

Mon-21-057 Changing the dynamics of relief development within the Kaniv natural park under the influence of anthropogenic factors

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Introduction

"Kaniv mountains" (dislocations) are distinguished by their elevation and dissected relief against the plain landscape of the middle Dnieper area. The height difference between the tops of the "Kaniv mountains" and the lowest marks in the river valleys exceeds 150 m. This is still one of the main exogenous factors in the formation of ravines and landslides.

It is interesting that one of the outstanding discoveries of Ukrainian archeology at the end of the XIX century is connected with landslide processes. Then, as a result of landslides and rock falls of the Kniyazha's hora part on the day surface got a significant number of unique items of high craftsmanship, which began to settle in private collections and museums. This, in turn, became the basis for diggings, and a site of ancient settlement was discovered (Bondarets, 1999). Many researchers associate it with the legendary Roden-town, mentioned in the chronicles (Figure 1).

Throughout the XXth century to the present day, Kaniv dislocations have attracted the attention of many researchers in various fields. This is reflected in numerous scientific papers (Tustanovska et al., 2016; Derevska et al., 2018; Ivanik et al., 2019).

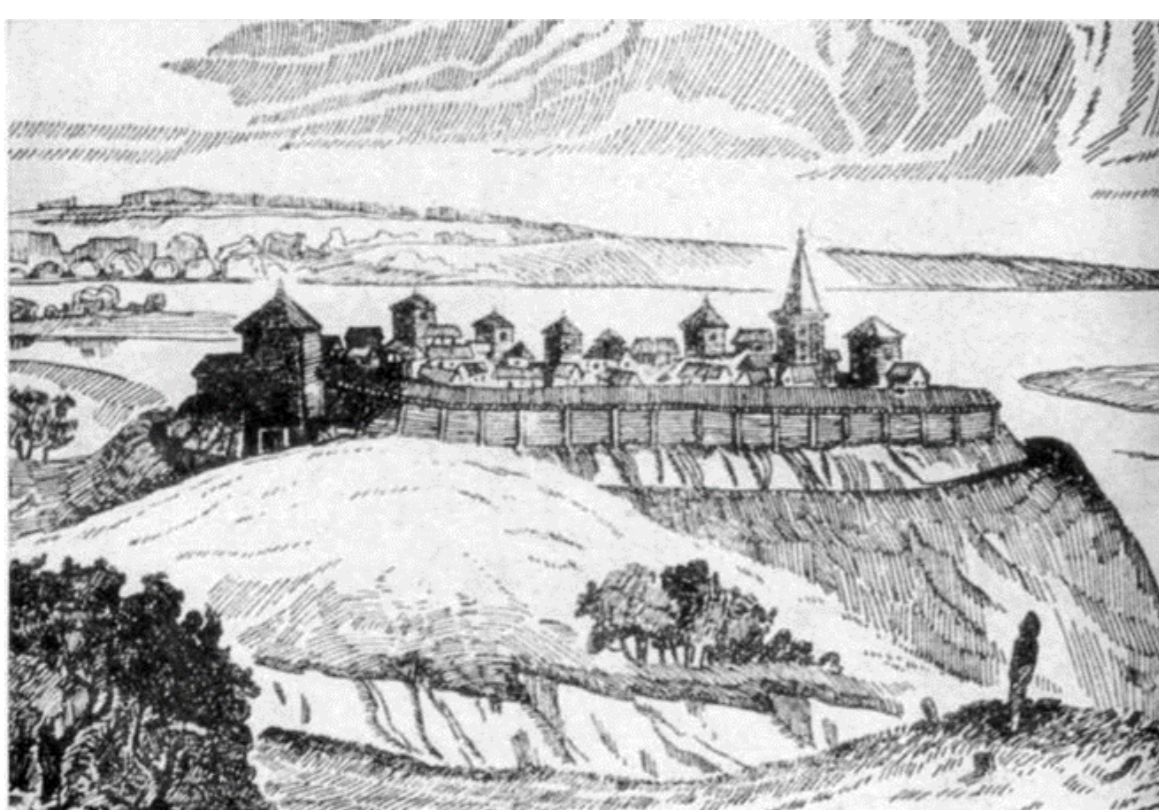


Figure 1 Reconstruction of ancient settlement Roden (by G. Mezentseva).

Method

For the past 18 years, we have been conducting field geological surveys within the Kaniv natural park. Even in this short time for geological processes there was a noticeable change in the appearance of local ravines. In addition to field work, a review of literature sources with data from observations of ravine activity before the HPS (Hydroelectric power station) construction was made. Comparison of the data made it possible to draw conclusions about the trend of significant weakening of erosion in the recent period as a result of anthropogenic activity.

Results

The formation of the Kaniv's dislocations relief took place for a long time (from the end of the Neogene to modern times) and was determined by the influence of both endogenous and exogenous factors. Endogenous factors include different in intensity and direction vertical movements of the basement rock. At the surface of the sedimentary cover, they turned into tangential ones. Exogenous factors are represented by landslides on the right bank of the Dnieper and the influence of the Dnieper glacier. They caused the movement and deformation of sedimentary rocks within the middle Dnieper area (Shyshchenko, 1992). The intensification of erosion processes began in the Dnieper stage, the most intense were the processes of ravine formation and gravity. This trend persisted until the great man-made intervention (in the second half of the twentieth century). In some areas, the ravine-beam network turned the surface into a badland, threatening existing buildings, roads and destroying fertile land. The ravines (at the end of the 60's) occupied about 14% of the area. The development of the ravine network (except for tectonic uplift) was influenced by the lithological composition of rocks, a relatively large amount of rainfall and the base level's low location (Palienko et al., 1971).

The rapid growth of ravines was primarily due to intense deep erosion. The average slope of the ravines was 45-50°, most of the slopes were covered with deluvial and colluvial formations; the depth of their cut was on average 35-40m, and in some ravines it reached 90 m. V-shaped and canyon-shaped cross sections were formed in most ravines.

A separate group of ravines stood out within the Kaniv natural park. There are Kholodnyi, Kniyazhyi, Marin and Biliashivskoho. No debris was deposited in their thalwegs at all. According to the classification (Palienko et al., 1971), they belonged to the ravines of removal - short in length (300-600 m), but very deep, with a cut to 70 m, ravines on the slopes of the right bank of the Dnieper.

The construction of the HPS cascade was accompanied by the creation of a number of reservoirs. This led to a change in the morphological characteristics and hydrological regime of the Dnieper and its floodplain area in the middle Dnieper region (Shyshchenko, 1992).

During the preparatory stage of Kaniv HPS construction (in the period from 1967 to 1969) along the right bank of the Dnieper from the center of Kaniv to the hotel "Tarasova hora" there was reclaimed sandy terrace, almost 4 km long and 100 to 500m wide. As a result, the floodplain level was raised by 3-4 m and thus the basis of ravine erosion increased. The new houses, a highway, a pier, etc. were built on this artificial terrace (Figure 2).



Figure 2 Anthropogenic activity: a – construction of the Kaniv HPS; b – new residential district on the artificial terrace.

From the following 1970, natural processes such as deluvial washing away and proluvial removals began to take part in the formation and strengthening of the terrace. Because its level increased from 0.2 to 1.2 m (near the Monastyrka village the thickness of alluvial formations reaches about 2m).

Changing the basis of erosion artificially led to the restructuring of the local terrain. Fifty years after the construction of the highway, the appearance of the «Kaniv mountains» became completely different.

Due to the attenuation of erosion processes, bare hills are overgrown with hornbeam and mixed forests, in the thickets of which ravines are hidden (Figure 3). They have also changed their morphology. Part of the ravines turned into gulleets. Other ravines, where there is a significant difference in altitude, continue to develop and deepen, but their regime has also changed.



Figure 3 «Kaniv mountains»; a - ear of XX century, b – our days.

We observed the dynamics of changes in the ravines: Melanchin Potik, Kholodnyi, Marin, Pekarsky and Biliashivskoho. They begin with the highest, Marina hora, which has been finally covered with forest for today. Over the years of observations in the ravines there have been noticeable changes. For example, Melanchin Potik significantly changed its morphology. Gradually, the slopes of the modern riverbed began to overgrow (Figure 4). Periodic fall of trees led to the clogging of the thalweg,

the creation of natural dams, the retention of precipitation, the formation of temporary reservoirs at the bottom of the ravine. This, in turn, caused landslides of large areas of slopes, which over time were also covered with vegetation. In other areas, the water washed away the slopes, they collapsed, forming a water-mud mixture, which after drying covered a thick layer of the ravine's bottom, increasing the width of the thalweg to several meters. In the lower part of the ravine has been a complete cessation of deep erosion. There is a constant stream. It meanders, approaching one side or the other, washing the shores, carrying and depositing loose material at the bottom of the ravine. In recent years, the bottom of the mouth has expanded significantly, reaching 15-20m in some areas. The slopes here are completely overgrown.

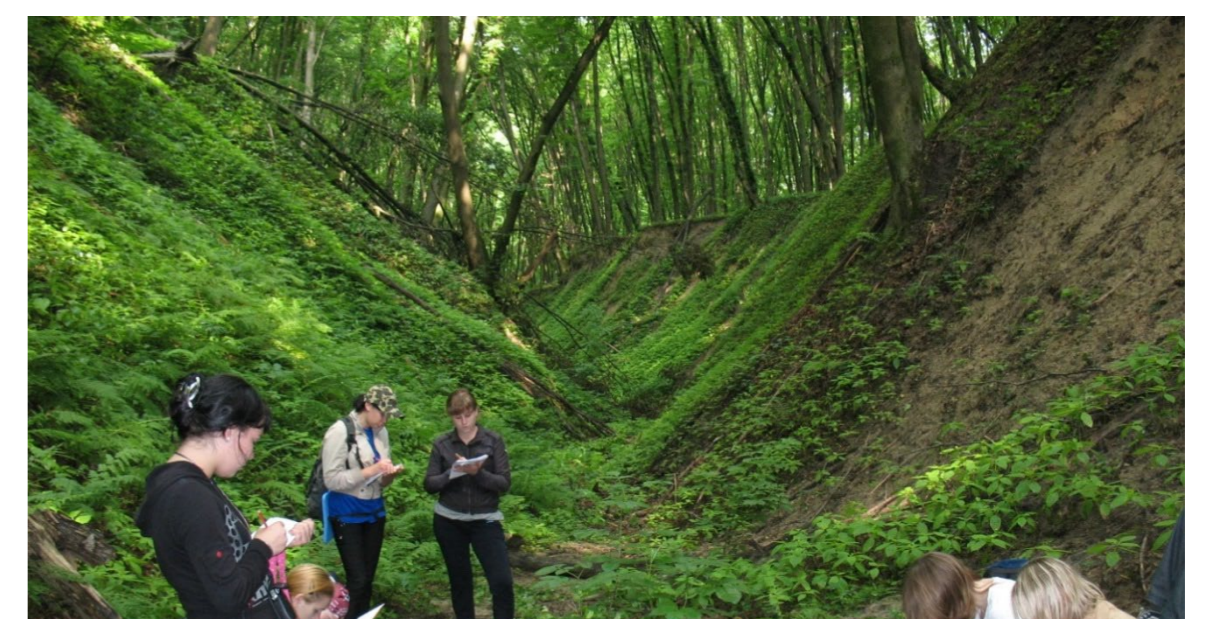


Figure 4 Upper part of the Melanchin Potik, our days

The base level for the ravine is an artificial terrace on which rests the debris cone. This leads to the formation of a swamp at the mouth. The swamp further contributes to the creation of a strong vegetation cover.

In the upper part of the ravine, the processes of active deep erosion are still going on. However, a system of parallel shafts surrounding the beginning of the ravine was built here. They stop regressive erosion and the ravine does not grow towards the top.

Similar processes are observed in other ravines: Kholodnyi, Marin and Pekarsky.

Conclusions

Anthropogenic activity (Kaniv HPS construction, artificial terrace etc.) affected the intensity of natural erosion processes within the Kaniv dislocations. Slowing of deep and development of lateral erosion contribute to the balancing of slopes and their overgrowing with vegetation. A positive consequence of these processes is the cessation of "aggressive eating" of the "Kaniv mountains" by intensive ravine activity. This led to the natural settlement of these areas by various complexes of plants and animals and as a result - the formation of rare biocenoses. All this has further enriched this unique natural and historical corner of Ukraine.

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