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**GEOMORPHOLOGY OF KARST DEPRESSIONS:  
POLJE OR UVALA - A CASE STUDY OF LUČKI DOL**

GEOMORFOLOGIJA KRAŠKIH DEPRESIJ:  
POLJE ALI UVALA, NA PRIMERU LUČKEGA DOLA

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**Abstract**

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**Martina Frelih: Geomorphology of karst depressions: polje or uvala - a case study of Lučki dol**

Lučki dol is a small depression, mentioned in the scarce literature about the karst of Dolenjsko and about the wider area between the Basin of Grosuplje and the valley of river Krka. It has been characterised very differently regarding the karstic form. So it has been named uvala, dry valley, blind valley and also karst polje. Among many definitions of karst polje the author has chosen the one stated by Gams. Although it is sometimes difficult to make a clear difference between uvala and karst polje, has the author made a conclusion, based on the geological, geomorphological and hydrological characteristics which were compared with definition of Gams, that Lučki dol is a small karst polje in the piezometric level.

**Key words:** karstology, karst polje, geomorphology, Slovenia, Karst of Dolenjsko, Lučki dol.

**Izvleček**

UDC: 551.44(497.4)

**Martina Frelih: Geomorfologija kraških depresij: polje ali uvala, na primeru Lučkega dola**

Lučki dol je manjša depresija, večkrat le omenjena v literaturi o Dolenjskem krasu in območju med Grosupeljsko kotlino in dolino Krke. Avtorji to kraško površinsko obliko različno poimenujejo. Lučki dol je imenovan uvala, suha dolina, slepa dolina in kraško polje. Med definicijami kraškega polja se je avtorica odločila za Gamsovo. Čeprav ni lahko jasno določiti ali gre za uvalo ali kraško polje, je avtorica na osnovi geoloških, geomorfoloških in hidroloških značilnosti Lučkega dola, ki jih je primerjala z Gamsovo definicijo, ugotovila, da gre v primeru Lučkega dola za kraško polje v višini piezometra.

**Ključne besede:** krasoslovje, kraško polje, geomorfologija, Slovenija, Dolenjski kras, Lučki dol.

## INTRODUCTION

Lučki dol is a karst depression situated in the northern part of Dolenjsko region, which covers the southern part of Slovenia. It is named after the settlement Luče. Dol means a valley, doline, hollow.

The karst of Dolenjsko is not researched as well as the Classical karst. In the scarce literature, where Lučki dol is mostly only mentioned, it is characterised differently regarding the karstic form. Possible karstic forms are uvala (Gams 1987), blind valley (Ferber 1993), dry valley, dry valley with uvala in the bottom (both Melik 1928, 1931, 1955, 1959) and karst polje (Meze 1981 and Kranjc 1990). In this literature there are no more accurate explanations stated, that would explain the characterisation of Lučki dol as one of the mentioned karstic forms.

Despite of the definitions it is in some cases difficult to clearly distinguish between uvala, karst polje and blind valley, as they are all relatively big karst depressions and have similar characteristics which can be present in all these forms. One of these cases is Lučki dol. The definitions used in this article are mostly from the Slovene Karst Terminology of Gams. There were geological, geomorphological and hydrological characteristics of Lučki dol studied, and the discussion about the form of Lučki dol is based on that.

## ABOUT THE RESEARCHED AREA

Lučki dol is situated in the central part of Slovenia, in the northern part of the karst of Dolenjsko. This is karst that comprises the area between Ljubljansko barje (Ljubljana moor), Posavsko hribovje (Posavje hills), river Sava, Krško hribovje (Hills of Krško), Roško višavje (Heights of Rog), Dobropolje and valley of Čelmejščica stream. In the narrower geomorphological view Lučki dol belongs to the western part of the region Dolenjsko podolje. It is a transitional area between Posavsko hribovje in the north, where mostly fluvial relief prevails and the calcareous plateau of Suha krajina (Dry land) in the south. For this area the interchanging of surface water and underground running of water is characteristic. To the north west is the Grosupeljska kotlina, basin of Grosuplje. Posavsko hribovje is the catchment area of the streams that run over the basin of Grosuplje. In its south eastern part several valleys were formed. One of these valleys to which all waters from basin of Grosuplje run, is Radensko polje. This is a karst polje, which is situated west of Lučki dol and has the same orientation southwest-northeast. Its floor is covered with thick layers of clay, and limestone can be seen only in the estavelles that are characteristic for this polje. It has underground connections to Lučki dol. Between Lučki dol and Radensko polje is a higher ridge called Lučko sleme (Ridge of Luče). The highest parts are 550 m a.s.l. North of Lučki dol is Čalnsko-Loška uvala, where many short sinking streams run. East of Lučki dol is Kriška planota with Višnjanska gora (stretching) from 400 to 600 m a.s.l. More to the east the relief sweeps down to the valley of Muljava, that connects Dolenjsko podolje (the Valley of Dolenjsko) and Valley of Krka. Lučki dol is therefore situated in the catchment area of the Krka river, 2 km north of the springs. Its bottom lies at the average altitude of 315 m a.s.l. It is 3 km long and approximately 0,5 km wide. The depression of Lučki dol has a longer axis in the direction northwest southeast, the so called dinaric direction, and its bottom covers an area of 1.6 km<sup>2</sup>. The lowest point of the polje is 294 m a.s.l. (in the south eastern part in doline Globočnjak), and the highest point is on the top of the Višnjanska gora hill in the eastern side at 630 m a.s.l.

On the western side it borders on the ridge of Luče, on the eastern side on the already mentioned ridge of Višnjanska gora. Lower bordering areas are Poljane in the north and Prestrana in the south. They are lower areas of the circumference of the depression of Lučki dol. Poljane is 25-30 m above the bottom of the dol and Prestrana 100 m. Both are a kind of passes, Poljane towards north to the depression of •alna (polje) and Prestrana towards south to the valley of Krka river. In Prestrana pass, which is also a plateau, about 1 km from the southeastern edge of Lučki dol, there are two relatively big collapse dolines Velika (Big) and Mala (Small) Prestrana. They are close together, only 50 m apart. Velika Prestrana collapse doline is bigger - volume is about 880.330 m<sup>3</sup> and deeper (from the highest to the lowest point is about 85 m). Its surrounding slopes are not very steep, that is why it is presumed to be older. The steepest is the northern wall with the inclination of 38°. This collapse doline also has much more vegetation than the Mala Prestrana, which measures 606.468 m<sup>3</sup>. From the highest to the lowest point of this collapse doline is 73 m. Also in this one the northern wall with 73 ° inclination is the steepest.

Occasionally there is a periodic stream of river Radenščica springing in Lučka jama on the north western side of the bottom of the polje and running over the bottom of Lučki dol in the streambed. In the northern part, where the village spreads, the streambed was ameliorated (deepened). These ameliorations of the streambed were performed in the years of 1930-1937. Within the ameliorations in the 19<sup>th</sup> century also two swallow holes were enlarged and consolidated.

Radenščica flows mainly in the winter times after long periods of rain. The waters that spring as Radenščica in the cave Lučka jama come from Radensko polje. To there the surface waters come from the basin of Grosuplje as Grosupeljščica and through underground connections from the Dobrepolje as sinking river Raščica, that springs in Radensko polje as Šica. Grosupeljščica sinks in the swallow holes in the northern part of Radensko polje and in the time of floods, the waters run also in the southern part of the polje. Šica and Dobravka sink in the cave Zatočna jama. From Zatočna jama to Lučka jama is 1 km in air distance. The whole area is the catchment area of the river Krka. In the normal conditions, the waters from Radensko polje run underground directly towards the springs of Krka. Water tracing has also been done and the tracer needed two days to come from the sinks of Raščica to Radensko polje and nine days to springs of Krka (Novak, 1981).

## **GEOLOGICAL, GEOMORPHOLOGICAL AND HYDROLOGICAL CHARACTERISTICS OF LUČKI DOL**

Lučki dol is formed in Jurassic oolitic limestone, along the fault called fault of Luče. This fault is parallel to the fault of •u•emberk, that runs along the eastern side of Lučki dol and is of regional importance (Buser 1974). They are both oriented in the direction southeast - northwest.

The straight eastern slope, which runs along the Fault of •u•emberk indicates the tectonic origin of the slope if not the whole basin of Lučki dol. There are two kinds of Jurassic limestone in Lučki dol - in the western side there are grey and thick oolitic limestone with insertions of dolomite and on the eastern side there are only grey and thick oolitic limestone without dolomite (Buser 1974). The bottom of Lučki dol is covered with alluvial deposits the depth of which are unknown, but it is certain that they are thinner in the south eastern part, where the bedrock comes to the surface and also the swallow holes and sinkholes are more frequent.

Lučki dol has a relatively flat bottom. There are some small local depressions, river terraces

and the streambed present, but the flatness is greater in the northern part, where the land is used for fields. The southern part is much more diverse with swallow holes, meandering natural streambed, dolines and one collapse. It is gently inclined from the northern part, where it is at the height of 325 m a.s.l. towards south eastern part, where it reaches the height of 310 m a.s.l. The inclination is 8,5%. The slopes rise from the bottom. The steepest is on the south eastern side with maximum inclination 34° and rocky edge. On the eastern side the slope is very straight in the dinaric orientation and it has inclination between 16° to 22°. The western slope has inclination between 10° and 16°. The northern slope has the smallest inclination (4° to 10°) (Frelih 2001).

There are two caves present in Lučki dol. They are both on the border of alluvial bottom and slope, where bedrock comes to the surface. In the north western side is cave Lučka jama. It is a water cave in two levels. The entrance of this cave is in the height of 315 m a.s.l., in the same height as the bottom. It has a relatively big entrance chamber that branches into two galleries. In both galleries the water level oscillates. In the gallery leading towards north is a shaft that is always filled with water. Here the deepest point has been set, which is 12 m below the edge of the shaft. The water was never below this point, even in the driest parts of the year (Frelih 2001). In the observation time also two diving attempts were made and they showed the depth of the shaft at least 40 meters. The difference in the height between the entrance and the lowest point of the cave that is not permanently under water is 26 m in the dry period. There were 171 meters of passages measured.

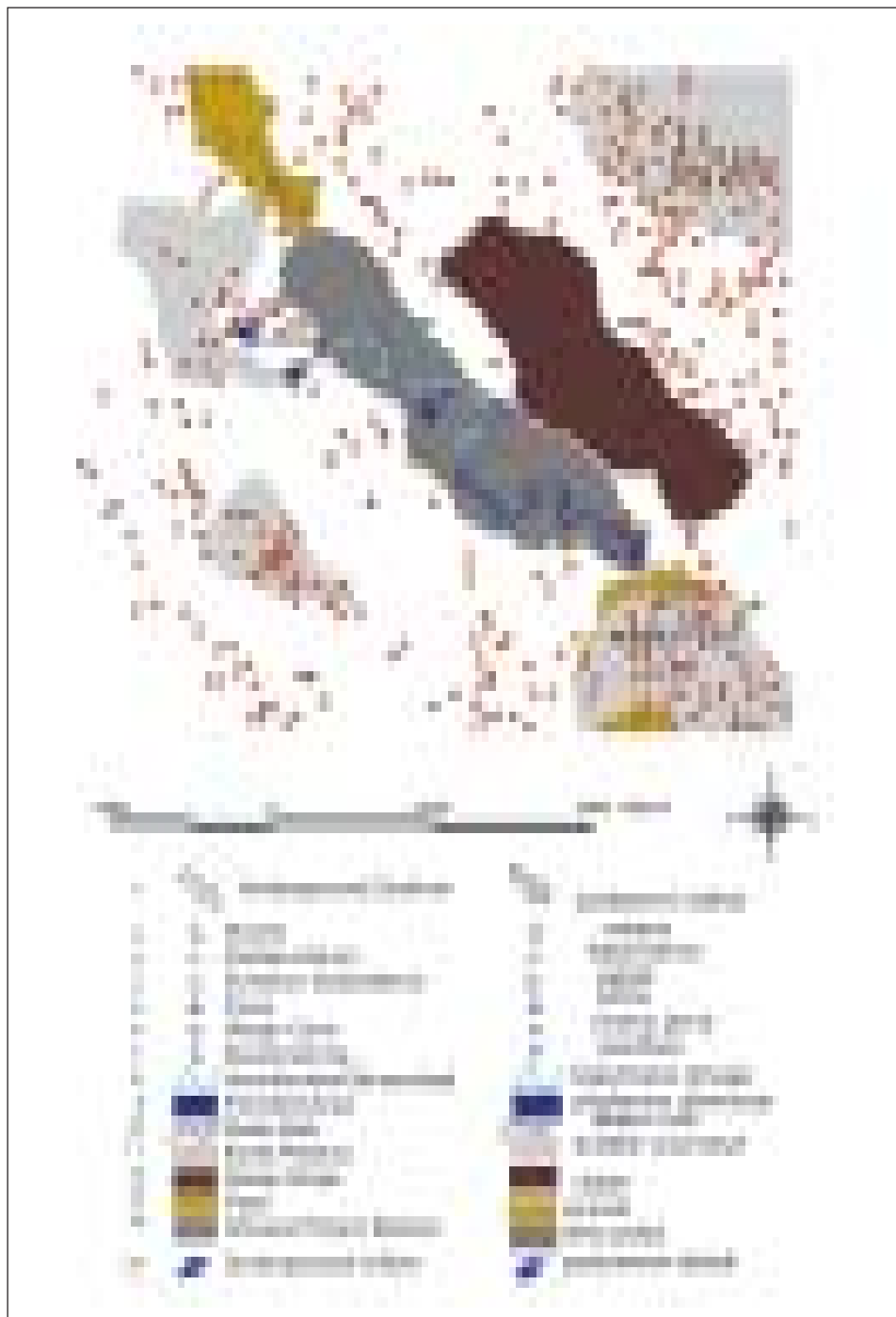
The other cave is Štupnikova lisičina, situated in the south eastern side at a height of 320 m a.s.l. It consists of two chambers and is twenty meters long and two meters deep. It is a dry, horizontal cave. The bottom is covered with mud, and there is more sinter than in the cave Lučka jama, as it is a dry cave.

Lučki dol has a karstic inflow and karstic outflow. Through the cave Lučka jama on the north western side the waters flow in and then over the bottom of Lučki dol as a periodical river Radenščica. The cave is mostly dry, but occasionally it gets flooded, so the river is a seasonal event occurring mostly in the winter time. In the southern part of the bottom the natural streambed is meandering and ends in the south eastern part of the bottom, where the frequency of swallow holes is higher. In the time of high waters the south eastern part of Lučki dol, that is also the lowest, gets flooded and a small lake appears. In the observations made in November 2000, the lake measured about 22 000 m<sup>2</sup> (Frelih 2001). The lake holds for a few days, depending on the water conditions and the amount of precipitation.

In the cave, in the entrance of the cave, in the streambed in front of the entrance, sediments that originate from the river basin of Raščica are present. Raščica sinks in swallow holes near village Ponikve five km in air distance from Lučki dol (Habič 1988). These waters first come to Radensko polje, sink there and come to the surface in Lučki dol at the time of high waters. Based on the sediments found in the cave, also first predictions of underground water connections were made in order to ameliorate the karst poljes of Dolenjsko, to avoid flooding (Hrasky 1887).

In the cave Lučka jama the water oscillates according to the amount of rainfall and water conditions in Radensko polje, that lies higher (325 m a.s.l.) and is one kilometre away. When the water is flooding the neighbouring Radensko polje, the water in Lučka jama starts to rise, and if the rain continues, it rises so high that it starts to run out of the cave.

Based on observations made in the spring cave of Lučka jama and in the enlarged swallow holes, we can conclude that the water is running under the surface when it is not flooding. In dry



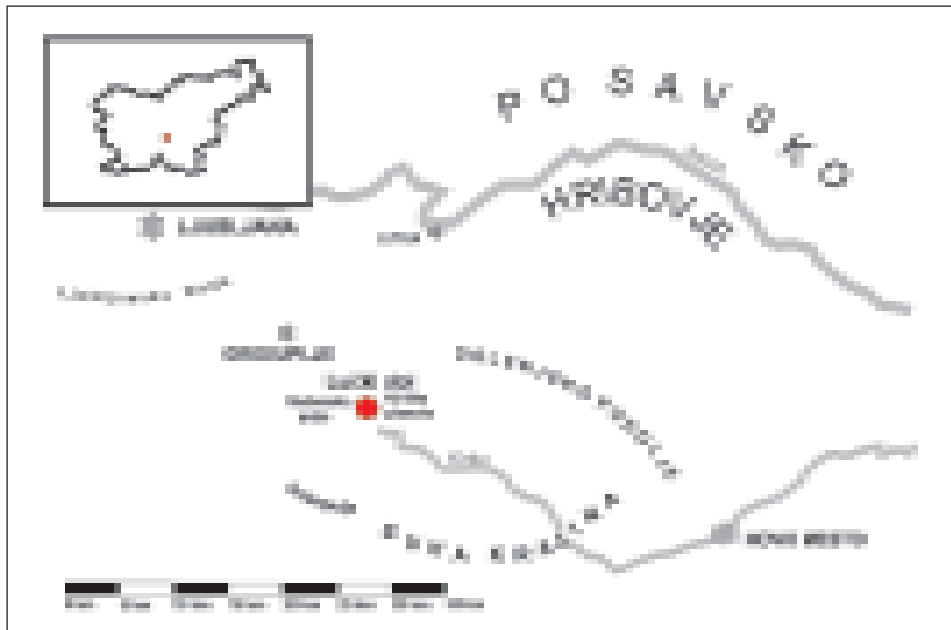


Fig. 1: The position of Lučki dol

Slika 1: Položaj Lučkega dola.

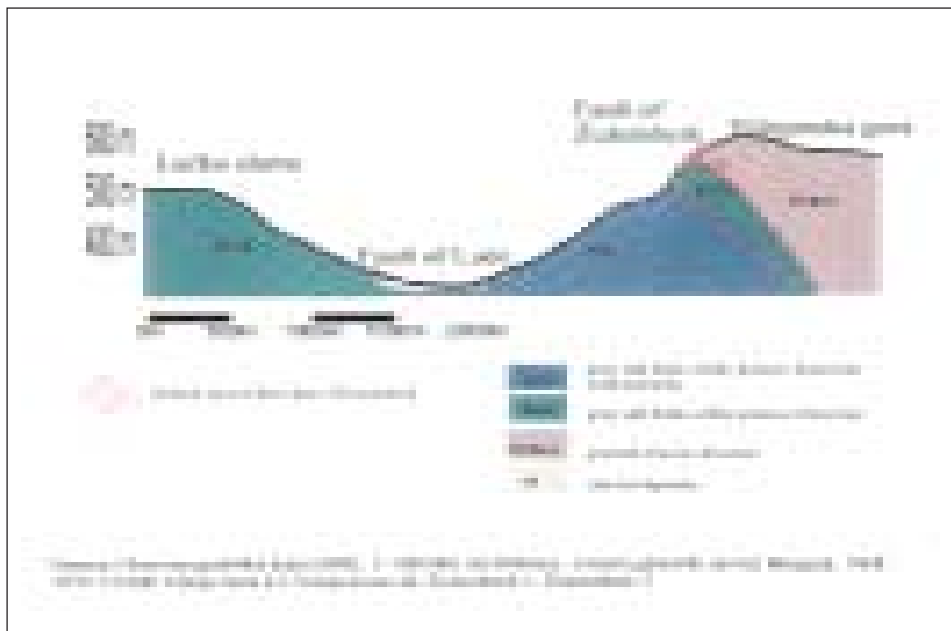
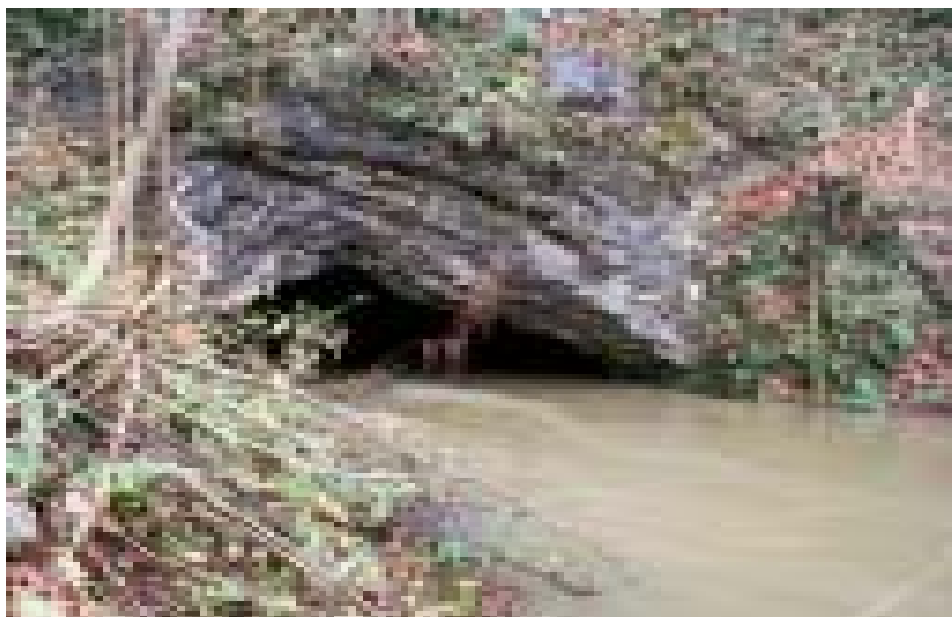


Fig. 2: Geological profile of Lučki dol.

Slika 2: Geološki prerez Lučkega dola.



*Fig. 3: Photo of Lučki dol, showing the flatness of the bottom.*  
*Slika 3: Fotografija dna Lučkega dola.*



*Fig. 4: The river Radenščica springing in the cave Lučka jama.*  
*Slika 4: Izvir Radenščice v Lučki jami.*



conditions, in summer time, when the amount of the precipitation is smaller, the waters run 28-30 m under the surface of the bottom of Lučki dol. That is in the level of 288 m a.s.l. When the floods come, the water level in the cave starts to rise.

The bottoms of both enlarged swallow holes are nowadays filled with mud and trash and not passable. According to the older inhabitants of the village Luče that own land in the southern part, until 50 years ago they were able to collect water and to cool their drinks in the water in the enlarged swallow hole in the southern part, during mowing of grass. At that time it was possible to pass the bottom of the enlarged swallow hole. Its upper edge is at the height 301 m and it is 15-20 m deep, therefore the bottom is at the height of 286-280m a.s.l. That is 10 m higher than the spring of river Krka in the cave Krška jama to which the waters from Radensko polje and very likely also from Lučki dol, run.

## DISCUSSION

In the literature Lučki dol is characterised differently regarding the karstic form. In opinion of Melik it is a dry valley, with an uvala in the bottom (1931, 1951). According to Gams it is an uvala (1987), Meze (1981) and Kranjc (1990) mention it as a karst polje and Ferbe•ar (1993) discusses it as a blind valley. For none of these characterisations any explanation was given, except from Melik for the dry valley. These are all surface forms, that all have in common a great basin, karstic drainage and steep slopes. Therefore in some cases it is difficult to clearly define the karstic form. One of these cases is Lučki dol.

The south eastern part of Lučki dol has a shape of a blind valley, ending with steep slopes. Under the slopes are the swallow holes and sinkholes, where the water sinks or even stagnates for short periods in the time of floods. **Blind valley** usually develops on contact between carbonate and non-carbonate rock. It is a river valley, which ends blindly. There are no non-carbonate rocks present in the vicinity of Lučki dol (except the alluvial deposits in the bottom). The nearest non-carbonate rock is in the northern fringe of Basin of Grosuplje – 15 km away and in the hills of Posavje (Posavsko hribovje) - 30 km away. It could function as a blind valley in the past, when the waters from the hills of Posavje were running towards the south in Pliocene, but that is only a presumption (Ferbe•ar 1993). Blind valleys are open in the upstream side, where the non-karstic rocks are and end in karst. As Lučki dol has a higher circumference on all sides, it cannot be a blind valley.

By another opinion is Lučki dol a part of a dry valley. **Dry valley** is a valley formed by a river in the past. At the present it is empty, dry and in some cases water runs through it. It is open at both ends. In the case of Lučki dol the river Krka, when running towards north in Pliocene would be able to form it, so the valley would start in the area of the pass Prestrana and would run over Lučki dol and Poljane. Later the bed of the valley would sink and the today's depression Lučki dol would be formed (Melik 1931). Today's knowledge of the decantation of the waters in the Dolenjsko area gives idea that in Pliocene the waters were running towards south or east and not towards north (Kranjc 1981). Besides there were no sediments found that could show traces of a stream running in any direction (Frelih 2001).

By opinion of Gams Lučki dol is an uvala (1984), Kranjc (1991) and Meze (1981) argue, that it is a polje. **Uvala** is bowl shaped, smaller than polje and bigger than doline, with an uneven bottom, that is covered with dolines (Gams 1973). According to Cvijić is uvala genetically an

intermediate stage between a karst polje and a doline. Already he concluded that it is difficult to clearly differ between uvala and polje (Cvijić 1895). There are many definitions of **karst polje** (Sweeting 1972; Gams 1973; Jennings 1985; Panoš 2001; Lehmann 1960). They all have in common some basic characteristics: large (the largest) closed depression, higher surroundings with steep hills descending to the flat-levelled bottom, karstic inflow, sinking river, floods, selective corrosion and influence of tectonics (Gams 1978). The author chose the following definition stated by Gams "polje is a depression in the karst area with the uninterrupted higher rim and at least 0,5 - 1 km wide flat bottom; in its typical form the depression has steep slopes and there is a surface water course on its bottom which disappears underground within the depression itself" (Gams 1973).

From the number of definitions it is obvious that the polje as geomorphological feature is very diverse and therefore it is difficult to state a universal definition that would hold everywhere in the world. There are 34 types of poljes indicated in the Terminology of Panoš (2001).

The diversity of poljes is reflected also in the diversity of the criteria by which poljes can be classified. These points of view may be as follows (by Gams 1973):

- 1) the structural geological aspect (graben polje, anticlinal polje, synclinal polje, horst polje);
- 2) hydrology: surface-inlet and sink-outlet polje, spring-inlet and sink-outlet polje, periodically inundated polje, lake polje, crypto-depressional polje, polje in the piezometric level (Vorfluter polje);
- 3) shape (form): bowl-like polje, kettle-like polje, elongated polje, valley-like polje, blind- valley-like polje, uvala-like polje, karst-valley-like polje;
- 4) the position in the surrounding landscape: plateau polje, piedmont polje;
- 5) origin: tectonic polje, tectonically preconditioned polje, erosional polje, corrosional polje, polygenetic polje
- 6) climate: Mediterranean polje (Nicod 1967), tropical polje, subarctic polje;
- 7) the relationship to impermeable and semipermeable sediments which control the hydrology: marginal polje (Lehman 1960), overflow polje, peripheral polje;
- 8) age of alluviation or basin: Quaternary polje, glacial polje, periglacial polje;
- 9) homogeneity: homogeneous polje, heterogeneous polje, compound polje;
- 10) with regard to economic use: water-storage polje.

From these different aspects Gams suggests five types of morphological-hydrological poljes: border polje, overflow polje, peripheral polje, piedmont polje and polje in the piezometric level (Gams 1973, 1974). Border polje is formed at the contact of permeable and impermeable rocks that drain into the polje. An overflow polje has either a belt or the whole bottom built of impermeable or semipermeable sediments, which act as a barrier for underground water rising at one side and sinking at another side of the bottom. In the peripheral poljes the impermeable sediments have a central or nearly central position in the polje and they are drained in all directions toward the bordering limestone and ponors. A piedmont polje is situated at the footslope of a mountain, which has under a Pleistocene glacial or periglacial climate provided more alluvium. The polje in the piezometric level has an inundated bottom at high water. The piezometric level is sustained by a river or sea, many kilometres away from the polje (Gams 1973, 1974).

Lučki dol is a relatively small depression in comparison to the polje of Planina or Cerknica, or the biggest polje in Slovenia - the polje of Kočevje. The bottom of the polje of Kočevje measures 50-100 km<sup>2</sup> (Gams 1974). Lučki dol measures in volume 223 millions of m<sup>3</sup>, is almost 3 km long, in average 0,5 km wide and the bottom covers 1,6 km<sup>2</sup>.

To distinguish between polje, blind valley, karst valley and doline with flat bottom, the limiting value of 400 m for the width of the bottom has been suggested (Gams 1978). According to this constrain, Lučki dol could be an uvala, due to its size. The bottom measures 1,6 km<sup>2</sup> and the width of the bottom on the narrowest part is 250 m. But the widest part measures 700 m, the average width is therefore 500 m. The word dol means in Slovene a smaller basin, that corresponds to the basin like uvala. Uvala is a serb-croatian term. It was introduced to Slovene karst terminology. Due to the name and the size Lučki dol could be an uvala. More important than size are the flatness of the bottom and other characteristics of the polje. The decisive factor in determining the difference between a doline and a karst polje is the flat alluvial bottom in the case of the latter (Gams 1973). Typical for an uvala is the uneven bottom, which often contains dolines, whereas the flat ground at the bottom is typical for a polje. The flat bottom however is normally the result of the deposition (loam, sand and gravel). On such a terrain also larger plots of arable land appear from which the name polje (Slavic origin) is derived (Gams 1973). The deposits hinder the sinking of the running water into the karst interior.

The bottom of Lučki dol is relatively flat and is a result of a deposition. It is more flat in the northern part, where it is also cultivated. In the southern part, the natural streambed is meandering, making the relief of the bottom more diverse including the sinkholes and one collapse. Calculations have showed inclinations between 0 and 4°. The cross sections over Lučki dol show a flat line in the bottom part; it was deposited and it is cultivated therefore is Lučki dol a polje.

Other characteristics of polje as unbroken higher rim, karstic inflow and outflow, steep slopes descending towards the bottom, formation in karstic rock and tectonic origin are present also in Lučki dol and are not disputable. The slopes of Lučki dol are descending at different gradients. At least on one side in the south the slope is rising steeply (34%) to the higher rim. This rim is unbroken, 50 m to 100 m above the bottom and makes Lučki dol an enclosed depression.

Through the cave Lučka jama has Lučki dol a karstic inflow. The stream Radenščica is periodical sinking river and can cause flooding. The water has a karstic outflow through the sink holes in the streambed and the enlarged sink holes. In the dry period the water runs underground towards the springs of Krka

Due to the straight-running eastern slope, which runs along the fault, and the fault of Luče, running under the bottom, we can presume a tectonic origin of the depression, that is oriented in the same direction as the faults. It is situated in the Jurassic limestones – calcareous rocks.

## CONCLUSIONS

Lučki dol is a small karst polje. It is polje due to following geological, geomorphological and hydrological features: built in karstic rock - Jurassic limestones, tectonic origin, higher enclosing rim, steep slopes at least on one side (the southern part of Lučki dol), relatively flat alluvial bottom, sinking river and karstic inflow and outflow. The narrowest part of the bottom measures only 250 m, and according to the definition (Gams 1973) it should be at least 400 m wide. Because of the size and the relative flatness of the bottom is Lučki dol a disputable case and that explains different opinions in terms of karstic form. But the size is not the decisive factor, more important are other, qualitative, characteristics of polje, which are present in the basin of Lučki dol.

Based on the studied geological, geomorphological and hydrological features, I can conclude, that Lučki dol is a small karst polje in the piezometric level.

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## GEOMORFOLOGIJA KRAŠKIH DEPRESIJ: POLJE ALI UVALA, NA PRIMERU LUČKEGA DOLA

### Povzetek

Lučki dol je kraška depresija, ki se nahaja med Grosupeljsko kotlino, Posavskim hribovjem in izviri Krke ter je del Dolenjskega krasa. Kras med Grosupeljsko kotlino in izviri Krke je še slabo raziskan, na kar kaže maloštevilna literatura. V tej literaturi je Lučki dol samo omenjen z enim ali dvema stavkoma. Opredeljen je zelo različno kot suha dolina (Melik 1931, 1951), slepa dolina (Ferbežar 1993), uvala (Gams 1987) ali kraško polje (Kranjc 1990). Preučene so bile geološke, geomorfološke in hidrološke lastnosti Lučkega dola, na osnovi katerih je bilo možno določiti za kakšno obliko gre.

Lučki dol na prehodnem območju med Posavskim hribovjem na severu, kjer prevladuje normalen relief in kraško Suho krajino na jugu. Severozahodno od Lučkega dola je Grosupeljsko polje, kamor se stekajo vode z jugozahodnega dela Posavskega hribovja. Na južnem obrobju Grosupeljskega polja se nahaja več vzporednih dolin. Najzahodnejša je Radensko polje. To je kraško polje, katerega dno je pokrito z naplavino, kamninska podlaga pride na dan samo v estavelah, ki so značilne za to polje. Podzemno je povezano z Lučkim dolom, je višje od Lučkega dola, loči pa ju Lučko sleme, katerega najvišji deli segajo do 550 m. Severno od Lučkega dola je Štajersko-Loška uvala, kjer teče več manjših potokov, ki ponikajo. Verjetno te vode tečejo tudi pod Lučkim dolom proti izvirov Krke. Na vzhodu omejuje Lučki dol Kriška planota. Južno in severno stran Lučkega dola omejujeta njuna predela-prevala: na severu Poljane in na jugu Prestrana. Povprečna nadmorska višina Lučkega dola je 315 m, dolg je 3 km in širok v povprečju 0,5 km, dno pa pokriva površino 1,6 km<sup>2</sup>. Lučki dol v dinarski smeri severozahod-jugovzhod (SZ-JV) (Frelj 2001).

Lučki dol je nastal v jurskih oolitnih apnencih ob Lučkem prelomu, ki je vzporeden večjemu - Štajerskemu prelomu. Zadnji poteka vzhodno od Lučkega dola in je regionalnega pomena. Oba potekata v dinarski smeri, se pravi SZ-JV (Buser 1974). Ravno vzhodno pobočje, ki poteka ob Štajerskem prelomu, nakazuje na tektonski nastanek pobočja, če ne tudi Lučkega dola (Frelj 2001).

Dno Lučkega dola je pokrito za aluvijalnimi nanosi, katerih globina je neznana, vendar pa je očitno, da so tanjši na jugovzhodnem delu, kjer prihaja kamninska podlaga na površje. Relativno ravno dno je tudi rahlo nagnjeno od severnega proti jugovzhodnemu delu. Na severni strani, ki je bolj uravnana in obdelana, dosega višine do 325 m n.v. na jugu, ki je poraščena z gozdom in meandrirajo naravna struga, pa 310 m.

Z dna se dvigajo različno strma pobočja. Najstrmeje je na jugovzhodu (35°). Vzhodno ravno pobočje ima naklon med 16 in 22°, zahodno med 10 in 16°, severno je najbolj položeno (med 4 in 10°).

Na obravnavanem območju se nahajata tudi dve jami. V severozahodnem pobočju je Lučka jama, skozi katero občasno priteče voda kot Radenščica v Lučki dol. To je vodna jama v dveh nadstropjih. Vhod je na višini dna-315 m. Ima večjo vhodno dvorano, ki se razveja v dva večja rova. V obeh rovih voda niha. V severnem rovu je brezno, ki je stalno napolnjeno z vodo. Najnižja točka suhih delov jame je bila izmerjena v tem breznu, 12 m pod vrhom brezna. Tudi v sušnih poletnih mesecih je voda ostala na tem nivoju. Višinska razlika med to točko in vodom je 26 m, izmerjenih je bilo 171 m rovov.

Druga jama je Štupnikova lisičina, ki se nahaja na jugovzhodnem robu v višini 320 m.

Sestavljena je iz dveh prostorov, ki sta skupaj dolga 20 m. Je suha, horizontalna jama, v njej pa je najti več sige kot v Lučki jami.

Lučki dol ima kraški dotok in kraški odtok. Voda v Lučki dol priteka predvsem sezonsko v zimskem času skozi Lučko jamo in teče naprej po strugi, ki se vije preko polja proti JV delu polja kot reka Radenščica. Voda, odvisno od vodnega stanja, lahko ponika •e prej v strugi, ob višjih vodah pa teče proti JV delu in tam zastaja, tako da se ustvari majhno jezero, ki po nekaj dneh odvisno od hidroloških razmer odteče v po•iralnike. Struga je v severni polovici polja, kjer je naselje, tudi regulirana-umetno poglobljena. Ostali del struge pa je naraven. V izvorni Lučki jami nivo vode niha, tako se ob pribli•evanju poplav dvigne in po koncu zopet spusti. Opazovanja tega nihanja v jami in v katavotronih ter poplav so pokazala, da se voda ob sušnih mesecih pretaka 28 do 30 m pod površjem (Frelih 2001).

Na podlagi sedimentov v jami in na vhodu jame ter v strugi so bile •e zgodaj predvidene povezave s sosednjim Radenskim poljem, kjer so enaki sedimenti v Zatočni jami. Ti sedimenti izvirajo iz porečja Raščice, ki ponika pri Ponikvah na Dobrepolju, pride na dan na Radenskem polju, ter tam zopet ponikne. Ob normalnem stanju teče proti izvirov Krke, ob poplavih pa priteče v Lučki dol.

V jugovzhodnem delu Lučkega dola se iznad po•iralnikov, kjer voda ob poplavih zastaja, dviga strmo pobočje a obliki amfiteatra, kar daje Lučkemu dolu videz slepe doline oziroma njen slep zaključek. Slep doline nastajajo na stiku kraške in nekraške kamnine kot oblika kontaktnega krasa in so odprte proti nekraškemu delu, od koder vode pritekajo. Na stiku kraške in nekraške kamnine ponikajo in z materialom, ki ga nosijo s seboj izdolbejo večje ali manjše jame. Lučki dol se nahaja v apnencih, ki so kraška kamnina. Dno je pokrito z aluvijalno naplavino v katero je vrezana struga, kar pomeni, da je zmo•na dr•ati vodo. Najbli•je nekraške kamnine so oddaljene nekaj kilometrov na obrobju Grosupeljskega polja, v Posavskem hribovju na severu in v Velikolaščanskem podolju na zahodu. Vode iz teh predelov pritekajo v Lučki dol, vendar ne površinsko, marveč podzemsko. Slep doline so odprte v stran proti toku, kjer so nekarbonatne kamnine in se končajo v krasu, Lučki dol pa ima višji kraški obod na vseh straneh in ne more biti slepa dolina. Morda je imel to funkcijo v pliocenu, ko naj bi reke s Posavskega hribovja tekle proti jugu.

Zaradi zni•anih delov oboda na severni in ju•ni strani si lahko Lučki dol predstavljamo kot dolino, kateri se je dno ugreznilo. Po mnenju A. Melika (1931, 1957) je ta dolina nastala ob pretakanju vod proti severu. Na to sklepa po razlikah v višini, saj je ju•ni preval Prestrana višji kot severni Poljane. Drugih dokazov za nekdanji tok reke proti severu ni. Poleg tega je to v nasprotju s kasnejšimi spoznanji, ki predlagajo odtok vode na Dolenjskem proti vzhodu - Krki in jugu (Frelih 2001).

Uvala je skledasta vdolbina, navadno manjša od kraškega polja in večja od vrtače, z neravnim, običajno z vrtačami razčlenjenim dnom (Gams 1973). Glede na to definicijo bi Lučki dol lahko bil uvala. Za kraško polje obstaja veliko definicij (Sweeting 1972; Gams 1973; Jenings 1985; Lehman 1960; Panoš 2001), vse pa imajo skupne naslednje značilnosti: velika zaprta kotanja, višji obod s katerega se spuščajo pobočja proti ravnemu dnu, kraški dotok, ponikalnica, poplave, vpliv tektonike (Gams 1978). Glede na te splošne značilnosti bi lahko Lučki dol bil tudi kraško polje. Število definicij kaže na to, da je kraško polje zelo raznolika oblika in je zato te•ko izdelati definicijo, ki bi veljala na vsem kraškem površju. Zaradi jasnosti smo izbrali definicijo I. Gamsa: "Kraško polje je kotanja v kraškem ozemlju s sklenjeno višjim obodom in ravnim dnom, ki je,

ako je v ostalih pogledih tipično, vsaj "do 1 km široko. Ima strm obod in površinski vodni tok, ki na polju ponika" (1973).

Lučki dol je razmeroma majhna depresija v primerjavi s Planinskim, Cerknjskim ali Kočevskim poljem, saj njegovo dno pokriva okoli 1,6 km<sup>2</sup>. Da bi lažje ločili kraška polja, uvale in kraške doline je bila predlagana mejna vrednost širine 400 m (Gams 1978). Lučki dol meri na najožjem delu 250 m, na najširšem pa 700 m, tako je v povprečju širok 500 m. Glede na velikost in tudi ime dol je Lučki dol uvala. Dol pomeni manjšo kotanjo, podobno uvali (Gams 1998). Vendar pa uvala ni slovenski izraz, ampak je bila prenešena iz srbo-hrvaščine. Osnovna razlika med kraškim poljem in uvalo je v izravnosti dna. Uvala ima tipično neravno vrtačasto dno, polje pa ravno, kar je posledica naplavljanja. Večinoma je tudi obdelano. Lučki dol ima relativno ravno dno. V severnem delu je bolj uravnano in so na njem tudi njive, južni del pa je poraščen z gozdom in bolj razčlenjen (Frelih 2001). Prisotne pa so druge geološke, geomorfološke in hidrološke značilnosti ki so nesporne in značilne za kraško polje: nastanek v kraški kamnini - jurski apnanci, tektonska zasnova, višji sklenjen obod, strma pobočja vsaj na eni strani (jugovzhodno pobočje), relativno ravno aluvijalno dno, ponikalnica ter kraški dotok in odtok. Zaradi velikosti in relativne izravnosti dna je Lučki dol sporen primer, kar pojasnuje tudi različna mnenja glede oblike. Vendar pa velikost nima odločilnega pomena, temveč so za prepoznavanje polj pomembnejše druge kvalitativne značilnosti polja, ki jih Lučki dol ima.

Na podlagi preučenih geoloških, geomorfoloških in hidroloških značilnostih lahko zaključimo, da je Lučki dol malo kraško polje v višini peizometra. Na to sklepam na osnovi meritev nihanja gladine v Lučki jami, opazovanja poplav in primerjav stanj z razporeditvijo padavin in pretoki Krke, Raščice in Grosupeljščice.