcracks in the Tanzawa Tonalite

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The Tanzawa Tonalite intruded around 5-4 Ma (Tani et al. 2010) is located in the South Fossa Magna region that records the collision of Izu-Bonin Arc against the Honshu Arc. The paleostress direction has been estimated from the analysis of microcracks in quartz grains in the Tonalite (Sato and Takagi, 2010). Healed microcracks (HC) forming the plane of fluid inclusions are considered that they had formed just after the intrusion using fluid inclusion thermometry, and sealed microcracks (SC) had formed after HC formation by crosscutting relationship. The orientations of both HC and SC indicate that σ_{Hmax} keeps around N-S~NNE-SSW direction. Recently, Yamaji et al. (2010), and Yamaji and Sato (2011) developed new method of grouping the orientations of dikes or veins (cracks) recording different stress field, and then to determine σ_1 , σ_2 , σ_3 axes of each group and stress ratios by fitting mixed Bingham distribution (Bingham, 1974) (hereinafter called “new dyke method”). In this study, we estimated the paleostress using “new dyke method” for oriented samples used by Sato and Takagi (2010) to make it clear whether the σ_{Hmax} is σ_1 or σ_2 .

We measured strikes and dips of intracrystalline HC and SC using U-stage, and then analysed the distribution using “new dyke method” and the correction developed by Kanai et al. (2014) to determine σ_1 , σ_2 and σ_3 .

As a result, the dominant stress directions for 16 points (HC) and for 22 points (SC) indicate that σ_1 for HC and SC concentrates in vertical and NE-SW direction, respectively. With correcting 10° clockwise rotation by paleomagnetic research (Kanamaru and Takahashi, 2005), the paleostress orientation results should be vertical around 4Ma, and in NNE-SSW direction after 4Ma. Accordingly, the σ_{Hmax} evaluated by HCs after Sato and Takagi (2010) is actually σ_2 , and this vertical stress seems to reflect the stress caused by the lifting in vertical direction along with subduction of Philippine Sea Plate placing the volcanic islands on it. On the other hand, the NNE-SSW direction of σ_1 estimated by SCs can be explained by the collision of relatively large blocks that might be the Izu Peninsula collided around 1 Ma.

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