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High-P/T metamorphic rocks in the Yilan area from Jiamusi massif, northeastern China

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The Heilongjiang Complex exposed in the western margin of Jiamusi Massif is characterized by high-P/T metamorphic rokcs of blueschists and pelitic schists with thin intercalation of siliceous schists and marbles, as well as ultramafic bodies varying in size, suggesting a tectonic melange metamorphosed in the subduction zone between the Jiamusi massif and Songnen massif (e.g. Wu et al., 2007). Metamorphic history of the Heilongjiang Complex has been suggested as 1) peak metamorphic stage (blueschist facies conditions; T=350-450℃ and P=6-7 kbar) and 2) retrograde stage (greenschist facies conditions) (e.g. Bai et al., 1988). Phengite $^{40}Ar/^{39}Ar$ ages of 165-175 Ma and 145-146 Ma for the blueschist facies metamorphism in the Heilongjiang Complex reveals the time of subduction and subsequent exhumation (e.g. Li et al., 2009).
In this study, high-P/T metamorphic rocks have been petrologically investigated from the Heilongjiang Complex in the Yilan area. Garnet barroistite schists consist mainly of albite (An<2), amphibole (glaucophane, barroisite and actinolite with rare ketophorite and winchite), phengite (Si =6.5-6.8 pfu), epidote (X_{Ps}=0.10-0.33), garnet ($Alm_{41-69}Sps_{8-39}Grs_{15-34}Py_{1-5}$), quartz and titanite with minor stilpnomelane, apatite, rutile, magnetite, hematite and ilmenite. A schistosity is defined by preferred orientation of chlorite, phengite and barroisite. Albite and epidote generally occurs as porphyroblast. Three-stage clockwise P-T evolution has been recognized: pre-peak stage of epidote-blueschist facies is characterized by inclusions of glaucophane, actinolite, and albite in barroisites, as well as phengite, epidote, glaucophane, garnet, titanite, and hematite included in porphyroblastic epidotes; peak stage of epidote-amphibolite facies (T=500-540℃ and P=10-12 kbar; by THERMOCALC) is characterized by inclusions in porphyroblastic albite such as garnet, epidote, barroisitic amphibole, phengite, chlorite and hematite along with schistosity-forming minerals of barroisite, phengite and porphyroblastic epidote; and retrograde stage of greenschist facies is represented by the amphibole rims of actinolite, porphyroblastic albite, titanite, stilpnomelane and magnetite.
Glaucophane sodic-pyroxene schists generally show a vesicular structure, and they consist mainly of albite (An<2), amphibole (glaucophane, katophorite and winchite), epidote (X_{Ps}=0.20-0.34), titanite, sodic-pyroxene [aegirine-augite (Jd<33 %) and aegirine (Ae=86-94 %)], chlorite, quartz, biotite and calcite with minor amounts of phengite (Si=6.6 pfu), apatite, magnetite and hematite. Albite and epidote commonly occurs as porphyroblast. Amphibole generally exhibits compositional zoning from winchite core through glaucophane mantle to katophorite rim, indicating progressive recrystallization with increasing of pressure and temperature conditions. The constituent minerals of katophorite, epidote, sodic-pyroxene, phengite and titanite with minor hematite and quartz are stable at the peak metamorphic stage of epidote-amphibolite facies, suggesting the temperature condition over 500℃.Maximum X_{jd}(=0.33) in aegirine-augite indicates the minimum pressure of 10 kbar for the pre-peak and the peak metamorphism. The sodic-amphiboles and sodic-pyroxenes are partly replaced by chlorites and biotites revealing the P-T conditions proceeding to greenschist facies.
The petrologic investigation of the samples above collected from the different locations at a distance reveals similar metamorphic process of high-P/T type reaching to the peak

metamorphism of epidote-amphibolite facies. The facts presented here in conjunction with previous data reveal that the peak metamorphic conditions obtained for the Heilongjiang Complex are varying in different areas, from epidote-blueschist facies to epidote-amphibolite facies.

Keywords: High-P/T, Heilongjiang Complex, Jiamusi Massif, northeastern China