# Distinction of Variscan, Permo–Triassic and Alpine events in andalusite–biotite–sillimanite schists from Sopron area, W-Hungary

Dégi Júlia[1], Török Kálmán[1], Schuster Ralf[2]

[1] *Geological and Geophysical Institute of Hungary, Stefánia út 14, Budapest, Hungary*
[2] *Geological Survey of Austria, Neulinggasse 38, Vienna, Austria*

Andalusite-biotite-sillimanite schists from Sopron area (W-Hungary) contain well-preserved relics of pre-Alpine mineral assemblages and therefor play a key role in the understanding of the metamorphic evolution of the easternmost part of the Austroalpine nappes. Pre-Alpine relics are found in three domains: sillimanite-plagioclase-K-feldspar-biotite rich layers, garnet porphyroblasts and andalusite porphyroblasts. However, these domains are separated from each other in space which gives large uncertainties in the reconstruction of the P–T path.

In order to distinguish different metamorphic events, we studied the submicron scale features of the rock and carried out Sm/Nd dating on garnet porphyroblasts and Rb/Sr dating on biotites, respectively. According to this, the oldest preserved mineral assemblage is represented by Ca-rich garnet cores, high Ti-biotite, sillimanite and plagioclase. Based on geothermobarometry, this mineral assemblage was formed at ca. 640°C and 0.9 GPa. According to a Sm/Nd isochron, calculated from whole rock and two garnet core fractions an age of 330.4±2.7 Ma was determined. This age corresponds to the Variscan peak. Following cooling and decompression to about 570 °C and 0.3 GPa resulted in the formation of Zn-bearing staurolite. During nearly isobaric heating during the Permo-Triassic event, staurolite started to decompose to form andalusite, Zn-bearing spinel and corundum. Close to the temperature peak at about 660°C sillimanite-K-felspar intergrowths were formed and melting occurred. During retrograde cooling to about 500°C perthites and antiperthites were formed. Subsequently albitic lamellae exsolved from the K-felspars in antiperthites and pure albite rims developed between host plagioclase and perthitic K-feldspar. Following the crystallization of melt pockets at the Permo-Triassic retrograde path, the remaining $SiO_2$-rich aqueous fluids caused different reactions in different domains. Hydration of sillimanite-K-feldspar intergrowths resulted in the formation of large muscovites with sillimanite inclusions. In andalusite porphyroblasts, new staurolite was formed at the expense of former decomposition products found as microinclusions in the outer rims of staurolite relics.

Garnet was produced in several reactions during the Alpine cycle. Mn-rich garnets were formed at the beginning of the prograde path at the expense of chlorite. In this stage, muscovite and ilmenite partly replaced large, pre-Alpine biotites with high Ti-content. At peak pressures staurolite and less Mn-rich garnet formed in equilibrium. Alpine staurolite overgrowths on staurolite and biotite relics within andalusite porphyroblasts may have formed during this stage as well. At the Alpine retrograde path, garnets with fluid and quartz inclusions formed from reaction of pre-Alpine biotites and aluminosilicates. Na- and Ca-bearing $SiO_2$-rich fluids interacted-with the rock during this stage, resulting in the formation of paragonite- and margarite-rich micas and kaolinite. During cooling retrograde Fe-Mg exchange occurred between garnet and biotite and at the late stages, submicron-scale Mg-rich biotite and kyanite replaced garnet along cracks. Scattering Rb-Sr biotite ages reflect disequilibrium of pre-Alpine domains and mineral phases formed during the Alpine event.