Complex Investigation of Krupnik–Kresna Region in Southwestern Bulgaria by Geodesy, Gravimetry and Seismology

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In the year of 1904, in the region of Krupnik–Kresna occurred one of the strongest earthquakes on the Balkan Peninsula, felt in almost whole Eastern Europe. The magnitude of this event was about 7.5 and intensity X in Medvedev-Sponheuer-Karnik scale in the epicentric zone. The seismologically active structure which caused this destructive event is the Krupnik Fault – a part of the Struma fault zone.

In the framework of "Young scientists" project between several research institutions in Bulgaria, an attempt to compare and complete the data, results and conclusions from different methods of geodesy, gravimetry and seismology was made. The main goal is to form a whole geodynamic picture in the area of investigation. Part of the present work is to determine double couple focal mechanism solutions from P wave first motion polarities of small earthquakes with magnitude about 3 in the region. On the other hand, several GPS campaigns were carried out re-measuring the points from long-existing investigation network in the area. A new set of benchmarks was established for levelling profiles through the visible rupture remaining after the strike from 1904. Also two gravimetric profiles crossing the main tectonic structures were re-measured. All these studies confirm the recent activity of the Krupnik fault.

Geochemical comparison of felsic Eocene granite intrusions in the Rhodope massif, southern Bulgaria and northern Greece

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We compare whole rocks geochemistry of several felsic granite bodies of similar age (53-42 Ma) that are emplaced into the intermediate and upper plate of the Central Rhodope metamorphic core complex (CRMCC), namely: the Smilyan granite in the southernmost part of the Madan unit; the Pripek granite in the Startsevo unit, the Yugovo granites in the Assenitsa unit and the Paranesti granite from the Barutin-Buynovo-Elatia-Skaloti-Paranesti plutonic complex partially hosted by the Madan and Assenitsa units. The time span of granite intrusions overlaps the period of synmetamorphic partial melting in the CRMCC (~50-36 Ma) and clearly predates the anatectic melts crystallization in the core of the complex (38-36 Ma). The temporal and spatial proximity suggests genetic/feedback relations between intrusive granites and migmatites.

The geochemical features of the compared granites show predominantly felsic compositions (SiO_2 > 70 %) and alkaline-calcium to Ca-alkaline and alkaline characteristics. The Smilyan, Pripek and Paranesti granites are meta- to peraluminous (A/CNK 0.80-1.29), and Yugovo granites are only peraluminous (A/CNK 1.06-1.26). High Ba (≥1000 ppm) and Sr (>600 ppm) content is a common feature of granite LILE (Ba, Sr, Rb) geochemistry. Negligible negative to positive Eu-anomaly (Eu/Eu* 0.8-1.2) and high LREE/HREE ratios (up to 54.1) are typical of the chondrite-normalized REE patterns. Increasing Rb/Sr (0.04→1.53) and Rb/Ba (0.03→0.45) ratios towards the most felsic granites mark a trend of feldspar fractional crystallization. The LILE distribution patterns of Pripek and Paranesti granites indicate more evolved differentiation than the Smilyan granite. Decreasing Zr and Hf contents and Zr/Hf

ratios towards the higher-silica compositions reflect typical magmatic trends with zircon fractionation and enhance the close geochemical resemblance of the granite intrusions. All of them display volcanic-arc and collision-related affinity according to the most popular discriminations based on incompatible trace elements. The isotopic data available support granite magma generation from predominantly igneous precursors of mixed mantle-crust characteristics.

On the other hand the granite intrusions show remarkable geochemical similarities with in situ formed anatectic melts from the CRMCC diatexitic core (felsic peraluminous compositions, low HFSE and REE, high LILE contents and LREE/HREE ratios, and negligible negative to positive Eu anomaly) that infer to a common mechanism of granite magma generation, e.g. crustal melting. The younger age of the anatectic melts (37-38 Ma) precludes direct feedback relations between intrusive granites and migmatites. A low temperature crustal melting involving mainly felsic minerals from orthometamorphic substratum could explain the granite magma origin and its similarities with the younger anatectic melts from the CRMCC core.

Acknowledgements: This work was supported by the National Science Fund of the Ministry of Education and Science in Bulgaria, projects DO 02-363/2008 and DO 02/-327/2008.

The exhalations of CO_2 in the Poprad River valley (Polish Inner Carpathians)

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The Krynica tectonic-facies zone within the Magura Unit of the Polish Inner Carpathians contains a region rich in carbonated mineral waters and in moffettes, i.e., dry exhalations of carbon dioxide. The lithostratigraphic profile spans the strata from the Upper Cretaceous to Upper Eocene. The region of the moffettes studied is situated in the Poprad River valley between Muszyna and Tylicz. The exhalations have been found in the Złocki stream and Jastrzębik stream valleys near Muszyna, in the Szczawiczny stream valley near Krynica and in Tylicz. The largest and most beautiful exhalation with an area of about 25 m^2 occurs in the bottom of the Złocki stream valley. Both this exhalation and the smaller, adjacent exhalations and the springs of carbonated waters are associated with the Szczawnik-Złocki-Jastrzębik antiform structure and with a system of discontinous dislocations, i.e., a thrust and faults. The emanating gas represents almost pure CO_2 (about 99.3%) with minor admixtures of CH_4, N_2, Ar and other noble gases.

The upper surface of the basement of the Carpathian orogen in the Poprad subregion rests at a depth of about fifteen kilometers. The origin of the gaseous components – particularly of CO_2 – is usually attributed to metamorphism of carbonates rocks under the thick cover of overthrusted flysch strata and/or to Tertiary volcanism. The volume of carbon dioxide emanating from the moffette in question is about 15,000 m^3 CO_2/day. The maximum content of CO_2 in the soil air close to the moffette reaches 94%. The temperature of the emanating gases is around +10^oC, both in the Złockie site and in other moffettes of the region.

The moffette is partly covered by the water of the stream and also by the water flowing out of submerged springs of carbonated mineral waters, thus the emanations are manifested by smaller or larger bubbles of carbon dioxide. They are accompanied by rusty-coloured, gelatinous floccules of colloidal hydrohematite and goethite, the minerals originating by oxidation and hydrolysis of hydrated ferrous carbonate contained in the mineral waters mentioned. The process is a result of metabolism of the green plants populating this habitat (forest bulrush *Scirpus silvaticus* is a dominating species), and also of ferruginous bacteria