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Geochemistry of the HP-UHP metamorphic rocks, Makbal complex, northern Kyrgyz Tien-Shan

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The Makbal UHP complex occurs in the western part of Kyrgyz Range of the Northern Tien-Shan and consists of quartzite and muscovite-quartzite, garnet-muscovite-quartz and chlorite-muscovite-quartz schists, marbles, amphibolites with relicts of eclogites and UHP talc-garnet-chloritoid schists (Tlc-Grt-Cld). The coesite has been found in quartzites and Tlc-Grt-Cld schists, and they experienced UHP metamorphism (P>29 kbar and T<600 ^{o}C), whereas the eclogites and garnet amphibolites are experienced mainly HP metamorphism with different peak P-T conditions (Tagiri et al., 2010). UHP Tlc-Grt-Cld schists are conformably intercalated in thick quartzite layers. Eclogites occur as imbricated lenses within these host UHPM rocks.

A phengite K-Ar age of 509+13 Ma (Tagiri et al., 2010), CHIME monazite age of 481+26 Ma (Togonbaeva et al., 2009) and 498+7 Ma for the UHP Tlc-Grt-Cld schist and paragonite K-Ar age of 482+17 Ma (Tagiri et al., 1995) and zircon SHRIMP U-Pb ages 509+7 Ma and 502+10 Ma (Konopelko et al., 2011) has been reported for the eclogite. The granitic rocks discordantly intruded in the Makbal complex are dated as 399+10 Ma (Tagiri et al. 2010).

We carried out whole-rock geochemistry analyses on major, trace and REE abundances for the eclogites, Qtz-Grt-carbonate rocks, Tlc-Grt-Cld schists, quartzites, garnetite and one clinopyroxene-biotite rich rocks (lamproite?) from the Makbal Formation. The classification diagrams, using major and trace elements, classify the eclogites as tholeiitic basalts. Tlc-Grt-Cld schists, garnetite and Qtz-Grt-Carb rocks plot in the same field. In the conventional tectonic discrimination diagrams, the eclogites plot in the field of MORB and VAB. Similarly, the Tlc-Grt-Cld schists and Qtz-Grt-Carb rocks show also same compositions in these diagrams as eclogites. However, Tlc-Grt-Cld schist have very low content of CaO (<2 wt%), Na2O (<0.1 wt %) and relatively high MgO (<18 wt %), which is not comparable with basaltic composition. Togonbaeva et al. (2010) pointed out the similarities of the eclogite and Tlc-Grt-Cld schists compositions, and they suggested that the Tlc-Grt-Cld schist is the mixture between eclogite protoliths (basaltic) and quartzites (pelitic) compositions.

Chondrite and primitive mantle normalized diagrams of REE and some trace element abundances show relatively similar pattern for the eclogites, Qtz-Grt-Carb rocks and Tlc-Grt-Cld schists, except some REE enrichments in Tlc-Grt-Cld schists. Eclogites and Tlc-Grt-Cld schists are depleted in incompatible elements (Rb, Ba, Sr, K, Ca), however enriched in Pb.

Here, we propose the possible metasomatic origin of Tlc-Grt-Cld schist in the Makbal complex, similarly to whiteschists formation in Dora-Maira Massif (DMM), Western Alps. Two main genetic hypotheses were proposed for the origin of whiteschists in DMM, i.e. sedimentary (highly Mg-meta-evaporite; Schreyer, 1977) vs. metasomatic (Mg-rich fluid into shear zones; Compagnoni & Hirajima, 2001; Schertl & Schreyer, 2008). We suggest that the origin of Tlc-Grt-Cld schist could be related to Mg-metasomatism on the basaltic protoliths of eclogites, at least prior to peak UHP conditions. This process can be responsible for the modification of some major and trace elements in the eclogites to more Mg-rich and Ca- and Na-poor, similarly to whiteschist in DMM. The metasomatic origin supported also by field relations of these rocks and their similar geochronological data.

References: Tagiri et al. (1995), Island Arc; Tagiri et al. (2010), JMPS; Togonbaeva et al. (2009), JMPS, Togonbaeva et al. (2010) JAMS Annual Meeting, Matsue; Compagnoni & Hirajima (2001), Lithos; Konopelko et al. (2011), Gondwana Research;

Schreyer (1977), Tectonophysics; Schertl & Schreyer (2008), Eur. Jour. Miner.

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