ENGINEERING GEOLOGICAL MAPS OF THE TIBREG REGION

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Abstract: A couple of engineering geological maps on the scale of 1:50 000 were prepared as a part of TIBREG (Tisza-Bodrog region) project. The first map is engineering geological zoning map, the second one is map of relevant geological factors of the environment. Both maps are compiled according to the Ministry of the Environment of the Slovak Republic Standards (1999). Main mapping results as well as evaluation of relevant geological factors in the region are presented in this paper.

Key words: TIBREG (Tisza-Bodrog region), geological factors, engineering geological maps

Introduction

Engineering geological maps together with other geological, hydrogeological and geophysical maps on the scale of 1:50 000 represent a set of maps of geological factors prepared within the framework of the TIBREG region.

Components of geological environment important from the point of land-use planning, design and construction of various types of engineering structures as well as creation and protection of the environment are displayed in engineering geological maps of two types. The engineering geological zoning map and the map of significant geological factors (geobarriers and geopotentials) may be characterised as synthetic and multi-purpose. The maps include legend, text explanations with detailed evaluation of physical-mechanical properties of soils and rocks.

Engineering geological zoning map

The map is prepared by using typologic zoning (Matula & Hrašna, 1976) on the level of zone and sub-zone and shows geological environment to the depth of 10 m. Zones are territorial units distinguished on the basis of homogeneity or similarity of one of the principal geological factors - rocks. In this respect, the genetic-lithologic classification of rocks valid on the territory of Slovakia is used (Matula & Pašek, 1986). This means that each zone represents a different genetic-lithologic rock complex. A change in the lithology within the same genetic complex or a

change of thickness of Quaternary layer is expressed as a sub-zone. The map includes text explanations with detailed statistic evaluation of physical-mechanical properties of rocks and soils within the all distinguished zones (46) and sub-zones (369). The total zone number distinguished within Quaternary rocks reached 31 (including combined zones). This number reflects a frequent occurrence of Quaternary sediments on the surface. Combined zones represent alternating of two or three different genetic types of Quaternary sediments. Besides schematic cross-sections are the zones briefly described in tables. Potential suitability of the zones for shallow foundations, for the construction of transport communication and earth dams was evaluated according to selected Slovak Technical Standards - STN 731001 (Subsoil under shallow foundation), STN 721002 (Soil classification for road buildings), STN 736850 (Earth dams) and STN 733050 - (Earth works).

Besides rocks and soils the map shows further significant geofactors, such as geodynamic phenomena (neotectonic faults, landslides, erosion gullies, seismicity etc.) hydrogeological phenomena (springs, water-logged areas, swamps, groundwater level depth and its corrosiveness, etc.), inundations, protected areas with significant groundwater resources, nature protected areas as well as occurrences of raw materials (quarries, sand, gravel and loamy pits) and oil wells.

Map of significant geological factors

This synthetic and multi-purpose map provides in a concentrated form complex picture of relevant geological factors of the environment (geopotentials and geobarriers) of the TIBREG region from the viewpoint of engineering geology.

This map shows the following geofactors - mineral deposits, groundwater resources, suitability of geological environment for waste disposal, fertile agricultural soil, slope stability, bearing capacity of subsoil, erosion, seismicity, inundation, landfill depositories occurrence, sources of potential pollution, nature protected areas.

Mineral deposits. About 199 raw material deposits with different level of investigation occur in the region. The most significant are ore materials (base metals, iron ores), fuels (anthracite, humodyl, natural gas, oil), technical gas (CO_2), heat-resistant materials (melting sand), ceramic materials (clay, bentonite, halloysite), metallurgical and chemical materials (zeolite, halite), building materials (limestone for cement and lime production, andesite and rhyolite and their tuffs, crystalline schists, perlite, arcose, graywacke, gravel, sand, brick loam or clay)

Nowadays only a small part of these raw materials is exploited. Each significant deposit is protected (deposit protected area, area of mining licence).

Groundwater resources. Usable resources of groundwater are distributed in Quaternary sediments of the Laborec River between Strážske and Stretava (902 $l.s^{-1}$), in SE part of the East Slovakian Lowland (750 $l.s^{-1}$), in Quaternary sediments of the Ondava and Topľa rivers between Slovenská Kajňa and Trebišov (554 $l.s^{-1}$), in down-stream parts of the Uh, Laborec, Ondava and Latorica (right-side) Rivers (530 $l.s^{-1}$).

Carbonic mineral waters are occasionally exploited for local purposes. Mineral waters with sulphur and salt content are used for therapeutic purposes (Sobrance and Byšta spas).

Suitability of geological environment for waste disposal. Areas suitable for waste disposal repositories are concentrated on bottom parts of the Slanské vrchy and Vihorlat Mts. as well as in northern part of the Pozdišovský chrbát (north of Trhovište). Occurrence of thick layers of Quaternary fine-grained (loessy, polygenetic and deluvial) soils as well as impermeable sediments and pre-Quaternary rocks is typical for these areas.

Fertile agricultural soil. Dominant part of agricultural soil in the TIBREG region is cultivated. The highest-quality soil types (Chernozem, Phaeozem, Luvisol, and Fluvisol) cover approximately 470 km^2 (18 % of the entire region area).

Slope stability. About 229 slope deformations with area higher than 5 000 m^2 have been recognized. The most frequent are landslides concentrated mainly in bottom hilly areas of the Slanské vrchy and Vihorlat Mts. as well as in northern part of Pozdišovský chrbát ridge. Landslides are mostly natural, areal in shape ($\leq$ 0,1 km^2), dormant, rarely active. The main natural causes of landslides are erosion, locally bad hydrogeological conditions and climatic oscillations, scarcely suffosion (Lekárovce). Landslides are responsible for degradation of agricultural soil, endangerment of roads, railroads, electricity lines and some buildings in villages. Remedial works on landslides are not frequent (e.g. wide-diameter railroad between Kalša and Egreš, embankments of the Uh River near Lekárovce).

Bearing capacity of subsoi. Low bearing capacity subsoils are concentrated mainly in the southern part of the East Slovakian Lowland. The area is built up mostly by fluvial, locally by aeolian and polygenetic fine-grained soils of soft and very soft consistency as well as loose sandy soils. High content of organic substances is frequent in these soils. Groundwater level depth is up to 2 m below surface.

Erosion. Water erosion, abrasion and wind erosion are dominant in the process of relief morphology forming in the region. Gully erosion is typical for bottom parts of the Slanské vrchy and Vihorlat Mts., for northern parts of the Pozdišovský chrbát, rarely for Humenské and Zemplínske vrchy Mts. Depth of gullies reaches almost 15 m, their wide ranges from 1 to 50 m.

Lateral erosion has been strong reduced by reconstruction of river channels and by building of embankments. Vertical erosion is responsible for landslide generation along the Uh River banks.

Abrasion forms especially banks along southern part of the Zemplínska Šírava Lake. Wind erosion is typical for East Slovakian Lowland (southern of Latorica and Bodrog Rivers). This type of erosion is responsible for deflation of fine-grained particles from fertile soil, fine-grained aeolian sands, dunes creation, as well as for washing of communications and drainage canals (Hraň, Kráľovský Chlmec).

Seismicity. Maximum expected macroseismic intensity in the region ranges from 4,5° to 8° MSK. The strongest earthquakes (7°- 8° MSK) can be expected in the central part of the East Slovakian Lowland, in down-stream parts of the Ondava, Laborec, Čierna voda and Okna rivers. Very sensitive to seismicity are soils of the most oxbows.

Inundation. A number of floods in the region was restricted to minimum due to hydrotechnical structures (flood protected embankments) built during 1950 - 1960.

Waste disposal sites. A great number (397) of waste disposal sites have been registered in the TIBREG region. Only 11 of them have established sealing. Nine sites are monitored from the point of groundwater and surface water pollution. Several waste disposal sites are full-controlled (Lastomír, Husák, Vojany, Veľké Ozorovce - solid waste, Moravany - liquid waste).

Potential sources of pollution. The most dangerous pollution sources in the region are - 36 sewage treatment plants, 8 out of date fuel pumping stations, 9 airports for agricultural purposes, 2 transshipment railway stations, 1 compressor plant (Veľké Kapušany), 1 petroleum refinery (Vo-

jany), tailings (Poša, Vojany) as well as majority of agricultural farms. The most dangerous pollutants for the environment are petroleum products, agricultural chemicals, industrial dust and cinder and waste liquors.

Nature protected areas. A several nature protected areas occur in the TIBREG region - 2 Protected landscape areas (Latorica, Vihorlat Mts.), 7 National nature reserves (Jovsianska hrabina, Senné lakes, Latorický luh I, II etc.), 21 Nature reserves. Around the Sobrance spa has been designated protective zones of mineral water (degrees I. - III.) In addition some water resources with their own zone of hygienic protection and protected areas with significant groundwater resources (Vihorlat Mts., flood-plains of the Ondava (near Dvorianky), Laborec (between Strážske and Sliepkovce) and Uh (between Bajany and Jenkovce) Rivers.

Conclusion

The Engineering geological zoning map and Map of significant geological factors of the environment on the scale of 1:50 000 are directly useable for regional land-use planning, for projection of constructions, for preventing or mitigation of negative effects of geofactors to existing constructions, for selection of suitable sites or waste disposal locations, for remedial works purposes (damages caused by erosion or landslides) etc. Because the maps are in the digital form it is possible to update them if needed.

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