Variscan Granitoid Magma Generation Processes

 in the Greater Caucasus Collisional Orogen

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The Greater Caucasus represents a Phaneroizoic collisional orogen formed along the Euro-Asian North continental margin and stretches on 1200 km, from the Black to the Caspian seas. Currently, it is an expression of continental collision between the Arabian and Eurasian lithospheric plates. Two major stage are distinguished in its construction: Pre-Alpine crystalline basement and Alpine volcanic-sedimentary cover. Crystalline basement complex (200 km x 40 km) is mainly constructed of Precambrian and Paleozoic crystalline schist, amphibolites, gneisses, migmatites and granitoides.

 The variscan plutonic magmatism has played significant role in the formation of the Greater Caucasus crystalline basement complex [1]. Our investigation indicate that granitoid melts are important component of these plutonic series, represented by different genetic types, and is characterized by a specific mechanism of magma generation processes. Four plutonic series of variscan generation have been distinguished (from the S to N): 1. Gabbro-plagiogranite, 2. Diorite-adamellite, 3. Plagiogranite-granite, and 4. Granodiorite- alaskitre.

 Gabbro-plagiogranire series, which is exposed along the Main Trust of the Greater Caucasus in the form of lesser tectonic flakes, was formed at early stage of variscan orogen evolution (355****15 Ma; Rb-Sr; Isr=0.70343). The series should have been formed as the result of subducting oceanic crust partial melting (P=8.2-8.7 kb; T= 620-6300 C) and high water potential regime (H2O/CO2=20.2). Crystallization of plagiogranite melts occurred at 6000C temperature and 7.0-7.5 kb pressure condition. According all data gabbro-plagiogranite series corresponds to the subducting oceanic crust I type formation.

 The diorite-adamellite series was formed at a late stage of the orogen evolution (32012 Ma, U-Pb). Its protolith was located over the subducting oceanic crust and magma generation mechanism share is decreased was mantle injection (tigel melting) and formed mantle-crust generation H type (hybrid) granitoid melts. In his series granitoids melts generation occurred at the temperature range of 630-6700 C and 4.0-4.5 kb pressure condition.

 Plagiogranite-granite series was formed at a late stage of the orogen evolution. Regional migmatization and ultrametamorphizm processes of this series matapelite protolith started at 720 -7500 C temperature and under 3.7-4.2 kb pressure. In the evolution processes of this series two stages are distinguished: syn-kinematic and post-kinematic. On the first stage of plagiogranite composition anatecric magma was genetated ( 3187 Ma; Rb-Sr; Isr = 0.70843), which made mainly conforming bodies, and on the second stage the granite composition melts were formed, which mainly made cross-cutting bodies (3155 Ma; Rb-Sr; Isr = 0.71134).

 The granodiorite-alaskite series was formed at a late stage of the orogen evolution (295810 Ma; Rb-Sr; Isr = 0.71572) and it ended the Greater Caucasus Variscan plutonic magmatizm. Magma in this series was generated as a result of remelting of Upper Caledonian granite-gneiss. The crystallization temperature ranges in the interval 710 -7350 C, and pressure is in 3.2-3.5 kb interval. This series corresponds to syn-collisional remelting, leading to formation of a S type granite.

[1] Okrostsvaridze A., Tormey D., 2011. J. of Nepal Geological Society, Special Issue, vol. 43, pp. 45-52,