Metamorphic evolution of eclogites in the Alag Khadny metamorphic complex, Lake Zone, SW Mongolia

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The eclogite-bearing Alag Khadny metamorphic complex in the Lake Zone, SW Mongolia located in the central part of the Central Asian Orogenic Belt, consist mainly of orthogneisses which interleaving with marbles including lenses of garnet-chloritoid schists of Maykhan Tsakhir Formation. Eclogites occur as lenses or boudins in orthogneisses and marbles, and their peak metamorphic conditions have been estimated as 590-610°C and 20-22.5 kbar (Stipska *et al*., 2010). Garnet-chloritoid schists occur as lenses or layers within marbles, which lie in contact with eclogite bodies showing distinct lower *P-T* conditions than eclogite (Javkhlan *et al*., 2013).
Glaucophane-bearing and amphibolitized eclogite consists mainly of garnet, clinopyroxene, sodic, sodic-calcic and calcic amphiboles (Gln, Brs, Fprg, Ts, Fts, Fe/Mg-Hbl, Act) with subordinate amounts of epidote, phengite (Si 6.51-7.11 pfu), plagioclase, K-feldspar, chlorite, rutile, titanite and quartz. Garnets display a prograde zoning (Sps_{9-1}, Prp_{5-19}, $Grs_{27-31-20}$), and the core of the garnets contains polyphase and discrete inclusions of amphibole (Trm, Prg, Ts) and plagioclase ($An_{<17}$), and also contains aegirine-augite/omphacite (Jd_{14-21}), epidote, K-feldspar, rutile and titanite. The rim of the garnet contains omphacite (Jd_{32-41}), barroisite, phengite, epidote and rutile. Omphacite (Jd_{27-46}) in the matrix are zoned, increasing jadeite content from core to rim (Jd_{27-41}). Omphacites are partly replaced by symplectite of diopside/aegirine-augite/omphacite ($Jd_{<25}$), Mg-hornblende and plagioclase ($An_{<13}$). Amphiboles in the matrix are zoned with glaucophane core through barroisite mantle to Mg-hornblende rim, and the others are actinolite/barroisite core and hornblende to tschermakite rim coexisting with large plagioclase ($An_{<18}$), which contains fragments of barroisitic amphibole and garnet.
Alag Khadny eclogites experienced multiple metamorphic events, i.e. precursor metamorphic event of relatively high-*T/P* metamorphism of amphibolite facies prior to eclogite metamorphism represented by pargasite/tschermakite and plagioclase ($An_{<17}$) inclusions in the core of the garnets. The minerals in the matrix are representative of eclogitic metamorphism and the prograde path pass through the epidote-blueschist facies to the eclogite facies. *P-T* pseudosections were calculated in the NCKFMASHO model system and compositional isopleths of garnet suggest the peak metamorphic conditions of the eclogite as 590-620°C and 21-22 kbar and retrograded into 510-540°C and 9-11 kbar in the epidote-amphibolite facies. Zoned amphiboles in the matrix (Act/Brs core Hbl to Ts rim) and associated large plagioclases suggest another prograde metamorphism of medium-*P* conditions. Peak eclogitic metamorphic conditions are similar to those of Stipska *et al*. (2010), and they correspond to subduction type metamorphic conditions with lower geothermal gradient (8°C/km). Subsequent medium-*P* metamorphism together with garnet-chloritoid schists (560-590°C/10-11 kbar; Javkhlan *et al*., 2013) took place in the higher geothermal gradient (19-20°C/km), and this metamorphic event is correspond to continental collision type metamorphism.
$^{40}Ar/^{39}Ar$ muscovite ages in the eclogites (543±3.9 Ma) within marbles and garnet-chloritoid schists (537±2.7 Ma) were determined (Stipska *et al*., 2010). K-Ar ages for eclogites (*c*. 600 Ma) within orthogneisses have been obtained by Javkhlan *et al*. (2014). These ages are interpreted as the exhumation ages for the eclogites and the garnet-chloritoid schists.

Keywords: eclogite, pseudosection modelling, garnet-chloritoid schist, Maykhan Tsakhir Formation, Lake Zone, SW Mongolia

