The Jurassic accretions on the eastern border of Central Asian Orogenic Belt: evidences from the glaucophanic metamorphic sequences (Heilongjiang Complex) in the Jiamusi Massif, NE China

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The Jiamusi Massif is located in northeastern China along the eastern border of the Central Asian Orogenic Belt, which lies between the Siberian and Sino-Korean cratons (Sengör et al., 1993). The Heilongjiang Complex exposed in the western margin of the Jiamusi Massif is characterized by high-P/T metamorphic rocks of blueschists and pelitic schists with thin intercalation of siliceous schists and marbles, as well as ultramafic bodies varying in size, suggesting a tectonic mélange metamorphosed in the subduction zone between the Jiamusi massif and the Songnen massif (e.g. Wu et al., 2007).

In this study, high-P/T metamorphic rocks of the Heilongjiang Complex have been petrologically and geochronologically investigated. Garnet barroisite schists consist mainly of albite (An < 2), amphibole (glaucophane, barroisite, and actinolite with rare katophorite and winchite), phengite (Si = 6.5-6.8 pfu), epidote, garnet (Alm_{41-69}SpS_{20-48}Gr_{15-33}Py_{1-5}), quartz and titanite with minor stilpnomelane, apatite, rutile, magnetite, hematite and ilmenite, suggesting the peak stage of the epidote-amphibolite facies (T = 500-540 °C and P = 10-12 kbar; Li et al., 2010).

Epidote-glaucophane schists are composed mainly of phengite (Si = 6.7-6.9 pfu), glaucophane, albite (An < 2), quartz, epidote and titanite, with minor amounts of chlorite, apatite and rutile, revealing the peak stage of the epidote blueschist facies (T = 350-550 °C and P = 10-15 kbar). Pelitic schists consist mainly of quartz, phengite (Si = 6.7-6.9 pfu), chlorite and albite (An < 2), with minor apatite and carbonaceous matters, and the garnet (Alm_{26-45}SpS_{20-43}Gr_{30-33}Py_{1-2}) additionally occurs in the sample (09YL10-1). The mineral assemblages of the pelitic schists also suggest a high-pressure metamorphism.

Two groups of \(^{40}\text{Ar}/^{39}\text{Ar}\) ages of phengites as 161-175 Ma and 145-146 Ma have been obtained from the pelitic schists and epidote-glaucophane schists, respectively (Li et al., 2009). A \(^{40}\text{Ar}/^{39}\text{Ar}\) plateau age of 179.9±0.8 Ma for phengite from the pelitic schists (422YQ-3) and a \(^{40}\text{Ar}/^{39}\text{Ar}\) total gas age of 189.8±0.8 Ma (I.C. age of 188.7±4.2 Ma) for phengite from the garnet-barroisite schists (423YJ-1) are newly obtained. The relatively old age group of 180-190 Ma should be included as the ages of the high-P/T Heilongjiang metamorphism, suggesting the multi-events of the high-P/T metamorphism and subsequent exhumation of the Heilongjiang Complex in the Jiamusi Massif. In addition, the LA-ICPMS U-Pb ages of detrital zircons from the pelitic schists (LG1-3) give a weighted mean age of 251.5±5.0 Ma (MSWD = 2.4), in contrast, the pelitic schists (09YL10-1) contains distinct populations of inherited zircon at mostly 190-270 Ma with minor 320-560 Ma and 780-1000 Ma, which are identical with the previously reported ages of detrital zircons (Zhou et al., 2009). The oscillatory zoning in CL images and Th/U ratios (0.10-2.33) indicate the U-Pb zircon ages are the formation ages of the igneous protolith. All the results presented here significantly contribute to supporting the view that the protoliths of the high-P/T metamorphic sequences (Heilongjiang Complex) were probably derived from Permian to Triassic batholiths, and the Jiamusi Massif was collided to the eastern border of Central Asian Orogenic Belt at the time of Jurassic period.

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