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The Determination of the PT Conditions during Transition from Steep Syn-Extrusional Fabrics to Horizontal: NE Snieznik Domain

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Steep to subvertical fabric overprinted by later shallowly dipping to subhorizontal foliation system is systematically preserved within the orthogneisses, HP granulites as well as within the volcanosedimentary Stronie series of the Orlica-Snieznik dome. These structures are interpreted as a result of a vertical extrusion of the lower crustal rocks and subsequent horizontal flow over mid-crustal units. The aim of this work is to correlate the PT evolution with this structural succession and particularly to determine the depth and the temperature conditions of this major structural fabric transition. For such a study we used the metapelite lithologies of the Stronie series. Besides the possibility of the calculation of the PT conditions using standard thermobarometry, the suitable assemblages of metapelites allow the modelling of mineral equilibria in the simplified chemical system with the software THERMOCALC. In addition, the relationships of the mineral inclusion trails within the porphyroblasts and the matrix foliation allow the correlation with the macroscopically observed polyphased structural evolution as well as with the metamorphic PT path.

The first observed foliation within the volcanosedimetary series is a steep NE-SW trending foliation, developed under amphibolite facies conditions. It is strongly folded by open to isoclinal folds with NE-SW trending axes and axial planes dipping under shallow angels either to NE or to the SW. The early crystallization of the garnet and albite porphyroblasts, followed by the growth of the staurolite and kyanite was connected with the development of the steep fabric. During development of subsequent flat crenulation cleavage and transposition into a new flat foliation these minerals were rigid and passively rotated into the new fabric. This observation is supported by detailed measurements of oriented quartz inclusion trails within the garnet porphyroblasts from the fold limbs and fold hinges. Within the fold hinges the garnets are not reoriented and still reveal the original steep inclusion trails, while the matrix foliation is strongly crenulated and flat. Within the fold limbs garnets rotated together with the foliation, and consequently the inclusion trails, which originated during S1 tend to be subparallel with the flat foliation S2. The development of the new fabric is contemporaneous with the growth of the sillimanite and the recrystallization of the plagioclase porphyroblasts into oligoclase aggregates. Later andalusite postkinematically overgrowths both steep and flat fabrics at the end of the metamorphic and structural evolution.

The garnet-biotite thermobarometry and garnet-plagioclase-Al_2SiO_5-quartz barometry calculated for two samples using the rim compositions of the minerals yield temperature around 580–620 °C and pressure varying between 8 and 11 kbar. The calculated PT conditions can be interpreted as the peak attained conditions. However, using this method we are not able to distinguish the difference between the kyanite and sillimanite grade. In addition this method does not provide any information about the PT evolution of the samples, and consequently does not allow the correlation of the PT evolution with the observed structural succession. To obtain better information about the PT evolution we have constructed the KFMASH pseudosections using the software THERMOCALC. These diagrams, calculated for a specific bulk rock composition, show directly the mineral assemblages that would crystallize in the studied rock under different PT conditions. The major advantage of pseudosections is that calculated isopleths of mineral composition compared with the observed zoning of the minerals now provide quantitative information on the PT evolution. The PT paths obtained for mineral compositions and zoning of the porphyroblasts of the garnet and staurolite from two pseudosections in the KFMASH system are correlated with the succession of the mineral growth deduced from microstructural analysis of inclusion trails and mineral textures.

Provenance and Diagenesis of the Upper Cretaceous and Palaeocene Sandstones of the Magura Nappe: Constraints from Cathodoluminescence Study.

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Cathodoluminescence is fairly used in sedimentary petrology to identify source of clastic material, diagenetic processes (Götze et al., 1999; Sikorska, 2000) and many others, though it was successfully used for such purpose for the investigated samples.

The studied samples represent the Szczawina sandstones, the Ropianka beds, the Jaworzynka sandstones and sediments belonging to the Jarmuta and Szczawnica formations of the Magura nappe.

The samples (polished thin-sections of rocks and separated heavy fraction) were analysed using hot cathode equipment HC2 – LM, Simon Neuser, Bochum. Zircons, monazites, apatites, quartz, feldspars and carbonate cement were chosen for CL-observations.

Among the zircon population we were able to identify eight types of zircons. They were as follows: 1) euhedral simply oscillatory zoned grains (which were the most frequent type), 2) crystals containing inclusions of non luminescent mineral in the central part of the grain, 3) two-stage zircons with the brightly luminescent oscillatory zoned core and dark oscillatory zoned margins, 4) patchy zoned, 5) corroded zircons, 6) blue zircons with a yellow rim-probably xenotime, 7) zircons with a very complex internal fabric, 8) non luminescent. Monazites were dull blue in CL. They were usually unzoned or, rarely, displayed sector zoning.

Most common apatites were yellow and unzoned, only few grains exhibited blue CL. Some grains were overgrown by a violet or pinkish zone.

If quartz grains are considered, five types of them could be distinguished in the analysed material: 1) most typical dark blue, 2) bright blue, 3) violet, 4) dark brown, 5) non luminescent.

Most feldspar grains, as they were very often altered, didn't display luminescence. Fresh plagioclase grains luminescent in green-yellow colour while K-feldspars were usually bright blue.

Carbonate cement filled holes between clastic grains, corroded them or formed thin veins. Three types of carbonate cement were observed. The oldest generation, probably dolomite, displayed dull red luminescence. The middle stage carbonates were characterised by dull orange CL colour, whereas the youngest were bright orange in colour.

Because the majority of zircons display magmatic zoning the source rock could be traced in magmatic rocks. Anyhow, the patchy zoning and resorption may indicate the metamorphic overprinting. The xenotime overgrowths are probably the effect of diagenetic processes in sediments. The most common blue luminescent quartz point to plutonic rocks e.g. granites or high-grade metamorphic rocks (Götze et al., 2001) and the presence of red-violet quartz grains and very fine-grained fragments of felsic volcanics, visible in thin sections, indicate that volcanics, e.g. rhyolites, contributed to the clastic material as well. On the base of the CL study the source area could be interpreted as highly variable, built of various magmatic and metamorphic rock types.

The three generations of carbonates indicate that the cementation was a multi-stage process when carbonates were gradually replacing the primary clay matrix.

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Vienna Basin and Adjacent Tectonic Units: Structural-Tectonic Elements Mapped by Means of the Gravimetry

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The unified processing of the gravity data in the Vienna Basin and adjacent geologic units (Flysh Belt, Neogene Foredeep, Klippen Belt, Carpathian and Alpine Calcareous Zone and the Central Zone) has been carried out in 2000. The primary gravity data originating from several data sources has been transformed into S-42 Coordinate System, Adriatic Altitude System and Absolute Gravity System. The data consisting of 96,487 gravity points of the territory of the Czech Republic, Slovakia and Austria has been reprocessed in the area of 16,790 km^2. After calculating Bouguer gravity anomalies by formulas according to Švancara (1996), final regular 250 m grid in the area has been generated. The following gravity maps were constructed:

· Bouguer gravity
· Regional gravity
· Residual gravity
· Horizontal gradient of gravity
· Vertical gradient of gravity
· Second vertical derivative of gravity
· Density boundaries indications (Linsser method)

Subsequently, there were also several illuminated gravity images and combined gravity and terrain elevation relief maps generated. These maps, depicting gravity effects of the Tertiary fill of the Vienna Basin as well as structural-tectonic features of the surrounding and uderlying geological units, gives an outstanding example how can pull-apart basin geology be mapped by geophysics. The set of gravity maps, together with the existing seismic and drilling knowledge, could bring new information on structures prospective for hydrocarbons in this petroliferous area.

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