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Distribution of landslides in the area of the town of Polski Trambesh, Northern Bulgaria

Разпространение на свлачищата в района на гр. Полски Тръмбеш, Северна България

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Abstract. The article presents the results of the landslide mapping in the area of the town of Polski Trambesh, central Northern Bulgaria. A total of 37 new landslides have been described, which have not been included in the landslide register so far. Landslides are classified by area, type and activity. Their location is mapped in a GIS environment.

Keywords: landslides, geological hazards, North Bulgaria.

Introduction

Landslide hazard assessment for a specific area begins with the compilation of inventory maps (distribution maps) (Dobrev et al., 2013; Ivanov et al., 2017a, b, 2020; Bruchev, 2018). These maps contain locations and contours of landslides. Knowledge is needed about the causes and factors, leading to landslides and measures to counteract them (preventive and post-landslide measures).

The study area falls entirely in the Danube Plain. The predominant relief is flat and slightly hilly. The eastern part of the region, east of the valley of Yantra River is occupied by the northernmost branches of the low Draganovski heights with a maximum altitude of 369 m, located south of the village of Orlovets. The western part is occupied by the hilly southern parts of the Middle Danube Plain, and north of the village of Karantsi, in the valley of Yantra River is the lowest altitude for the region, about 34 m.

The main river artery is the Yantra River, which flows through the eastern part of the region from south to north with part of its lower course. Its main tributary is the Eliyska River (left), on which the town of Polski Trambesh is located.

The studied region as tectonic units is a part of the Moesian Platform. To the east of the Yantra

River the region is built of the Lower Cretaceous sediments of the Gorna Oryahovitsa Formation (clay marls and layers of sandstones and limestones), the Trambesh Formation (marls with layers of limestones and sandstones) and the Kovachevo Formation (flint limestones, clayey limestones and marls) (Khrishev et al., 1990; Filipov, 1992). To the west of the Yantra River, loess deposits (clayey loess) predominate (Minkov, 1968; Antonov et al., 2018; Evlogiev, 2019; Tchakalova, Karastanev, 2019). Alluvial formations (gravels, sands and clays) are revealed in the river valleys.

Results

During the study, a total of 38 landslides (37 new landslides) were found in the area. They can be located in 3 main sections: 1) on the slopes of the right bank of the Yantra River; 2) on the slopes of the right bank of the Eliyska River and its tributaries; 3) in the area of the village of Maslarevo.

So far, the data of only one landslide is entered in the landslide register. It affects the right bank of the Eliyska River between the villages of Obedinenie and Ivancha. The landslide has an area of 3500 dec and is defined as periodically active. Lawn areas are affected, no buildings or facilities are endangered.

It was registered in the landslide register under № VTR 26.53014.01 in 2011 as periodically active. The landslide is of a flow type.

During the study, an active landslide was found, affecting the road Polski Trambesh-Karantsi. The landslide has an area of approximately 74 dec. The deformations can be traced in a 520-meters section of the road, most clearly in the middle (about 70 m long). The landslide is not registered by Geozashtita EOOD (Geoprotection Ltd). The landslide mechanism is of a rotational type.

Most of the landslides are formed in the sediments of the Trambesh Formation, which age is Early Cretaceous (Aptian). Its composition is dominated by clay rocks, represented mainly by calcareous clays, often silty to sandy.

Landslides in the eastern and northern part of the region are formed in slopes with a low inclination – between 5° and 13°, most often around 7–8°. On the banks of the Yantra River the slope angles reach up to 20–22°. Most of the landslides are shallow, some of them may be of a medium depth.

The landslides in the western part – on the right bank of the Eliyska River are of rotational and consistent

type (most are not active and have smooth shapes). Those along the tributaries of the Eliyska River are of a consistent type. On the right bank of the Yantra River they are mainly of rotational and complex – rotational-consistent type. According to locals, some of the landslides on the tributaries of the Eliyska River are periodically activated after rainfalls.

All established landslides are outside the settlements and affect only meadows, and those on the right bank of the Yantra River – forest areas. No landslides have been identified that affect or threaten urban or agricultural areas. Some of the landslides pose a risk to the integrity of the roads (dirt roads) in the area. They are located on the right bank of the Yantra River, and one of them (the road Polski Trambesh-Karantsi) threatens access to the settlement.

Part of the landslides on the banks of the Eliyska River and its tributaries in extreme climatic conditions are able to barrage the riverbeds and thus cause local increases in groundwater levels, as well as local floods.

The main destabilizing factors are precipitation and river erosion. The precipitation factor is

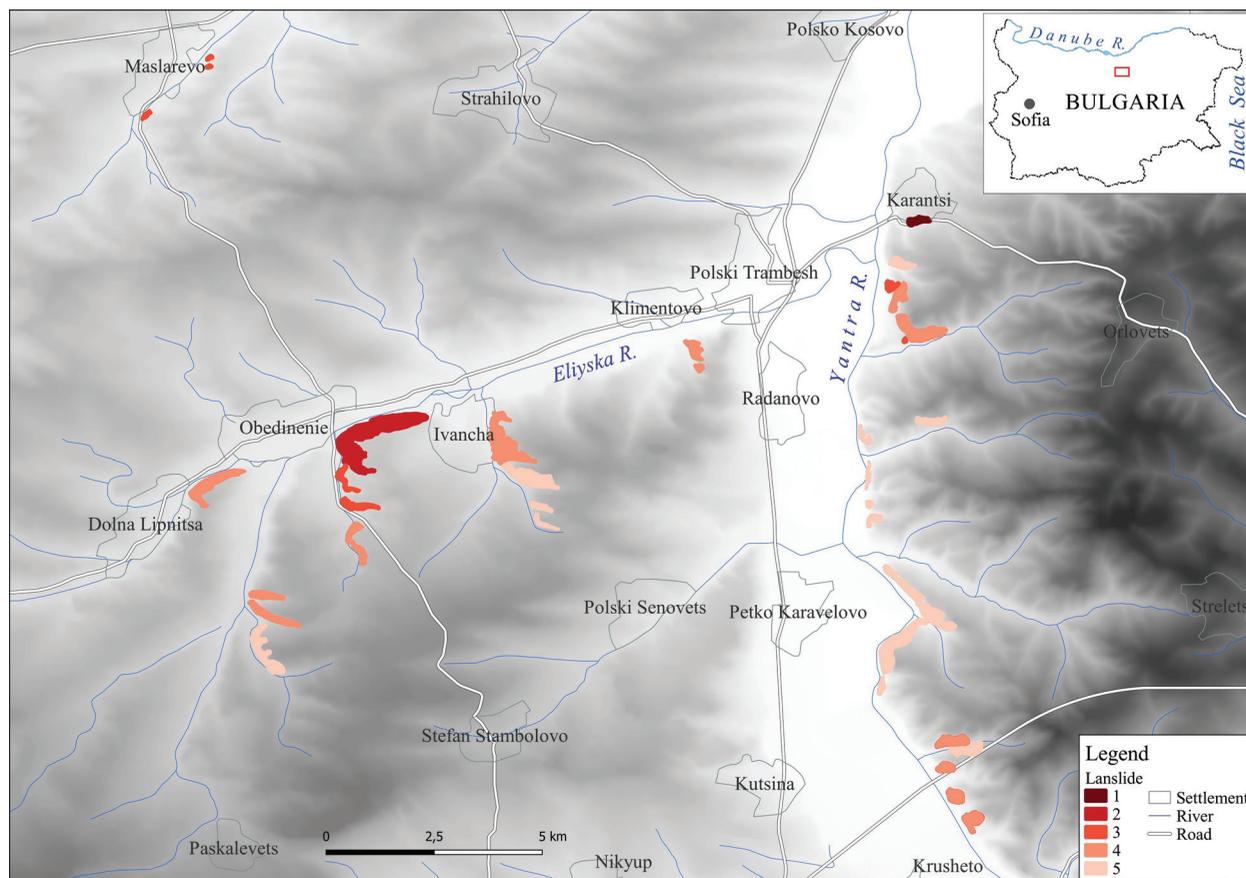


Fig. 1. Distribution of landslides in the area of the town of Polski Trambesh: 1, active; 2, suspended; 3, reactivated; 4, potential (dormant); 5, abandoned (acc. to UNESCO WPWLI, 1993)

stronger in the western part of the region, mainly on the banks of the Eliyska River and its tributaries.

The distribution of landslides in the area of the town of Polski Trambesh is presented on Fig. 1. The classification is by a degree of activity according to the methodology proposed by UNESCO WPWLI (1993) and adopted in the Methodology for assessment of geological risk (2014)¹. Most of the landslides are potential (dormant). Those on the right bank of the Eliyska River are characterized by periodic activations as a result of the precipitation factor and erosion of the high or temporary waters along its tributaries.

Conclusions

The assessment of the landslide hazard in the area of the town of Polski Trambesh shows the presence of a significant number of landslides. Their distribution is related to the river system – the slopes on the right bank of the Yantra River and on the slopes on the right bank of the Eliyska River and its tributaries. Single small landslides were also registered near the village of Maslarevo. Most of the landslides are of shallow to medium depth, with periodic activation of the landslide process. Their manifestation is associated with precipitation and river erosion. The established landslides are outside the settlements. No landslides have been identified in the area that affect or threaten urban areas or agricultural areas. Some of the landslides pose a risk to the roads in the area. It is recommended that they are added to the National Register of Landslides of the Republic of Bulgaria.

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