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Distinct difference of metamorphic texture between high P/T and low P/T metapelites

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Localization of deformation and reaction will affect macroscopic evolution of metamorphic belt in the crust. To evaluate localization of deformation and reaction, metamorphic textures of metapelites from high P/T metamorphic belt (Sanbagawa Metamorphic Rocks) and low P/T metamorphic belt (Ryoke Metamorphic Rocks) are examined.

Distinct difference of metamorphic textures between high P/T and low P/T metapelites is observed with EPMA mappings of thin sections as follows. Metamorphic differentiation and coarsening of metamorphic minerals progressed well in high P/T metapelites. Quartz-rich layers or lenses are formed in high P/T metapelites. On the other hand, mosaic textures of quartz-rich and Al-bearing mineral domains are developed in low P/T metapelites. Textures of migmatite of low P/T metamorphic rocks are exceptional and complex. Coarsening of metamorphic plagioclase is clear in high P/T metamorphic rocks. Average size of metamorphic plagioclase in higher-grade high P/T metapelites is about 10 times larger than those of lower-grade high P/T metapelites. At the same metamorphic temperature (around 500 ?C), average size of metamorphic plagioclase of high P/T metapelites is about 10 times larger than those of low P/T metapelites. Exceptionally, average size of metamorphic plagioclase in migmatites is much larger than those in the non-migmatitic low P/T metapelites.

It is suggested that quartz-rich layers or lenses in high P/T metapelites were formed by deformation, because these layers or lenses are parallel or subparallel to schistosity. To examine the deformation-associated metamorphic differentiation, deformation of immiscible two-phase viscous fluid is simulated. The results of deformation of the two-phase fluids without viscosity contrast show that coarsening of the each mosaic domain takes place. And multi-layers or elongated mosaic structures are formed by deformation. On the other hand, the results of deformation of the two-phase fluids with viscosity contrast show that branching layered structures or lenses of lower viscosity fluid are formed. These types of structures are developed with strain localizing in low viscosity fluid.

The numerical simulations suggest that formation of quartz-rich layers or lenses in high P/T metapelites is caused by strain localization in quartz-rich domain. On the other hand, coalescence and precipitation-dissolution are important for coarsening of metamorphic minerals with deformation. Because dihedral angle between quartz and water becomes less than 60? at high P/T conditions, fluid network will be formed within quartz-rich layers or lenses, which will enhance reaction-diffusion in high P/T metapelites. The above-mentioned mechanism has a positive feedback, therefore, it is expected that textural evolution due to deformation and reaction in high P/T metapelites will accelerate progress of deformation and reaction.

Keywords: metamorphic rock, metamorphic texture