

Reaction to define the orthopyroxene isograd of the Ryoke metamorphism in the Yana area, SW Japan

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Recent studies have revealed that the highest grade of the Ryoke metamorphism belongs to the granulite facies, contrary to the amphibolite facies as previously asserted. This study proposed the reaction to define the orthopyroxene isograd in Yanai area, SW Japan.

The coexistence of garnet and cordierite in pelitic rocks defines the highest-grade metamorphic zone of the study area, garnet-cordierite zone. Metabasic assemblages including orthopyroxene occur only in the garnet-cordierite zone. The orthopyroxene isograd is spatially coincident with the boundary between the garnet-cordierite zone and the lower-grade K-feldspar-cordierite zone, occurring on the northern-side of the garnet-cordierite zone. The chemical compositions of hornblende and biotite have significant variation depending on mineral assemblages in each metamorphic zone. The hornblende and biotite that coexisted with each other together with cummingtonite represent systematic compositional change with metamorphic grade. Based on these compositional changes of constituent minerals, we proposed the following reaction that accounts for the formation of orthopyroxene at the isograd:

Al, Fe+Mg-rich biotite
+ Si, Fe+Mg-rich hornblende
+ ilmenite + quartz

= Ti-rich biotite
+ Al, Ti-rich hornblende
+ orthopyroxene.