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Thermochronological modeling of the Greater Caucasus metamorphism age

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The pre-Alpine basement of the Central Caucasian terrain consists of several blocks: Main Range, Fore Range and Bechasyn. Each of them has their own characteristics of tectono-magmatic and metamorphic evolution. The relations between infrastructure (gneiss-mimgmatitic complex) and superstructure (crystalline schist) of the Main Range zone HT/LP blocks usually demonstrate tectonic disturbance of mutual contacts, often penetrated by latest (Hercynian) granite bodies. Some LP zones of the andalusite mica schist complex are almost totally amagmatic and were not effected by latest granite intrusions. Therefore they could be used for petrological investigation and isotope dating of the metamorphic evolution of the Greater Caucasus.

The andalusite mica schist with Grt from Mt. Cheget of Main Range zone is presented by mineral assemblage: Grt-Bt-Ms-And-Pl-Qtz +Ilm +Zrn +Mnz +Tur. Crystals of Grt up to 2 mm size are very rich of MnO (7-8 wt %) and demonstrate complicated prograde growths zoning with increasing of X_{mg} from core to rim (from 0.015 to 0.077). Preliminary estimated pick of metamorphic temperature is about 530-560^{o}C and pressure is 2-3 kbar. Three groups of K-rich minerals (Bt from matrix, Ms from matrix and large Ms from And-Qtz-Ms veins) were used for K-Ar thermochronological dating of time - temperature (T-t) retrogressive evolution of metamorphic system. In correspondence with closure temperature of Ar diffusion for each group of minerals (Dodson, 1973), T-t trend of evolution was obtained. It was shown that cooling of metamorphic system from T=515^{o}C to T=300^{o}C took place during almost 100 Ma at the ages range from 400 Ma to 300 Ma. The average rate of cooling is about 2^{o}C/Ma and real geological age, through the T-t extrapolation to the thermal pick of metamorphism at

560^{o}C give us the value of age - 425 Ma. Discordant U-Pb age of zircons (Zrn) from para-gneiss complex of Mt. Cheget demonstrates almost the same result.

In the HP Western part of the Great Caucasus terrain Grt-Ky mica schist and Grt-Bt-Ky-Or gneiss were found in the association with eclogites and serpentinite melange of the Blyib metamorphic complex (Forerange zone). Gneiss mineral assemblage: Grt-Bt-Ky-Or-Qtz +Ms +Rt +Zrn +Mnz was studied in the detail by electron microprobe. Crystals of Grt up to 1 cm have retrogressive diffusion zoning (increasing of Fe and decreasing of Mg contains) on the mutual contacts with Bt. The preliminary estimation of the metamorphic thermodynamic conditions is T=750-770^{o}C by Bt-Grt equilibrium and P=8-10 kbar by Grt-Ky-Rt-Ilm-Qtz barometer. K-Ar dating of different potassium bearing minerals demonstrates the characteristic specter of ages, very typical for the fast cooling metamorphic systems: Bt - 366 Ma; Ms - 353 Ma; Or - 328 Ma. Taking into account a different rate of Ar volume diffusion in the crystal structures of these minerals and using thermochronological technique, it is possible to show that real geological age of the thermal event during HP metamorphism could be expect at 380-400 Ma.

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