

Timing of crack sealing in the Shimanto metamorphic rocks

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The sealed cracks in the Shimanto metamorphic rocks in the eastern Kyushu are mainly filled with quartz in deformed metacherts. The bulk strain magnitude and geometry of the metacherts have been determined earlier by Toriumi and Teruya(1988) by means of deformed radiolarian method. If the cracks sealed by quartz are deformed plastically, the ratio between strains by drms and strains by sealed cracks becomes possible marker of the timing and time scales of the crack sealing in the plate boundary metamorphic rocks.

Samples studied here were collected from metacherts above the Nobeoka Tectonic Line which belong to the ductile shear zone along the NTL studied in detail by Toriumi and Teruya together with metamorphic rocks. Maximum elongation orientation of the metacherts are nearly normal to the NTL showing that the strain geometry of plane strain type. The metamorphic temperatures estimated from prehnite ? pumpellyite ? epidote chemistries with actinolite reach about 250-300 C. The metamorphosed and plastically deformed cherts contain abundant deformed radiolarians and sealed cracks. Those are composed mainly of quartz as well as matrix, but the grain size of quartz in sealed cracks is much larger than those in matrix and radiolarians, suggesting that there seems slight contrast in effective viscosity between them.

The author measured the aspect ratios of the deformed radiolarians and geometries of deformed sealed cracks: thickness, wave length and amplitude of the sealed cracks in the single thin sections. Cutting surfaces are b- and a- tectonic planes. The data were plotted in the deformation magnitude from deformed shape of radiolarians and deformed ? folded sealed cracks in the single thin sections. We concluded that the timing of crack sealing took place during prograde and retrograde stages. The frequency of crack sealing suggests intermittent but not continuous in the plate boundary process. Thus, we concluded that the plate boundary zone should contain abundant various cracks so that the permeability of this zone is very large compared with surrounding zones.