Talus slopes and related deposits in Zemen Gorge, West Bulgaria

Срутищно-сипейни склонове и наслаги в Земенския пролом, Западна България

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Zemen Gorge is located in southern parts of Kraishte region, between Zemenska and Konyavska Mountains. In broad sense the area of interest is a transition zone between Rhodopes massif and Balkanides belt. In narrow sense Zemen Gorge is part of Struma river valley which flows through 12 sequential gorges. Due to the river incision the slopes in the study area are steep and various geomorphological processes occur. Some of which are related to mass movement of the surface materials and their accumulation in the lower parts – the foot of the slope where talus cones are formed. They represent sediment storage which is compound element of every sediment budget.

Three sites with different aspect and slope declivity situated on the left and on the right river bank are selected in order to study the talus slopes and related deposits. Each key site represents given situation which is consider to be typical for the study area. Key site 1 (KS1) is located near town of Zemen. In this site slope processes are triggered by natural phenomena and anthropogenic disturbances. As a result several talus cones are formed. Marked lines are used to determine the movement of individual rock particles (boulders, cobbles, pebbles). Soil erosion plot is installed to determine the quantity of moving finer materials (gravel, sand and clay). Erosion pins (also referred as denudation gauges) are installed to determine changes in the topography (Haigh, 1997). Several readings are taken since November 2015. This site is selected for capturing of multiple overlapping photos using quadcopter (DJI 3 Advanced) that are used for generation of 3D model. This approach (structure from motion photogrammetry) allows to perform measurements without disturbing the slope surface.

Key sites 3 (KS3) and 5 (KS 5) are located in a remote areas which limits the opportunities for regular measurement. These sites are situated on slopes with smaller declivity than KS1. KS3 represents rockfall slope with scree which form small cone. The mean slope angle varies from 35 to 45° whereas KS5 is an almost vertical rock wall at the base of which a small cone is formed. It is consisted of angular coarse materials with finer matrix. At each site two rectangles are painted with spray and the area of each rectangle is calculated. Fallen debris bellow each line could be identified and quantified by weighing it using portable electronic scale. Since the source area is known it is possible to relate the debris to it (Beylich, 2008).

The finest deposits from each key site are characterized by grain size analysis. Morphoscopic analysis is used to determine the sizes of pebbles. Grain size analysis is made by series of sieves with different mesh sizes varying from 20 mm to 0.02 mm in diameter. Grain size distribution (Wentworth, 1922) of each sample is presented on Figure 1. Results are converted to Phi (φ) units to determine the standard deviation or the sorting (σ_1) of each sample (Folk, 1974). Deposits from KS1 and KS5 (the both with σ_1 2.90) are very poorly sorted, whereas sample from site 3 is poorly sorted according to used classification scale (Folk, 1974). The degree of sorting and dominance of angular particles indicates short transport distance.

Presented results have preliminary character and aim to describe and quantify the velocity of different slope processes and related deposits. Applied field, cameral and laboratory methods provide information about surface changes and the migration of individual particles. Nevertheless more data and more frequent observations are needed to understand the seasonal rates of slope denudation, sediments redeposition and formation of talus cones. Further studies should examine the relation between occurrence, velocity and frequency of slope processes and regime of climate elements.

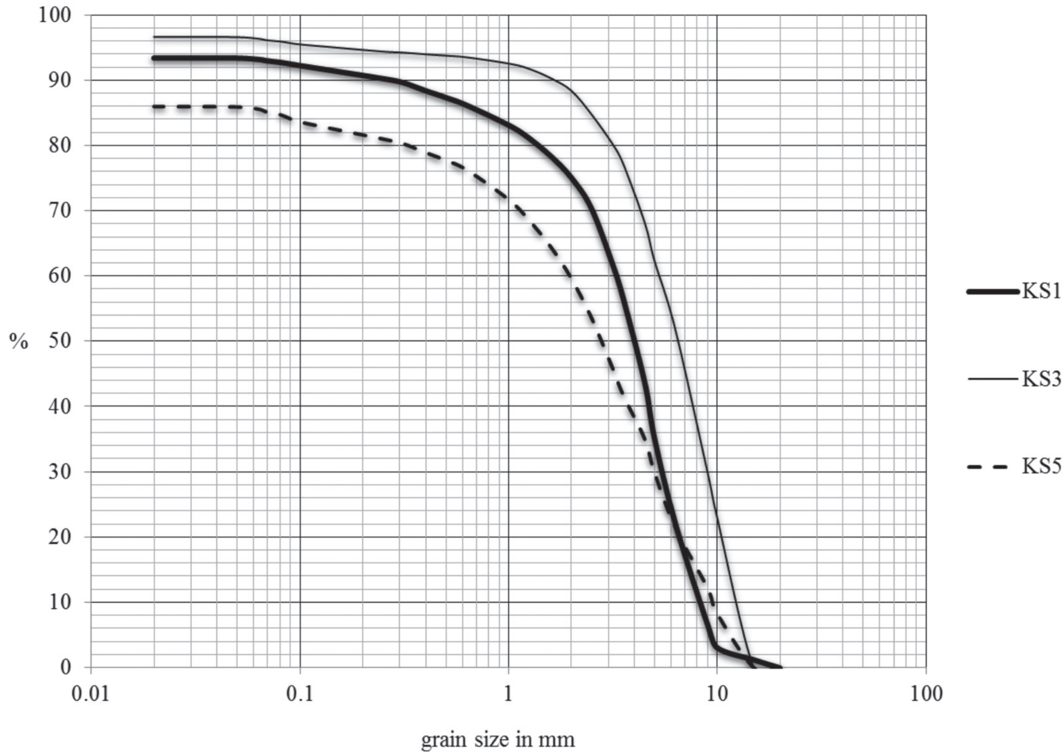

Fig. 1. Grain size distribution of samples from 3 key sites

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