Contrasting pressure-temperature records from the Altai Range, Mongolia; constraints from multiple growth of garnet, aluminosilicates and monazite

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Pelitic gneisses from the western Mongolian Altai Range of the Central Asian Orogenic Belt exhibit multistage aluminosilicate formation and various chemical zoning patterns in garnet. The studied pelitic rocks are divided into four types; garnet-kyanite-biotite gneiss, garnet-cordierite-biotite gneiss, garnet-staurolite-sillimanite-biotite gneiss, and garnet-staurolite-kyanite-biotite gneiss. The former two gneisses contain kyanite in the matrix and sillimanite inclusions in garnet. The Ca concentrations in garnet from the garnet-kyanite-biotite gneiss increase and those from garnet-cordierite-biotite gneiss decrease from centre to inner rim in the core. In garnet-staurolite-sillimanite-biotite gneiss, and garnet-staurolite-kyanite-biotite gneiss, sillimanite or kyanite occurs in the matrix, respectively, and both have kyanite inclusions in garnet. The garnet has homogeneous high-Ca core part, and the mantles are characterized by low-Ca.

Monazite U-Th-Pb dating for the studied samples shows the bimodal ages; c. 360 Ma and c. 260 Ma. Combining the microstructural information, thermodynamic calculations, and geochronology suggests all rock types experienced compression at c. 360 Ma, but this compression occurred at different crustal levels. The garnet-kyanite-biotite gneiss and garnet core in garnet-cordierite-biotite gneiss increase from centre to inner rim in the core. In garnet-staurolite-sillimanite-biotite gneiss, and garnet-staurolite-kyanite-biotite gneiss, sillimanite or kyanite occurs in the matrix, respectively, and both have kyanite inclusions in garnet. The garnet has homogeneous high-Ca core part, and the mantles are characterized by low-Ca.

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Keywords: garnet, aluminosilicate, monazite, pressure-temperature path, Altai, Mongolia