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Geological and geomorphological characteristics of the area of Botanical Garden of PJŠU in Košice and the use of these data in botanical practice

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Abstract:. The paper deals with the area of Botanical Garden of PJŠU in Košice from the viewpoint of geology and geomorphology. Next to the general characteristics, the special attention is paid to the Quaternary elements of this area. Present state of woody plant stands, both planted and spontaneously occurred ones, are mentioned in connection to geological and geomorphological features.

Keywords: botanical garden, Košice, geology, geomorphology, woody plants

Basic geological and geomorphological features

Geological structure of Košice Basin and the adjacent regions is considerably complicated. The emerged rocks are from the periods of early Paleozoic, Mesozoic, molasse Tertiary and Quaternary.

The object of Botanical Garden is situated in the area formed on the right side of Hornád river between altitudes 210 to 370 m a.s.l.. The west border of the area is formed by Čičkov creek. Parts of the geological composition of the area are Paleozoic complexes of Gemericum of the Slovak Ore Mountains represented by Dobšiná group from Carboniferous period. With its development

since transitional geosynclinal period of Variscan (Hercynian) orogene to the early stage of molasse development, it represents the complex which was folded and considerably metamorphosed. In it there occurr 2-micas locally chloritic phyllites, grey-wacke phyllites with transitions to metaquartzites, changing to biotite hornfels paragneisses at contacts with granites. The rocks represent various types of regional low metamorphosed originally clay-sand rocks, later progressively contact metamorphosed. In the object of Botanical Garden, we investigate them in 2 exposures next to outbuildings (detailed photographs).

Two-micas paragneisses are of former flysch nature with insertions of minerals – biotite + flint + sillimanite + oligoclas + andesine.They are compact but also shale-like. In the exposure (Fig. 1) they are compact, little weathered, tectonically disturbed. They are of light to dark grey colour with tiny grains of biotite which is of yellow-tobacco to silver shined colour on schistosity planes (FUSAN et al. 1963).

In the next exposure (Fig. 2) the graphite phyllites emerge. They are of light yellow colour with brownish tone (as a result of weathering). Mineral composition is as follows: flint, senicite, ore pigment, chlorite, up to 1 mm sized garnet grains. They have good cleavage along schistosity planes.

Fig 1: Two-micas paragneisses of former flysch nature with interbeds of minerals.

Fig. 2: Graphite phyllites with clearly visible cleavage along schistosity planes.

The weathering of paragneisses and phyllites in the area of the Botanical Garden is considerably restricted. The rocks are deposited in N-S direction with sloping of strata to SW what results to the formation of convex to convex-concave slopes with inclinations of 3 - 17°. The soils on the mentioned rocks are shallow ones of cambisol type. The upper part of the garden is covered by the so-called natural forest which ais represented by the forest stands planted in the time of the Botanical Garden foundation, consequently not maintained, extended to the highest parts of the garden bordering with the magnesite mine in Bankov location. Particularly, they are the plantations of both native and introduced woody species, namely: *Acer platanoides* L., *Robinia pseudoacacia* L., *Quercus petraea* (Mattusch.) Liebl., *Cerasus avium* L., *Tilia platyphyllos* Scop. and *Ulmus laevis* Pall.. As accessory coniferous elements, there occur *Larix decidua* Mill. and *Pinus sylvestris* L.. In several parts of the garden there was preserved the schematic combined plantation of the woody species *Tilia platyphyllos* and *Quercus petraea* originally carried out by professor Samuel Kriška. Nowadays, these stands on shallow soils are of exceptional soil conservation and melioration value.

Quaternary

In the period Neogene (Pliocene) – Quaternary, in the area of the botanical garden there took place formation of „river plane“, fluvial sedimentation and formation of river terraces of Hornád river.

While the river plane covers the highest locations of the botanical garden in relative altitudes of 150 – 160 m, during the site excavation on the slope in relative altitudes of 48 – 50 m we found gravels sands of river terrace with thickness ranging from 2 to 3 m and caliber from 5 to 15 cm. Gravel sands are of rusty brown colour, they are mostly well rounded. From petrographic point of view they consist of flint, quartzites, granite, crystalline slates, sandstones. The exposure is covered by 2-3 m deep diluvium. It is preserved in situ. It can be correlated with a terrace preserved at final bus stop of Košice city bus No. 16, south from Hradová. From stratigraphic point of view, the accumulation can be classified to the high terrace from the Mindel stage.

Next to the area with outbuildings and greenhouses, there is preserved the surface with relative altitude of 14 – 22 m. Morphologically it represents a Hornád terrace from the Middle Pleistocene – Riss 1. The gravels are of more fresh appearance, with grain diameter of 6 – 12 cm and depth to 150 cm.

Fig. 3: Clearly visible gravel sands of the river terrace of Hornád river.

In this section, there were done the most extensive ground shapings and soil accumulations, therefore there is concentrated the substantial part of the botanical garden summarized in Catalogue of Plant Collections (MÁRTONFIOVÁ et al 2010).

In the south part of the botanical garden area was drilled a hole with depth of 50 m reaching to the Neogene floor. Its description does not represent the structure of the area.

The transition from the river plane to the terrace R1 is formed by approximately 1 km long convex – concave slope tectonically conditioned by the fault of „Hornád system" of N-S direction. The slope is covered by aeolian – diluvial sediments, with considerable anthropogenic interventions related to the planting of forest stands – especially a broadleaved forest. While in the upper part of the slope the inclination is low (2 - 5 °), down to the waste channel it increases to 9 – 12°. The maximum inclination it reaches southward from the waste channel (11 – 18°) as far as the edges of the buildings (former Publishing House of PJŠU)

In the accentuated part of the area we follow several terraced fields, e.g. alley of lime trees *Tilia cordata* 'Aurea', alley of Turkish hazel trees (*Corylus colurna* L.), to the border of the broadleaved forest.

Deep diluvia with a considerable portion of loess fraction (diameter 0,01 – 0,05 mm), with the occurrence of terrace planes as suitable anti-erosion measures, were artificially excavated, they are 3 to 8 m deep furrows which sides are liable to high soil erosion (Fig. 4). Originally they played a significant role in slope stabilization and fixation against whole erosion on slope surface and against soil deflation.

Fig. 4: Erosion on slopes of former intercepting ditches.

In the south-western part of the area we follow the suitably adjusted fields formerly designed as vineyards and orchards. These areas are abandoned from grower point of view due to unsolved property rights and there is self-sowing of various expansive woody species - *Fraxinus excelsior* L., *Acer campestre* L., *Acer platanoides* L., *Swida sanguinea* L., *Rosa canina* L., *Rubus fruticosus* L., *Ligustrum vulgare* L., *Prunus spinosa* L. and *Clematis vitalba* L., which cause that these terraces are somewhere totally impassable (Fig. 5). Even in spite of vegetation self-sowing, e. g. in the area of the vineyard, there is successive erosion of soils and landslide of terraces.

Fig. 5: View of the anthropogenic terraces of the former vineyard with self-sowing vegetation

The area of the botanical garden is suitably placed on the right side of the Hornád river where the landslides occurr only sporadically. Arrangement of slopes, planting of woody species and overall appearance of the area need considerable care and financial subsidies to perform the assigned tasks in the area of sience, research, practical education for students of biology as well as for visitors of the botanical garden.

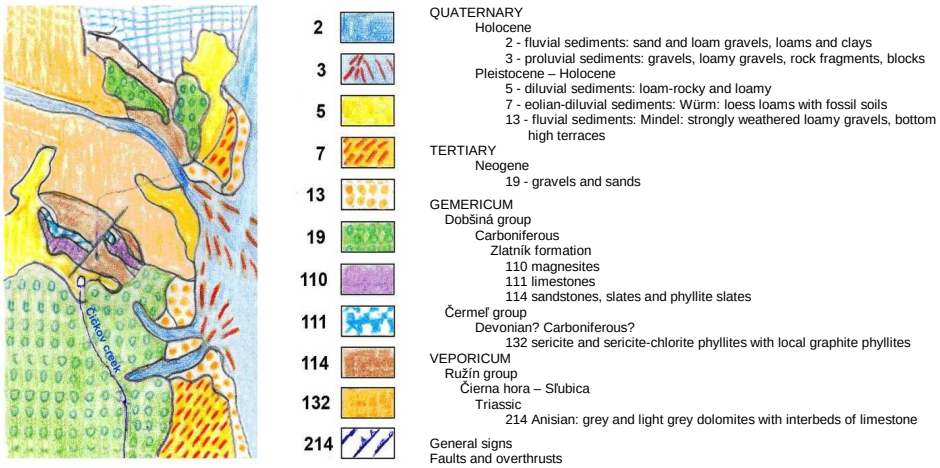

Fig. 6: Geological map of the East part of Slovak Ore Mountains in Košice, the area between Čermeľ stream and Myslava streem. Worked out by KOŠŤÁLIK (2010) according to BAJANÍK et al (1984).

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