Structural development in cataclasite zones associated with faulting: an example of the Median Tectonic Line

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The Median Tectonic Line (MTL) is extended more than 800 km in the East-West direction in Southwest Japan, and it is the largest fault, which defines the boundary between the Sambagawa and the Ryoke belts. It is very important to observe exhumed faults, which were active in the past for understanding the development of fractures along faults. In this study, we described the geological map around the MTL, which is distributed in Tsukide, Iitaka-town, Matsusaka-city, Mie-prefecture, and microstructures in deformed rocks and inferred their genesis. Then, we showed brittle fracturing along the MTL, and the development of geological structures related to the faulting.In this study, we mapped lithology along eight valleys, which extend ~300 m in N-S direction, in the area spanning 2 km in E-W direction, including the MTL. As a result of field study, we showed that around the MTL the rocks are structurally overlain in the ascending order of the Sambagawa pelitic schist (>50 m) and pelitic schist derived from chert-laminite (~90m), and cataclasite (~80m) and fractured protomylonite derived from the Ryoke Granitoids (>15m). Furthermore, we classified protomylonite and cataclasite distributed in this region by two kinds of microstructures; crack density (/cm) and the ratio of matrix and clast (%). As a result of crack density measurement, we classified deformed granitic rocks into four groups: non-, weakly, moderately, and strongly fractured rocks. In this classification, we showed that the rocks are strongly fractured near the MTL, and are moderately fractured far from the MTL. On the other hand, with respect to fragments caused by fracturing, we distinguished clasts from the fine-grained matrix, which is defined by fine-grained aggregates consisting of crushed particles with size <50 μm. From the preliminary results, we divided the ratio of matrix in protomylonite and cataclasite samples into three classes; (A) ~20%, (B) 40~50%, (C) ~100%. Furthermore, based on the comparison of two different classification results and microstructural observation with scanning electron microscope (SEM), class (A) and (C) samples were further divided into two classes by the degree of development of cracks and by the presence of strongly foliated structure, respectively. Further, we can show that it seems that the crack density is related to the ratio of clast and matrix between non- to weakly fractured and class (A) rocks, while between moderately to strongly fractured and class (B) to (C) rocks, these two microstructure indices are not correlated.Based on the results described above, we classified protomylonite and cataclasite in this region into 5 classes (the rocks which have the least ratio of matrix and crack density are defines as class 1). Further, we showed that in the structural development of cataclasite three stages may exist; increase of crack density (1 to 2), reduction in grain size (2 to 4), and foliation formation (4 to 5).In the stage of reduction in grain size, it seems that the cracks which are initially created gradually grow and widen, and the area of matrix increases. In the stage of foliation formation, the ratio of quartz and clay minerals and their preferred orientations resulting from pressure solution and precipitation could be responsible for the formation. Based on the spatial distribution of different classes of protomylonite and cataclasite in the geological map, it has been found that in the protomylonite zone rocks of class 1 and 2 exist, while in direct proximity to the MTL rocks of class 5 exist, though between those classes of rocks cataclasites of class 3, 4 and 5 are distributed heterogeneously. This heterogeneity of fracture development in the cataclasite zone and the growth of cracks which results in the increase of the area of matrix can be discussed in relation to the existing models of development of fault zone (Fusseis *et al.,* 2006, Schrank *et al.,* 2008).

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