APPLICATION OF K-Ar AGE DETERMINATION OF HYDROTHERMAL CLAY MINERALS FOR RECONSTRUCTION OF FLUID MOBILIZATION PROCESSES IN THE VARISCAN GRANITE INTRUSION OF THE VELENCE MTS. (TRANSDANUBIA, HUNGARY)

BENKÓ, ZS.[1], MOLNÁR, F.[1] & PÉCSKAY, Z.[2]
[1] Department of Mineralogy, Eötvös Loránd University, Pázmány Péter sétány 1/C, H-1117 Budapest, Hungary
E-mail: benkoo@elte.hu
[2] Institute of Nuclear Research, Hungarian Academy of Sciences (ATOMKI), Bem tér 18, H-4026 Debrecen, Hungary

The age of the biotitic monzogranite intrusion in the Velence Mts. is 280-300 Ma based on K-Ar age determinations on fresh biotite (BUDA, 1985). Granite hosts vein-type quartz-polymetallic and quartz-fluorite mineralization with argillic wall rock alteration. By the time of the Palaeogene age, several andesite veins intruded the granite and along the eastern border of the granite body a large intrusive-volcanic structure has formed in relation to the Alpine collision. The Palaeogene hydrothermal circulation resulted in intense alteration in the diorite intrusion and in the stratovolcanic sequence and also caused intense argillitization and brecciation around the andesite veins in the granite. For reconstruction of age relationships of magmatic and hydrothermal processes, systematic mineralogical studies and K-Ar age determination was carried out on the K-rich mineral phases of the argillic alteration zones in the granite and on rock forming K-feldspars. Oriented and ethylene-glycolated clay mineral fractions were analysed by X-ray power diffraction (XPD) method. Morphological analysis of the clay minerals was carried out by scanning electron microscope (SEM). Four different argillic alteration types of granite were detected: 1) Pure illite occurs along andesite veins intruding granite, along quartz-barite veins and in hydrothermal breccias. Illite is well crystallized (10 μm) based on the short sedimentation time during smoothing and the sharpness of the (001) peaks and SEM photographs. 2) Pure kaolinite was found in the matrix of some hydrothermal breccias. 3) Mixture of illite and kaolinite was found in hydrothermal alteration zones away from the andesite veins intruding granite and in the breccias. Both mineral phases are well crystallized based on the sedimentation time and XPD measurements. 4) Mixture of illite-kaolinite-smectite occurs in the altered granite along polymetallic veins. Based on the sedimentation time and the XPD measurements, illite is less crystallized and kaolinite is the dominant mineral.

The kaolinite-illite-smectite clay mineral mixtures and fresh K-feldspar along polymetallic veins of granite provided 209-232 Ma K-Ar ages, obviously not matching with the 280-300 Ma age of the granite. If this association did not undergo any overprint by younger hydrothermal events, then the age of the polymetallic mineralization is Triassic. Thus this type of mineralization could be related to a regional heat effect causing fluid mobilization. Regional fluid mobilization and mineralizing processes forming Pb-Zn deposits are widely known in relation to the early opening of the Tethys-ocean in the Alp-Carpathian-Dinaride region.

K-Ar ages for the illite-kaolinite association scatter between 55 and 125 Ma. The 55-125 Ma ages may reflect the fluid mobilization effect of the Alpine subduction-collision events. Theoretically, it also cannot be excluded that hydrothermal fluids of Palaeogene volcanic events penetrated the whole granite body and overprinted the radiometric clock of the Variscan minerals due to their heat effect, however, systematic fluid inclusion studies (MOLNÁR, 2004) do not confirm the regional character of the Palaeogene hydrothermal circulation within the granite body.

The K-Ar age of pure illite samples is between 40-29 Ma. The younger ages corresponds to the 29-31 Ma age of alunite from the hydrothermally altered stratovolcanic series and K-Ar ages for K-feldspar and illite from the diorite intrusion along the eastern boundary of granite (BAJNÓCZI, 2004). The 33-40 Ma K-Ar age range of some illite samples correspond to the K-Ar age of andesite veins intruding granite. The age of the quartz-barite vein mineralization in the granite is also Palaeogene based on the 30 Ma age of illite along those veins.

Results indicate that systematic analysis of K-rich clay minerals from argillic alteration zones and rock forming minerals in old granite intrusions provides new aspects to discrimination fluid circulation events. Determination of the radiometric age of those events contributes to the better understanding of the tectonic and geodynamic evolution of the area.

References

BAJNÓCZI B. (2005): Tertiary hydrothermal systems of the Velence Mountains. Unpublished PhD Thesis, Budapest: Eötvös L. University, 79–86. (in Hungarian)

BUDA, GY. (1985): Origin of collision-type Variscan granitoids in Hungary, West Carpathian and Central Bohemian Pluton. Unpublished CSc Thesis, Budapest: Hungarian Academy of Sciences, 95. (in Hungarian)

MOLNÁR F. (2004): Acta Mineralogica–Petrographica, 45: 39–48.