GRANITE HILL-TOP DEPRESSION IN THE ŽULOVSKÁ PAHORKATINA (Hilly land)

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SUMMARY

Study of a small hill-top depression in the Žulovská pahorkatina (Hilly land) clarified the first occurrence of this specific mesoform in Czechoslovakia. The morphology, lithostructural settings and possible modellation factors were described. The present stage of depression is of polygenetic origin and testify to a slow transformation of the relief during the Quaternary.

1. INTRODUCTION

The term "hill-top depression" refers to enclosed hollows situated on level or gently sloping ridge crests. Such landform have already been described in various environmental settings: igneous and massive metamorphic terrains in humid, temperate regions [2, 5]: quartzites, phyllites, sandstones and shales in subhumid equatorial regions [1]. The paper deals with a special case of such depression in the Žulovská pahorkatina (Hilly land) at the north-west edge of the Bohemian massif.

2. REGIONAL SETTINGS

The area in which the hill-top depression was found and examined has a complicated relief with numerous inselbergs and granite weathering forms persisting from a sub-tropical or even tropical climatomorphogenetic zone. Their origin is mostly the result of denudation of the thick kaolinic weathering crust of Tertiary age. The most dominant forms from that period are those of inselbergs interpreted as the landforms of profound differential weathering and denudation. Ivan [4] also admits the possibility of their origin through the processes of linear erosion and of

a parallel slope retreat. The Pleistocene continental glaciation occurred twice at least, but it is worth noticing, that on inselberg there are only rare traces either of glacial or periglacial modellation. The stripped basal surface of weathering — the etchplain — is also complicated by numerous low exfoliation domes (ruwares) reaching as high as 30 m. We are able to recognise some meso- and microforms of polygenetic origin [3].

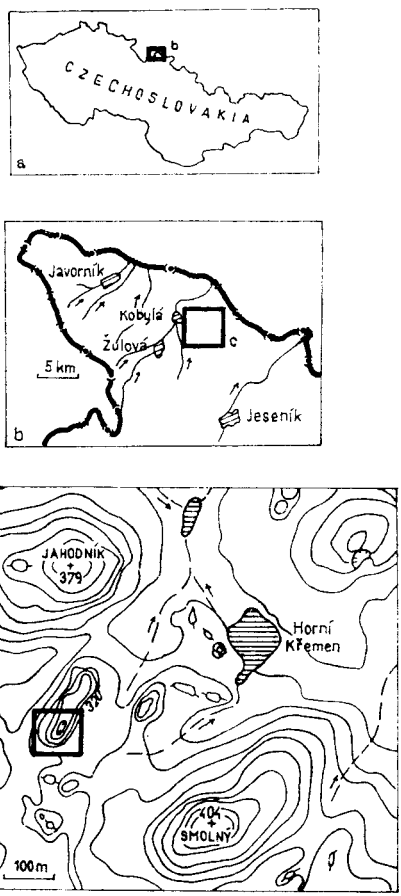

Fig. 1. Location of the investigated area

3. MORPHOLOGY

The locality under investigation is situated in the central part of the Žulovská pahorkatina (Hilly land) between inselbergs Jahodník (379 m

a. s. l.) and Smolný (404 m a. s. l.) (Fig. 1). It is asymmetric eminence with the maximum relative exaggeration about 20 m at the SW part. The slope angles vary from 2° (NE) to 25° (SW). The SW abrupt slopes are even with a small rock step at the upper part.

On the top there is a depression bordered with the bedrock outcrops (tors), talus and boulder piles. It is possible to distinguish several minute hummocks (Fig. 2). The width of the depression ranges between 17 m and 27 m and its depth reaches 5 — 7 m. In the southeren part there is a narrow saddle, only 1 m above the concave bottom of the depression. The bottom surface is gently undulated without visible blocks or boulders.

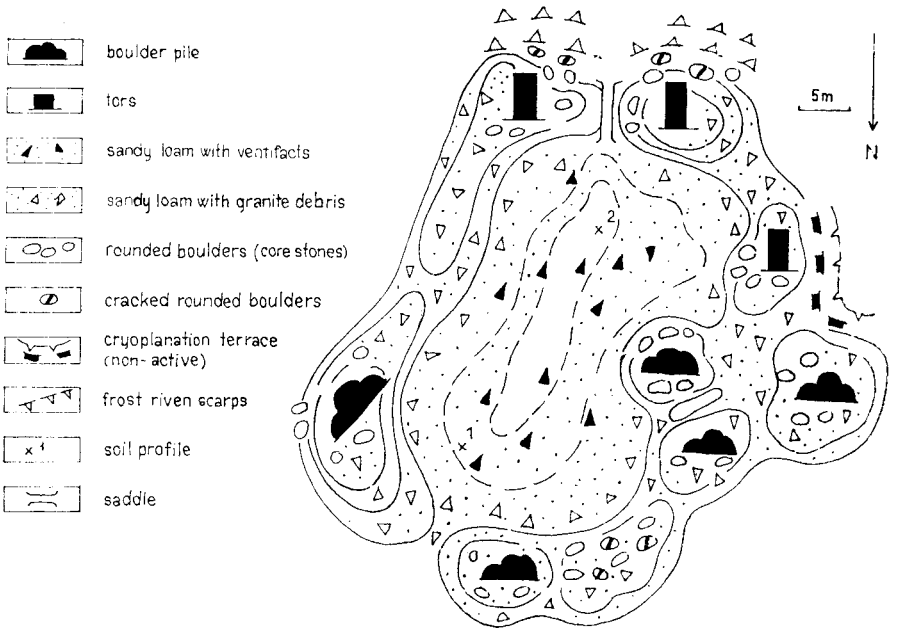

Fig. 2. A geomorphological field sketch of the study area

4. LITHOSTRUCTURAL SETTINGS AND TYPES OF MODELLATION

The depression is filled with a shallow sandy soil covering clayey sand with quartzite cobbles, which have undergone the periglacial aeolian modellation forming ventifacts. The minimum depth of this layer is approximately 30 cm. Only mechanically weathered granite is found deeper (Fig. 3).

Both outer and inner slopes are covered with the boulders of polyge-

netic origin. Rounded boulders and minute domes are genetically conected with warm and humid climate [3, 4]. As the climatic conditions changed in the Pleistocene, the geomorphological agents of periglacial or even glacial clima-morphogenic zone started the remodelling of the whole region. This is particularly reflected at the upper part of the slope where frost riven scarps have developed. They are covered with the combination of rounded and angular boulders and blocks and it is worth noticing, that some rounded ones have cracked. The nivation hollow and initial cryoplanation terrace, which have developed on the SSW edge, are the only "pure periglacial" relief forms.

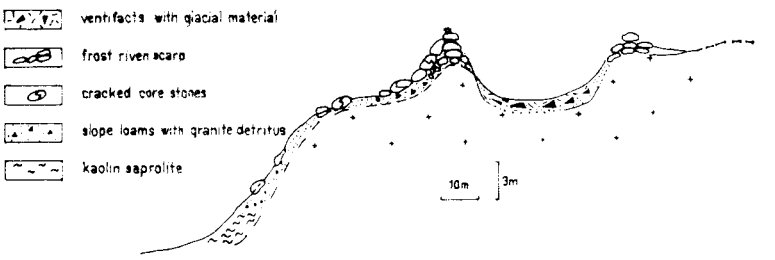

Fig. 3. A cross section through the hill-top depression

The profile through the slope loams at the foot is about 1 m deep and reveales also granite debris and blocks reaching as much as 1,5 m in diameter. The slope loam passes gradually into kaolin saprolite.

5. GENETIC CONSIDERATION

As far as the authors know hill-top depressions are quite exceptional mesoforms on granitic rocks [1, 6] and due to lack of information it is necessary to compare their development described under different geological conditions.

Brosh and Gerson [1] suppose that in sites associated with the occurrence of depressions the prevalent mode of water movement is by percolation, so that removal of material is carried out by solution. Such denudation processes are affected by structure (bedding planes, joints). They quote at least two phases of formation within a cycle of erosion, controlled by the intermittent upwrap and climatic change from warm-humid to subhumid conditions in the studied area. The existing depression may have been formed before, during or even after the dissection of each surface. We can recognise several types and stages of development of hill-

-top depressions but all of them are ultimately consumed by the slope retreat.

In the territory studied the sediments at the centre of the depression play the key role for the description of genesis and the age of the landform. They are supposed to be of glacial or fluvioglacial origin according to their sandy composition and occurrence of quartzite ventifacts. With respect to the petrographic differences of the local bedrock these ventifacts had to be the part of the former glacial — transported material. It means that the depression is at least of pre-glacial age. Due to the rounded "core stones" on the border and kaoline mantle at the foothill it is very probable that the embryonic stage of the hill-top depression developed under warm and humid climate. Such clima-morphogenic environment occured for the last time during the late Tertiary at this region [4].

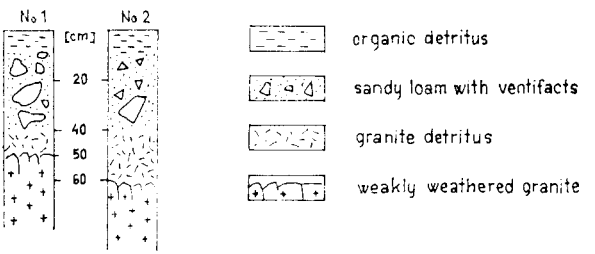

Fig. 4. Soil profiles in the hill-top depression

Periglacial remodellation caused only frost cracking of tropical weathering residual boulders and the development of initial stages of cryoplanation terraces (nivation hollows, frost riven scarps). Slope loams of Pleistocene age are not very thick and do not dramatically change the shape of the slope.

6. CONCLUSION

The occurrence of the hill-top depression and the sediment fill testify to a slow transformation of the relief on crystalline rock during the Quaternary. In the future it will be necessary to pay more attention to landshapes, which can be buried under the tropical weathering mantle or glacial sediments in other parts of the Žulovská pahorkatina (Hilly land). The origin and development of the hill-top depressions is still ambiguous, nevertheless the lithology, climate and joints are probably the most influencing factors.

The authors will gratefully accept hints indicating the occurrence of hill-top depressions throughout the world and especially in granitic regions.

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