Structural development of cataclasite zones associated with large-scale faulting: an example of the Median Tectonic Line

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The Median Tectonic Line (MTL) is the largest fault, which defines the boundary between the Cretaceous Sambagawa high P/T-type metamorphic rocks and the Ryoke low P/T-type metamorphic rocks and granitoids. The MTL in eastern Kii Peninsula is known as a non-active fault, and preserves the structural development at the brittle-ductile transition conditions formed at deep levels of the crust. There are some detailed researches focused on the MTL distributed in Tsukide-area, Iitaka-town, Matsusaka-city, Mie-prefecture (e.g. Jefferies *et al.,* 2006, Webberley and Shimamoto, 2003). However, in this area there are few researches which cover a broad area including the MTL for understanding of the development process of the fault zone. In this study, we constructed a geological map around the MTL and analyzed the microstructures in deformed rocks, and conducted analyses of microchemistry with EDS and XRD aided by RockJock (Eberl. D. D. 2003) in order to identify fractures and newly-grown mineral phases. Then, in comparison with the existing fault zone development model (Fusseis *et al.,* 2006, Schrank *et al.,* 2008), we discussed the structural development process of fault zones along the MTL with brittle deformation. In this study, we first measured the crack density (number/cm) in cataclasite and fractured protomylonite. As a result of the measurements, we classified deformed granitic rocks into four groups: very weakly, weakly, moderately, strongly fractured rocks. It has been found that the crack density decreases in the rocks with increase in distance from the MTL from strongly through moderately to weakly fractured rocks, and finally to very weakly fractured protomylonite. As a result of the mineral composition mode measurement with XRD, we showed that the proportion of plagioclase in cataclasite decreases, on the other hand, the proportion of the clay minerals (e.g. muscovite and chlorite) increases with decrease in distance from the MTL. The cataclasite which deformed in direct proximity to the MTL exhibits Fe-rich pressure solution seams, and contains the clasts of strongly deformed mylonite (ultramylonite). Based on the results described above, we showed the three stages exist in the structural development of the cataclasite and fractured protomylonite: increase of the crack density, increase of the matrix with reduction in grain size, and foliation formation. In the stage of increase of the matrix with reduction in grain size, it seems that the cracks which are initially created in intact rocks gradually grow and widen, and the softening of minerals by chemical reaction like muscovitization of feldspars promotes the production of the matrix. In the stage of foliation formation, the increase of modal ratio of clay minerals and development of their preferred orientations resulting from pressure solution and precipitation are responsible for the formation. We particularly showed the degree of fracture development in fault rocks in the cataclasite zone is very heterogeneous. The fact could be partly attributed to the fact that the architecture of the protolith mylonite zone had a heterogeneous structure: not consisting of homogeneous mylonite, but varying from ultramylonite through mylonite to protomylonite away from the MTL. Finally, we concluded that the cataclasite started to form in the ultramylonite in direct proximity to the MTL, and propagated toward the protomylonite away from the MTL, as the site of stress concentration moved away from the MTL, due to the softening of strongly fractured rocks.

Keywords: Median Tectonic Line, cataclasite, fault zone, pressure solution, clay minerals

