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Reconstructing the P-T-paths of mafic rocks enclosed in UHP schists of the Makbal Complex, Tianshan Mountains (Kazakhstan / Kyrgyzstan)

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Occurrences of high-pressure/ultra high-pressure – low-temperature (HP/UHP–LT) metamorphic rocks in orogenic belts provide a unique opportunity to obtain insight into subduction zone processes at great depth since they are the only natural, direct witness of such processes.
The Makbal Complex is one of the HP/UHP-LT metamorphic belts in the Tianshan mountain range. The Tianshan extents from north-western China over Kyrgyzstan and Kazakhstan to Tajikistan and is located in the south-west of the Central Asian Orogenic Belt (CAOB), the biggest Palaeozoic orogen on Earth.
Former studies on the Makbal Complex focused on either UHP metasedimentary rocks (garnet-chloritoid-talc schist) and/or HP eclogites, the latter of which normally occur as boudins in the metasediments (e.g., Tagiri et al., 2010). Until now, the Makbal Complex was assumed to be characterized by continental lithologies while metamorphosed sections of the oceanic crust (like blueschists) were supposed to be rare or absent (Konopelko et al., 2012). We conducted a detailed petrographic and petrologic investigation of mafic boudins enclosed in the UHP host rock. Besides strongly retrogressed eclogites, which have already been subject of previous studies, an omphacite-phengite-bearing blueschist was investigated for the first time.
Furthermore up to now, the metamorphic evolution of the different rock types from the Makbal Complex has not been constrained in detail, since only conventional geothermobarometric calculations were undertaken. These calculations resulted in rather vague P-T estimates (e.g., Tagiri et al., 2010). This study presents the first P-T pseudosection modeling of different rock types from the Makbal Complex. This approach is used to determine the P-T conditions and metamorphic evolution of the different (U)HP rocks. Phase relations and changes in mineral chemistry with changing P-T-conditions are elaborated using a pseudosection approach in the MnNCKFMASHTO system with the software Theriak-Domino (de Capitani & Brown, 1987, de Capitani & Petrakakis, 2010). Due to a rare preservation of suitable mineral assemblages for conventional geothermobarometry, the prograde P-T paths were derived from growth zoning of garnet porphyroblasts by applying garnet-isopleth thermobarometry (method of Evans, 2004, modified by Gaidies et al., 2006).
Our modeling suggests different peak metamorphic conditions for various rock types of the Makbal Complex. Variable peak metamorphic conditions including intimate interlayering of high- and ultra high-pressure rocks were also reported from other localities of the Tianshan. The intimate occurrences of these rocks suggest that they were derived from different depths of the subduction zone and subsequently juxtaposed during exhumation within the subduction channel.

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