

Paleostress profile across the Sanbagawa metamorphic belt along the Asemi River, Central Shikoku, Japan, estimated from dynamically recrystallized grain size of quartz

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We measured quartz grain sizes in the Sanbagawa metamorphic belt, Central Shikoku area, Japan using EBSD mapping to obtain grain size profile across the metamorphic belt. Previously, it was suggested that grain sizes decrease southward from the biotite zone (high temperature) to the high-grade side of the chlorite zone (low temperature) and increase again at one locality in the low-grade side of the chlorite zone (Ueda and Shimizu, 2017, JpGU-AGU). We collected new samples from new localities mainly in the chlorite zone to confirm the grain size profile and estimated the paleostress profile across the metamorphic belt. As with previously analyzed samples, analyzed areas were chosen so that most quartz grains are not sandwiched or surrounded by other minerals.

The new data lie well on the interpolated curve of the previous grain size data in the high-grade side of the chlorite zone. The gradually decreasing grain size profile go across metamorphic isograds. This suggests that the grain sizes reflect the deformation associated with the metamorphism. In the low-grade side of the chlorite zone, the new data lie around the previously-obtained value. In the high-grade side of the chlorite zone, quartz grains show fabrics with c-axis parallel to the foliation and perpendicular to the lineation. The quartz deformation structures indicate subgrain rotation recrystallization and grain boundary migration toward subgrain boundaries in neighboring quartz grains. In the low-grade side of the chlorite zone, quartz fabrics are rather random, but quartz grains still show subgrain boundaries and grain boundary migration toward subgrain boundaries in neighboring grains, suggesting dynamic recrystallization. These quartz deformation structures are common throughout in quartz schist in the analyzed samples. This indicates that all the obtained quartz grain sizes are the product of dynamic recrystallization. By applying grain size piezometers, it is suggested that there are a stress peak at the high-grade side of the chlorite zone and a stress decrease toward the low-grade side in the chlorite zone.

Keywords: grain size piezometer, subduction zone, paleostress profile