Thermobaric structure of the Ryoke belt

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Pressure-temperature conditions of metamorphism in the Yanai district, Ryoke belt, SW Japan, have been determined using garnet-biotite thermometry in combination with an empirically calibrated barometer in the assemblage common in pelitic and siliceous rocks, garnet + biotite + plagioclase + quartz. The barometer estimates pressure difference between a well-established sample and unknown samples based on the reaction,

pyrope + grossular + eastonite + quartz = phlogopite + anorthite.

Pressure and pressure gradient increased with increasing temperature such that pressures of high-grade area exceeded that of the triple point of aluminosilicates. The thermobaric structure of the study area shows that pressure increased up to 6 kbar with southward increase in metamorphic temperature up to the highest-grade area, the garnet-cordierite zone. Further south, pressure was almost the same as that of the garnet-cordierite zone and temperature decreased. This asymmetric distribution of metamorphic conditions on both sides of the garnet-cordierite zone can explain the asymmetric distribution of metamorphic zones; the K-feldspar-cordierite zone and sillimanite-K-feldspar zone on the north and south sides of the garnet-cordierite zone, respectively. The breakdown reaction of muscovite and quartz defines the beginning of both the K-feldspar-cordierite zone and sillimanite-K-feldspar zone, which took place under low and high pressures, respectively. These thermobaric structures suggest that temperature varied laterally at mid-crustal level during the peak of metamorphism.