Geomorphologic landscapes of the central part of Northern Eurasia

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We define geomorphologic landscape (GL) as the complex of geomorphologic, tectonic, and landscape-climatic characteristics incident to a certain territory. Such complex includes absolute height, amplitude of neotectonic movements, their gradients, the depth of erosion dissection ant its density, intensity of landslide, karst, thermokarst and glacial processes, the amount of woodlands and the degree of peat formation, precipitation, runoff, and frost-free period. The territory analyzed includes the East-European Plain, the Ural Mountains, and the Western Siberia. The 20'x30' spatial cells, described by the above mentioned 15 parameters, were clustered by k-means method with different k values. Euclidean distance was used. The results of clustering are represented as maps, where spatial distribution of different clusters, or GL, can be seen. Each GL is characterized by the set of parameter means, which determine the shape (the type) of a given GL. According to F-ratio the geomorphic parameters play the significant if not the main role in clustering. The set of cluster solutions with k=2, 5, 9, and 17 are represented.

The two plains have some common GLs only at rough division with small k values; at k=2 there are two variants of division: first – mountainous (The Urals) and plain GLs, second – GLs of the accumulative plain (the Western Siberia) and of the erosion-denudation plain. At k=5 the northernmost and the southernmost parts of the plains have common GLs: tundra GL of permafrost-erosion dissection and GL of semiarid plains with extremely low erosion and denudation correspondingly. GL of boggy lowlands with low neotectonic intensity and low erosion occupies the central part of the West Siberia while GL of neotectonic highlands with intense erosion dissection and complex of denudation processes occupies the most part of the East-European Plain. More detailed divisions (with k=9, 17 and more) show clear difference between the two plains, and at k=20 they have no common GLs. The GLs of the Western Siberia have less dispersion of parameters, i.e. they are more homogeneous, and their boundaries show stronger dependence on the latitudinal zonality than those of the East-European Plain. The latter reveals more diversity of GLs than the Western Siberia. The Urals having the GLs of the "mountain" type don't form the single area: the most part of the Middle Ural falls into the GLs of the East-European Plain types at any k value.

The tree clustering of the GLs themselves (Euclidean distances, Ward method) demonstrates their hierarchical structure, which is in good agreement with the results of k-means method. The spatial GL's boundaries are sufficiently stable to the changes of k values and to the variation of the set of parameters. The approach described can be used also as a method of typological regionalization in other geographic regions.

Age relations and volcanology of zircon bearing basalts from Eastern Saxony (Germany)

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In alkali basaltic rocks scarcely appear accessory minerals such as zircon and corundum. The origin of these mostly gem stone like mega-crystals is unknown and controversial. However, if zircon crystals present they are important tools to clarify petrogenetic questions of the host melts. Host magmas of the zircon mega-crystals are normally SiO_2 under saturated such as basanites and nephelinites.

In several localities we could observe some zircon mega-crystals and in a quarry in Saxony (eastern Germany) we collected 36 crystals up to 15 mm in size in situ from the basanitic rock. Zircons occur in agglutinates of lower crater facies of a scoria cone. The related lava flows are almost free of zircons and their Zr contents reaches up to 900 ppm. There is a good correlation between Ar/Ar data of the basanites (30 to 31 Ma) and the zircon U/Pb data which show ages about 30.5 Ma.

A further known locality of zircon mega-crystals is the so called Seufzergründel placer in Elbsandsteingebirge / Saxon Switzerland (eastern Germany). There are observed zircon mega-crystals up to 9 mm in size. Their host rock is a lapilli bearing volcanic breccia, implying here a polyphase explosive volcanism. The age data of zircons have various values; while the Pb/Pb crystallization-ages range by 54±6 Ma the U/Pb dating gets about 35 Ma.

Furthermore zircon mega-crystals were sampled from placers and residual soil of basanitic and nephelinitic as well as phonolitic rocks from different localities via heavy mineral separation techniques. The crystals show an intensive magmatic corrosion in alkalibasaltic rocks (including nephelinites), while zircons out of phonolites are mostly euhedral.

Thus the zircon mega-crystals were carried by alkali basaltic magmas but were not in equilibrium with these melts. Basaltic host rocks of the mega-crystals are developed of primitive mantle melts, implying a short residence time for zircons in the melt. The solution rates of zircon in such melts are possibly high which could be seen in the intense magmatic corrosion. Therefore zircon mega-crystals occur mostly in pyroclastic rocks and are scarce or absent in massive lava flows. The latter have a much longer cooling time.

Another possibility for enrichment of mega-crystals in pyroclastic rocks should be that the ascending bubbles in the vent carry away the solid parts, like xenocrystals or phenocrystals of the magma column. This could be the reason for lacking of in situ proofs of zircons in massive basalts.

The age data of the zircons in relation to that of the host rocks imply a cogenetic development of both.

Geology and tectonics of the Vršatec Klippen area (Pieniny Klippen Belt, Western Slovakia)

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The Pieniny Klippen Belt (PKB) is a narrow (merely several km), but lengthy (up to 600 km) zone dominated by Late Oligocene – Miocene wrench tectonics. It separates the Cenozoic accretionary complex of the External Western Carpathians from the Cretaceous nappe system of the Central Western Carpathians. Our investigation was focused on the tectonic structure and evolution of the Vršatec klippen area in the western Púchov sector of the PKB. The studied area includes the Oravic (Czorsztyn, Kysuca, Orava and Transitional Units) and the "non-Oravic" tectonic units (Klape and Drietoma Units). Detailed geological mapping and systematic field structural research of meso-scale deformational structures revealed the record of multistage tectonic evolution during Senonian-Pliocene times. The oldest recognized stage resulted in formation of the Mesoalpine fold-nappe system of the PKB due to subduction and closure of the Vahic Ocean during the Senonian – Early Eocene times. This compressive stage was accompanied by thrusting of the presently most external Kysuca Unit over the Czorsztyn and transitional units and by formation of macroscopic folds with the NNE-SSW to NE-SW trending fold axes. The main compression was oriented perpendicularly to the strike of the PKB recently trending in the SW-NE direction. The thrusting and folding were followed by several brittle deformation stages. The oldest stages (E-W to NW-SE oriented maximum compression) produced the NE-SW trending dextral positive flower structure along the western boundary of the PKB and resulted in the final morphostructural character of klippen with long axes oriented in the NE-SW direction. The dextral transpression was a result of the continuing shortening and relative counterclockwise rotation of the ALCAPA block in the Late Oligocene – Early Miocene. The younger N-S oriented compression (Early – Middle Miocene) produced mainly sinistral faults roughly