and Blundy 1994), or at T=530–550 °C and P = 5–8 kbar (geothermobarometer of Plyusnina 1982). This event was followed at lower P-T conditions by porphyroblastesis of low-Al hornblende and less calcic plagioclase at low to very small deviatoric stress. Further deformation turned porphyroblasts to porphyroclasts. The deformation paths for the metabasites consist then of oblique to strike-slip dextral shearing and mylonitization along the main foliation planes followed by normal regime due to late orogenic collapse. Asymmetric folds with radially disposed SW/W/NW vergence are accompanied by numerous shallowly to moderately dipping shear zones with similar kinematics. Both the dextral shear planes and axial plane zones to these folds developed under decreasing P-T conditions marked by a retrograde assemblage (low-Al Hbl–Act–Chl–Olg $_{(An15)}$Ab$_{(An4)}$) developing at T = 480–510 °C and P = 4 kbar (geotherm. Holland and Blundy 1994).

Modeling of deformation of metabasites prior to metamorphic peak has been proved impossible. Deformation at the peak conditions was clearly contractional and generally E-vergent which led to crustal stacking. Younger fold deformation was apparently related to the formation of the OSD. The NMG rock series were stacked over the OSD core then were subjected to gravitational collapse and radially outward gliding down the slopes of the OSD core units during final stages of Variscan collision.

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The Early Miocene Olistostromes and “Old Styrian Overthrusting” in the Polish Western Carphatians

Nestor OSZCZYPKO and Marta OSZCZYPKO-CLOWES

Jagiellonian University, Institute of Geological Sciences, Oleandry 2a, 30-063 Kraków, Poland

The Lower Miocene, autochthonous deposits from the basement of the Flysch Western Carpathians in Poland have been known since the late 1970’s. The deposits were documented in the following deep boreholes: Bielsko 4, Sucha IG 1, Zawoja 1, Lachowice 1, 2, 3a, 7, Cieszyn IG 1, Bielowicko IG 1 and Zebrzydowice 13 (see Oszczypko and Oszczypko-Clowes 2003, Ślączka and Oszczypko 1987, and bibliography therein). The oldest known deposits of the Zawoja Fm. probably belong to the Oligocene (Egerian). In the middle part of this formation a 43 m strongly, folded flysch olistostrome (Palaeocene-Middle Eocene) was pierced.

The Sucha Formation, which was identified in the given boreholes, overlaps the Zawoja Fm.: Sucha IG 1, Zawoja 1, Lachowice 1, 2, 3a, 7 and Stryszawa 1K. This formation is an olistoplaque of up to 370 m thick and composed of Lower Cretaceous to Paleocene flysch olistholiths from the Subsilesian and Silesian units with an Early Miocene matrix. This formation is mainly covered by coarse, clastic, Stryszawa Fm. deposits of up to 566 m thick. The conglomerates, derived from the erosion of the Carpathian Flysch belt and the Paleozoic basement, contain carbonate and gypsum cement. From this formation Ottnangian-Karpatian, calcareous nannoplankton (NN 4) was also reported as well as recycled Lower Cretaceous – Early Miocene foraminifera. These deposits became transgressively overlapped by Dębowiec Conglomerates (Late Karpatian/ Early Badenian).

In the Cieszyn area between the Zebrzydowice Fm. (Eggenburgian-Ottnangian) and the Dębowiec Conglomerate, a 25–150 m thick, flysch olistoplaque (Zamarski Mb.), composed of elements of the Subsilesian Unit were discovered. This olistoplaque is also known as the „Old Styrian overthrust” from Northern Moravia. All of the buried flysch outlayers probably developed during Ottnangian-Karpatian as an olistoplaque or a gravitational nappe, which slid from the front of the contemporaneous, Flysch Carpathians. The geological results of the boreholes drilled in the Andrychów- Zawoja –Żywiec- Cieszyn enable us to propose the following paleotectonic scenario:

The Egerian-Ottnangian period of the marine deposition in the Carpathian foreland basin was followed by the Intra-Burdigalian folding (Late Ottnangian), the uplift and overthrust of the Outer Carpathians onto the foreland platform. At the turn of Ottnangian the front of the Outer Carpathians was located about 50 km south of the present-day position. The load of the growing, Carpathian accretionary wedge caused a bending of the platform basement and the development of the moat-like flexural depression of the Carpathian inner foredeep (Oszczypko 1998), filled with molasee deposits. This was accompanied by the development of large-scale slides (olistoplaques and gravitational nappes) along the front part of the Sub-Silesian Nappe. In the Cieszyn area this overthrust reached more or less the

present-day position of the Carpathians. The olistoplaque formation was postdated by the Karpatian period of intensive subsidence and deposition in the inner foredeep.

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Mineral Chemistry of Variscan Granitoids from Highis Mts. (Apuseni Mts., Romania)

Elemér PÁL-MOLNÁR[1], Zsombor KASSAY[2] and Eduárd ANDRÁS[2]

[1] University of Szeged, Department of Mineralogy, Geochemistry and Petrology, 6722 Szeged, Egyetem u. 2-6. Hungary
[2] Department of Geology, Babeş-Bolyai University, 400084 Cluj-Napoca, M. Kogălniceanu str. 1, Romania

Introduction

A major proportion of the Pre-Neogene basement of the Apuseni Mts. (Romania) and the Pannonian Basin (Hungary) is built up by the Tisia Composite Terrane Alpine Megatectonic Unit. The crystalline mass of the Tisia Composite Terrane is characterised by granitoid ranges and anticline wings of middle and high grade metamorphites (Pál Molnár et al. 2001A, B, 2002). The largest basement exposure within the Tisia Composite Terrane is represented by the Apuseni Mts. The Apuseni Mts. are partially built up by two Alpine overthrust units (Codru and Biharia Nappe Systems), carrying Variscan granitoid intrusions (Pană 1998). These granitoids were mainly characterized by petrographical and geochronological studies (Giuşcă 1979, Pană 1998), their relation to the Pannonian Basin granites are less studied.

The paper presents results of mineralogical and mineral chemistry studies performed on granitoids of the Codru and Biharia Nappe Systems, exposed in the Highiş Mts. The final aim of the research is to reveal correlations between the granitoids of the Apuseni Mts. and the Variscan granitoids of the South Hungarian Basement.

Geological Setting and Location

The Highiş Mts. are located on the W-SW part of the Apuseni Mts. Its crystalline basement is formed by the Tisia Composite Terrane, its main mass is made up by nappes of the Codru and Biharia Nappe Systems, both of which were formed during the pre-Gosau tectogenesis but with strikes of opposite direction. The Codru Nappe System is in lower position and the Biharia Nappe System is in upper position. Both nappe systems are positioned on the Bihor Unit (Săndulescu 1984), both contains granitoids of Variscan age (Pană 1998). The granitoids of the Codru Nappe Sytem, which are located in the Highiş Mts., are positioned into the Upper Proterosoic Codru sequence as a part of the Finiş Alpine Nappe (Şiria granitoids). Şiria granitoids, located on the N and W part of the Highiş Mts., form a unified mass with a network of aplitic and pegmatitic veins, their contact zone is characterised by biotite-rich hornfels and paragneises of high biotite content. According to Pană (1998), their age is on the boundary of Carboniferous and Permian. With the help of the K/Ar method Soroiu et al. (1969) determined a 221–226 Ma age from the biotites of the Şiria granitoides. The granitoids of the Biharia Nappe System, which are located in the Highiş Mts., are positioned in the Biharia Lower Paleosoic sequence as a part of the Biharia Alpine Nappe. In their contact zones hornfelised metabasites and paragneises can be found (Highiş granitoids). Highiş granitoids are Variscan, postkinematic granites, containing aplitic and pegmatitic veins (Giuşcă 1979). Giuşcă et al. (1964) estimated a 350 Ma age from the Highiş Granitoid Complex with the help of K/Ar (WR) method. Nevertheless, Pană (1998) with the more reliable U/Pb method determined a 264-267 Ma age from zircon fractions, and he explained the formation of Highiş granitoids with a short lasting magmatism at the end of the early Permian.

Sampling and Analytical Methods

Samples are originating from the vicinity of settlement Galşa (Şiria granitoids – 32 rock samples) and Păuliş (Highiş granitoids - 28 rock samples). During the research 84 mineral chemical analyses were made at Department of Mineralogy and Petrology, University of Graz. Measurements were performed at a 15 kV acceleration voltage and 10 nA current. Spectra were evaluated with software Oxford-Isis. Processing of raw data was made with softwares MinPet 2.0 and Minprog.

Mineralogy and mineral chemistry

On the basis of modal analyses, rock samples from Galşa are syenogranites with high mica content (10–12 vol.%). The mo-