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THE CAVES OF THE CONTACT KARST OF BEKA AND OCIZLA, IN SW SLOVENIA

JAME KONTAKTNEGA KRASA BEKE IN OCIZLE, JZ SLOVENIJA

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Abstract UDC: 551.442(497.4-16)

Nadja Zupan Hajna: The caves of the contact karst of Beka and Ocizla, the SW Slovenia

The cave system of Beka-Ocizla is developed in the area of contact between Palaeocene limestone and Eocene flysch at 350 m a.s.l. in south-western Slovenia. The beds of limestone could generally be traced in the direction towards NW; the most distinct tectonic structures are in the Dinaric direction and transversely to the Dinaric direction. Three bigger streams and one smaller flow from the flysch on the contact with limestone, which sink into the limestone. The following caves are connected to the cave system: Ocizeljska jama, Blažev spodmol, Maletova jama s slapom, Jama z naravnim mostom, Jurjeva jama v Lokah and Jama S-4 / Socerb; the entrances of four of those caves function as occasional ponors. The least close entrances are 500 m away from each other. The water in the system simultaneously flows on various levels and drains in the direction of Boljunec. The system of parallel fault planes with dip 220/50-80 is the most important for the development of the cave system, the general direction of the cave's passages and the flow of water in the system.
Key words: contact karst, Beka-Ocizla cave system, Slovenia.

Izvleček UDK: 551.442(497.4-16)

Nadja Zupan Hajna: Jame kontaktnega krasa Beke in Ocizla, JZ Slovenija

Beško-Ocizeljski jamski sistem je razvit v območju kontakta med paleocenskim apnencem in eocenskim flišem na nadmorski višini 350 m na jugozahodu Slovenije. Plasti apnenca generalno vpadajo proti NW, najizrazitejše prelomne strukture so v dinarski in prečnodinarski smeri. S fliša na kontakt z apnencem pritekajo trije večji in en manjši potok, ki ponikajo v apnenec. V jamski sistem se povezujejo Ocizeljska jama, Blažev spodmol, Maletova jama s slapom, Jama z naravnim mostom, Jurjeva jama v Lokah in Jama S-4/Socerb od katerih vhodi v štiri jame delujejo kot občasen ponor. Skrajna vhoda sta drug od drugega oddaljena 500 m. Voda se v sistemu istočasno pretaka na različnih nivojih in drenira proti Boljuncu. Za razvoj jamskega sistema, generalne smeri jamskih rovov in pretakanje vode v sistemu, je najpomembnejši sistem vzporednih tektonskih ploskev z vpadom 220/50-80.
Ključne besede: kontaktni kras, Beško-Ocizeljski jamski sistem, Slovenija.

INTRODUCTION

The contact karst of Beka and Ocizla is located in the south-west part of Slovenia (Fig. 1), southeast of Kozina. On the contact between limestone and flysch, west of the villages Beka and Ocizla, at 350 m a.s.l., the oblong depression named Loke is formed. More caves developed on this contact, which are connected to the Beka-Ocizla cave system (Fig. 2). According to the Basic geological map 1: 100000, Trieste sheet (Pleničar et al. 1969), this is the contact between Palaeocene / Eocene limestone and Eocene flysch. The area belongs to the morphostructural unit of the Podgorski Kras (Bosak et al. 1999), for which the narrow stripes of flysch between limestones are characteristic, because the area belongs structurally to the nappe structure of Čičarija (Pleničar et al. 1973, Placer 1981).

The following caves are connected to the cave system: Ocizeljska jama (Reg. No. 1003), Blažev spodmol (Reg. No. 1004), Maletova jama s slapom (Reg. No. 726), Jama z naravnim mostom (Reg. No. 723), Jurjeva jama v Lokah (Reg. No. 636) and S-4 / Socerb (Reg. No. 5772), all with big entrances. The plans of the caves, the interconnections between the caves and the research about them are evident from the records of the Cave Register of the Speleological Association of Slovenia and the Karst Research Institute of the ZRC SAZU. All the caves are connected with passable passages with the exception of the passage of the cave S-4/Socerb, which according to the plans in the Cave Register, comes very near to the main passage of Jama z naravnim mostom. The cave system is relatively well researched. At the end of the 19th and at the beginning of the 20th century the Ocizeljska

Figure 1: The Beka-Ocizla cave system is located in SW of Slovenia.
Slika 1: Beško-ocizeljski jamski sistem se nahaja v JZ delu Slovenije.

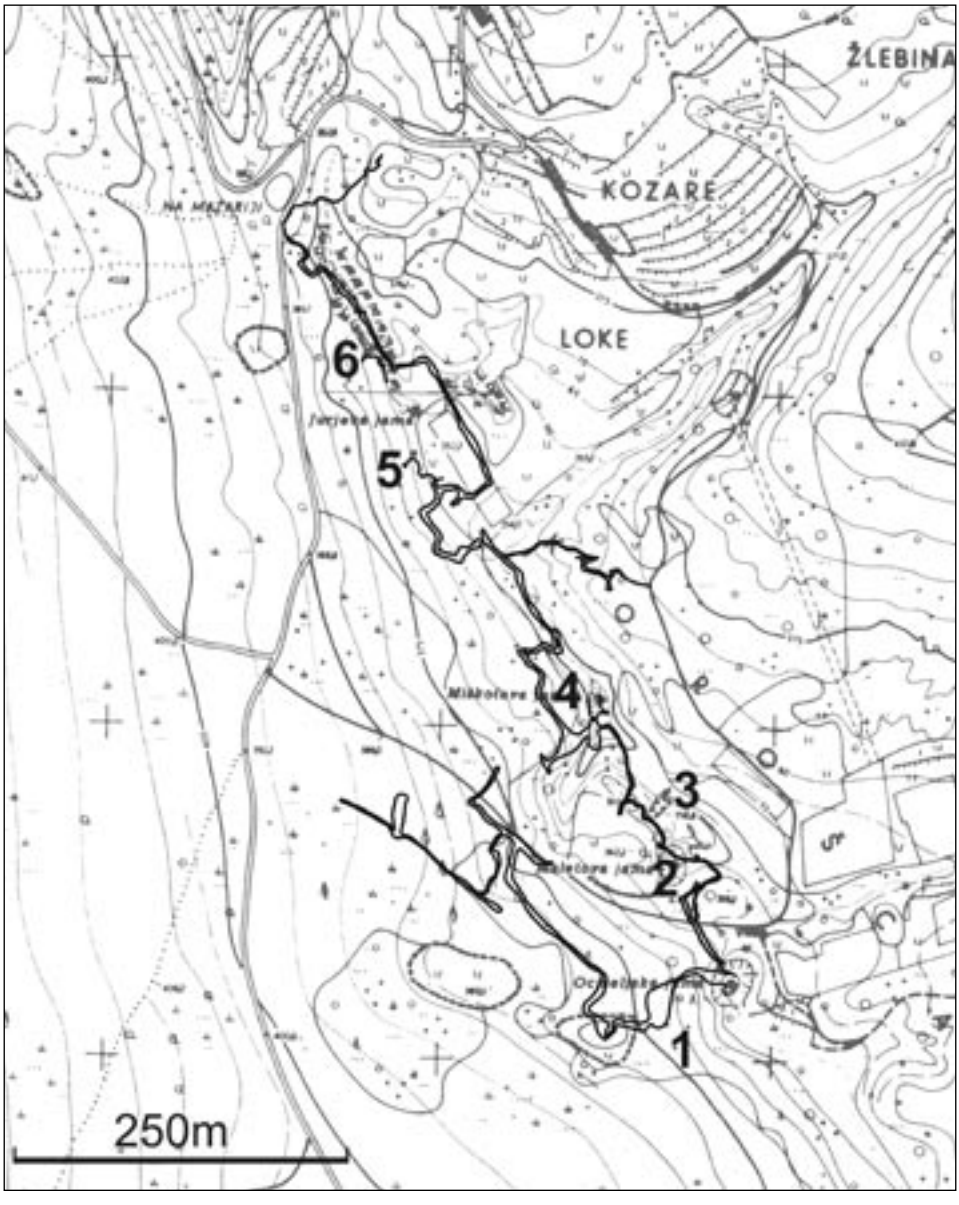

Figure 2: Position of the caves in Loke depresion (after Cave register of IZRK ZRC SAZU and JZS). 1 – Ocizeljska jama, 2 - Blažev spodmol, 3 - Maletova jama s slapom, 4 - Jama z naravnim mostom, 5- Jurjeva jama and 6- S4/Socerb.

Slika 2: Lega jam v depresiji Loke (po Katastru IZRK ZRC SAZU in JZS). 1 – Ocizeljska jama, 2 - Blažev spodmol, 3 - Maletova jama s slapom, 4 - Jama z naravnim mostom, 5- Jurjeva jama in 6- S4/Socerb.

jama, was researched by the members of the S.A.G. from Trieste, who measured the cave to the passage Staro Dno (Old bottom) (Bratoš & Sancin 1984). Later on the members of the Caving Club Železničar were visiting the cave and then the members of the society of caves the JOSPD Trieste continued with intensive research under the leadership of Stojan Sancin. The members of this society contributed the enormous amount of records to the Cave Register about the research and also about the measurements of the cave system. They are also the authors of most of the plans. We measured again the Ocizeljska jama, Jama z naravnim mostom, Jurjeva jama and the cave S4 / Socerb for the needs of a geological mapping. The measurements and drawings were provided by the following

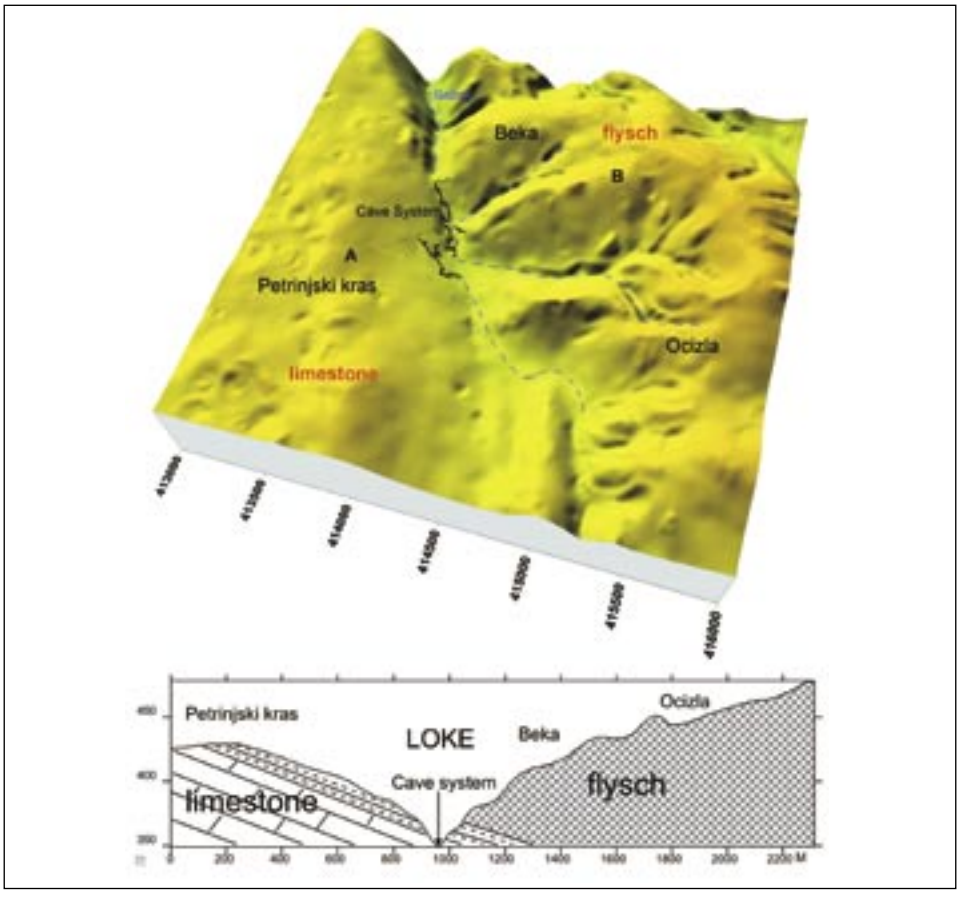

Figure 3: The morphology of the contact between limestone and flysch in Loke and the geological profile through the contact. Contact between Eocene Alveolinid-nummulitid limestone and Eocene Flysch (alternation of marl, quartz sandstone and breccia) is over transitional beds (marl and marly limestone).

Slika 3: Morfologija kontakta med apnencem in flišem v Lokah in geološki prerez čez kontakt. Kontakt med eocenskim Alveolinsko-numulitnim apnencem in eocenski flišem (menjavanje laporja, kremenovega peščenjaka in breče) je čez prehodne plasti (lapor in laporni apnenec).

members of the Karst Research Institute of the ZRC SAZU: Gabrovšek, Hajna, Drole, Slabe and Zupan Hajna (The Archive of the Karst Research Institute of the ZRC SAZU).

GEOLOGICAL AND SPELEOMORPHOLOGICAL CHARACTERISTICS OF CAVES

The entrances to the caves of Beka and Ocizla system are mainly in the central part of the depression. The lowest is the entrance to Jama z naravnim mostom at 346 a.s.l., the highest is the entrance to the cave S4/Socerb which lies at 371 a.s.l. and is located near the pass in the direction of the canyon Grižnik. The biggest distance is between the entrance to the Ocizeljska jama and the cave S4/Socerb, which is 500 m. The total length of the known passages of the system is more than 4500 m and the biggest depth is 157 m to the bottom of the Ocizeljska jama. The length of the cave passages is not yet final, because the research has not been finished. The biggest entrance to the system is the collapse doline Ocizla, which is 34 m deep and has a diameter of 50 m. Relatively big also is the entrance to Blažev spodmol.

Nearly all of the above caves' entrances function as occasional ponors with the exception of S4 / Socerb and the entrance to Blažev spodmol. The flow of water is the most usual into the Maletova jama s slapom and Jama z naravnim mostom and it dries up the latest in Jama z naravnim mostom. Water flows into Ocizelska jama and the Jurjeva jama only when there is a large amount of rainfall, according to the season.

Between the farthest entrances to the cave system, that is between the Ocizelska jama and the Cave S4 / Socerb, Alveolinid-nummulitid limestone of the Upper Eocene proceed into flysch rocks through the so-called (Jurkovšek et al. 1996) transitional beds. Transitional beds are of marly limestone and marl, which can be found at the bottom of a depression; they also constitute the entrance parts into all the caves of the system. The canyon of the stream, which sinks into Jama z naravnim mostom is hollowed out in the marly limestone. From the point of view of karst the most interesting entrances are the one into the Jurjeva jama and especially into the Cave S4 / Socerb, which are developed in the cleavaged marl. The beds in the area of contact are generally directed towards the north-east (70/20-40). The connection between all three lithologic units is in the middle of a depression (Fig. 3). The main tectonic structures are in the Dinaric direction and transversely to the Dinaric direction.

Ocizeljska jama (Ocizla cave)

(Reg. No.: 1003; synonym: Ocizla, the Ocizeljska jama. The coordinates of the entrance: y = 5414229, x = 5050337, z = 356; length 2780 m, depth 137 m).

In the scope of the geological and speleological research other measurements of Ocizelska jama were carried out (Gabrovšek et al. 2001). The difference in altitude between the entrance (356 m) and the lowest point of the cave (219 m) is 137 m and the lake at there is about 20 m deep. When the waters are high the lowest 50 m are flooded, that is up to the altitude of 250 m (Sancin 1984).

The Oziceljska cave is the biggest cave of the Beka-Ocizla system. The cave has two entrances, the first through the 34 m deep and 50 m wide collapse doline and the other through Blažev spodmol. The cave descends in south-west direction through three sets of stepped shafts to the siphon lake at the bottom of the cave. The horizontal passages are at a depth of 80 m (Novi rov (New passage)

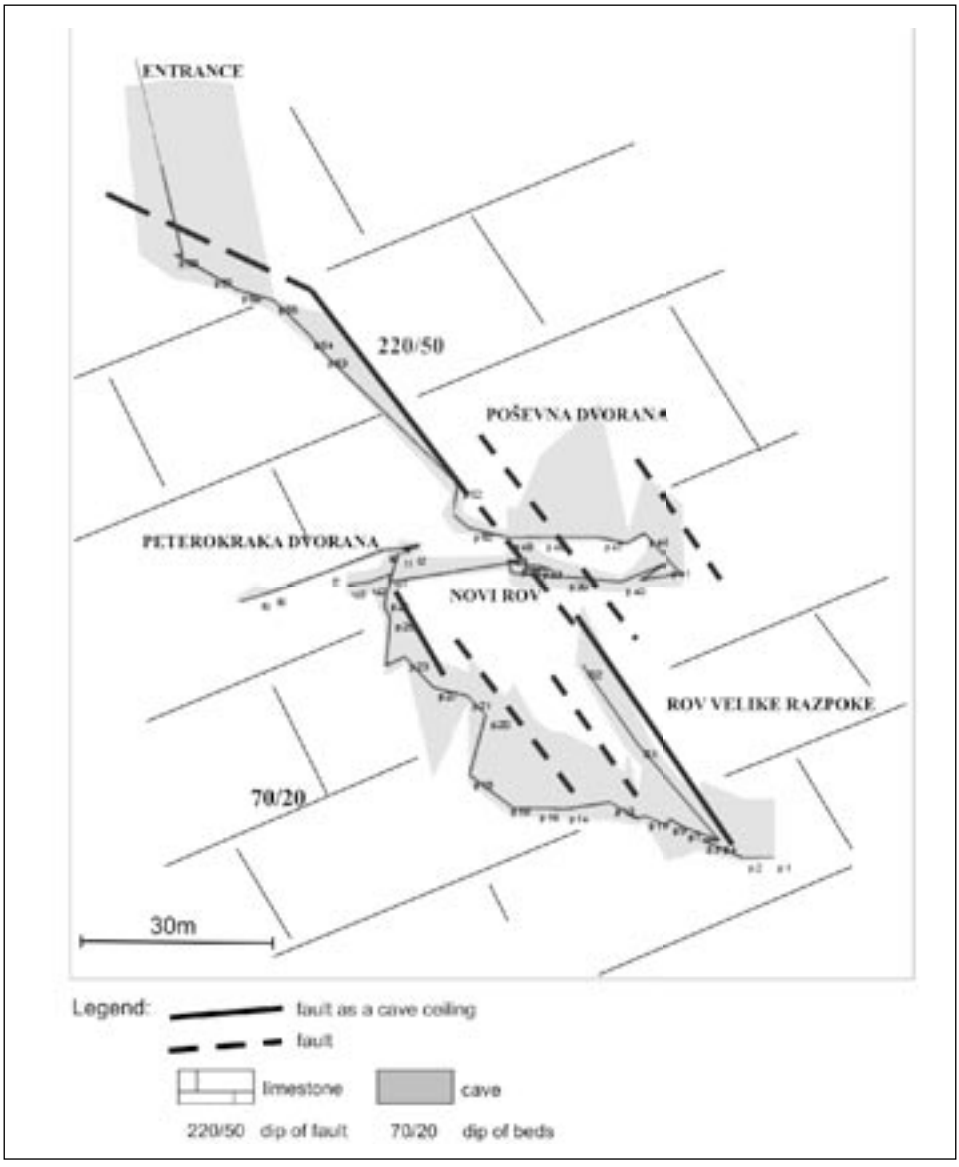

Figure 4: The Ocizeljska jama, the profile 130^0. One fault plane is followed (dip 220/50) through the whole cave. System of parallel fault planes was important factor for whole cave system development, orientation of the main passages and water flow direction. Plan Karst Research Institute of the ZRC SAZU 2001.

Slika 4: Ocizeljska jama, profil 130^0. Eno samo prelomno ploskev (vpad 220/50) sledimo čez vso jamo. Sistem vzporednih prelomnih ploskev je bil pomemben dejavnik za razvoj celotnega jamskega sistema, orientacijo glavnih rovov in smer pretakanja vode. Načrt IZRK ZRC SAZU 2001.

and Peterokraka dvorana (Five-armed chamber)) and at the bottom of the cave (Rov velike razpoke (Passage of large fissure)). The stepped shafts follow the dip of the fault plane (220/40-50) and are developed under it. The cave passages are mostly narrow, and more than 30 m high, the highest being Rov velike razpoke, which is more than 40 m high.

The beds of marly limestone and limestone on the surface are directed toward NE; the dip is 70/20(30). The same dip of the beds of dark Foraminiferal limestone can be traced in the whole cave. Some of the passages are developed along bedding planes, especially the bottoms of stepped shafts. The most important for the development of the cave and for the orientation of its passages is the system of parallel fault planes with dip 220/40-50. The ceiling of the cave and the direction of the main passages generally follows the dip of these planes (Fig. 4). The last part of the cave, the passage Rov velike razpoke, is all opened along one plane (dip 220/50) by corrosion of the fissure (Fig.5). In this place the ceiling of the passage is a fault plane, too, which we can follow upwards in the chimney for another 40 m. Along the same fault plane there is the open part of Novi rov, which is also widened due to corrosion. In Novi rov we can trace fault planes several times along them the passage can be widened due to corrosion for some metres or along plane clay of the inner fault zone exists. We can trace one of the parallel fault planes also in the upper part of the cave this is in the first set of stepped shafts at depth between 35 and 70 m. Parallel with it is a fault plane in the first part of Zasigan rov (Sinter passage) and Blatni rov (Muddy passage) at a depth around 80 m. In the other set of stepped shafts at depth between 90 and 120 m another parallel fault plane with the same dip can be traced.

The stepped shafts are formed in this way beside the above-mentioned fault planes at three different depths. The ceiling of the passage is in all three cases one of the fault planes (Fig.6). Along it on the left and on the right the labyrinth of smaller passages with a phreatic shape are developed. Where water flowed for longer along the fault plane the passage is widened due to corrosion. This is most evident in the passage Rov velike razpoke (Fig. 5). In cases of transverse fissures, which mechanically weakened the main fault plane, the water flowed through the plane in many places and the passage continued transverse to the fault plane again. All that is repeated with the subsequent parallel fault planes with the same dip (220/40). In the lower part of the cave there is a distinct system of fissures with the dip 310/70-90, which are followed by the individual parts of passages. In the collapse doline and in the passage Novi rov some fissures in the direction N-S occur, which did not have any direct influence on the development and arrangement of the caves' passages.

There is a lot of water in the Ocizeljska jama especially after heavier rain. In the dry season there is a small stream in the stepped shafts, which flows toward the bottom. On the bottom of the horizontal passages there are many pools where the water remains, but it dries out in drought. The permanent water stream is present only at the bottom of Rov velike razpoke, where water flows towards the final lake, which is, according to the Register data, 20 m deep. When there is more rain, the water in the cave rises for 50 m, that is up to the horizontal passages at 80 m depth. At the entrance to the first stepped shafts small scallops are developed on the walls, which indicate fast water flow. The water, which now flows through the stepped shafts, deposits flowstone or corrodes it in other places. The water brings leaves, mud, flysch pebbles and sand into the cave whenever there are floods, and deposits sand mostly in the side passages of the Peterokraka dvorana in the central part of the cave.

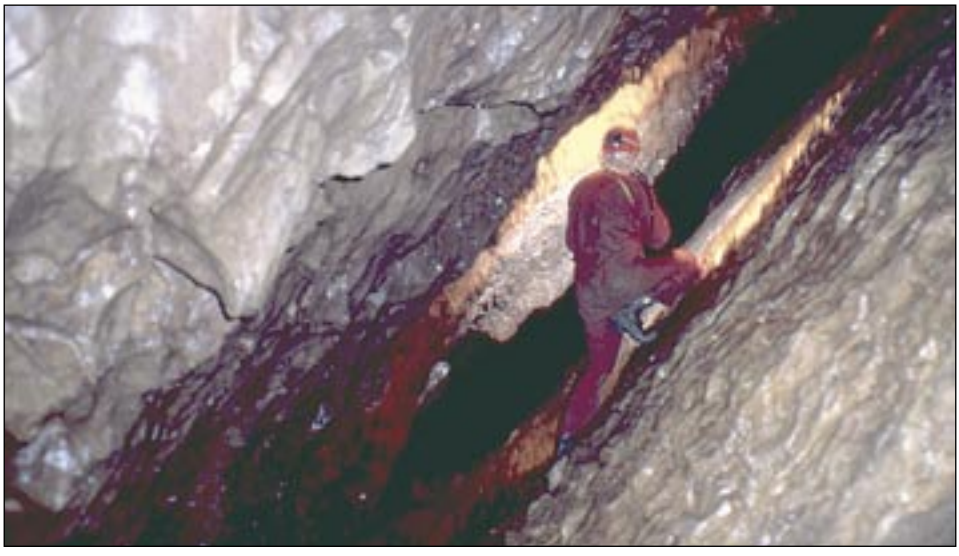

Figure 5: The passage of a big fissure on the bottom of Ocizeljska jama is 100 m long and more than 40 m high. It developed along the fault plane with dip 220/50. (Photo F. Gabrovšek)
Slika 5: Rov velike razpoke v dnu Ocizeljske jame je dolg 100 m in visok preko 40 m je razvit ob tektonski ploskvi z vpadom 220/50. (Foto F. Gabrovšek)

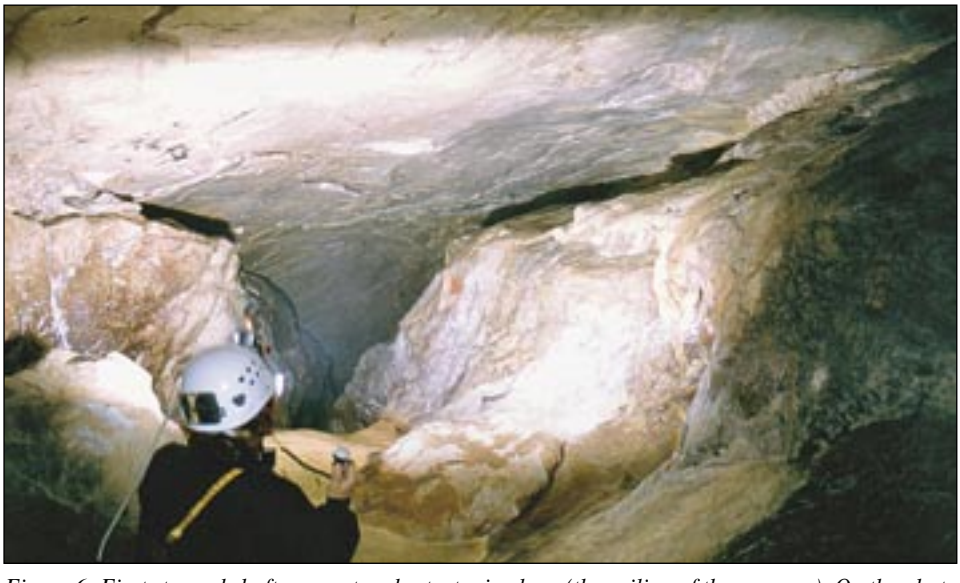

Figure 6: First stepped shafts are cut under tectonic plane (the ceiling of the passage). On the photo (point p55 on fig.4) is the place where fault plane changes its inclination. (Photo J. Hajna)
Slika 6: Prvi niz stopnjastih brezen je urezan pod prelomno ploskvijo (strop rova). Na sliki je mesto (točka p55 na sl.4), kjer prelomna ploskev spremeni svoj naklon. (Foto J. Hajna)

Blaž's spodmol (Blažev rock shelter)

(Reg. No.: 1004; synonym: Bečka jama. The coordinates of the entrance: y = 5414229, x = 5050337, z = 356; length 120 m, depth 30 m).

The entrance to Blažev spodmol is through the smaller collapse doline. Its main passage finishes in the collapse doline of Ocizeljska jama. The side passage in the upper part of the main passage connects the cave with the entrance passage of Ocizeljska jama. The other longer passage leads north to Jama z naravnim mostom.

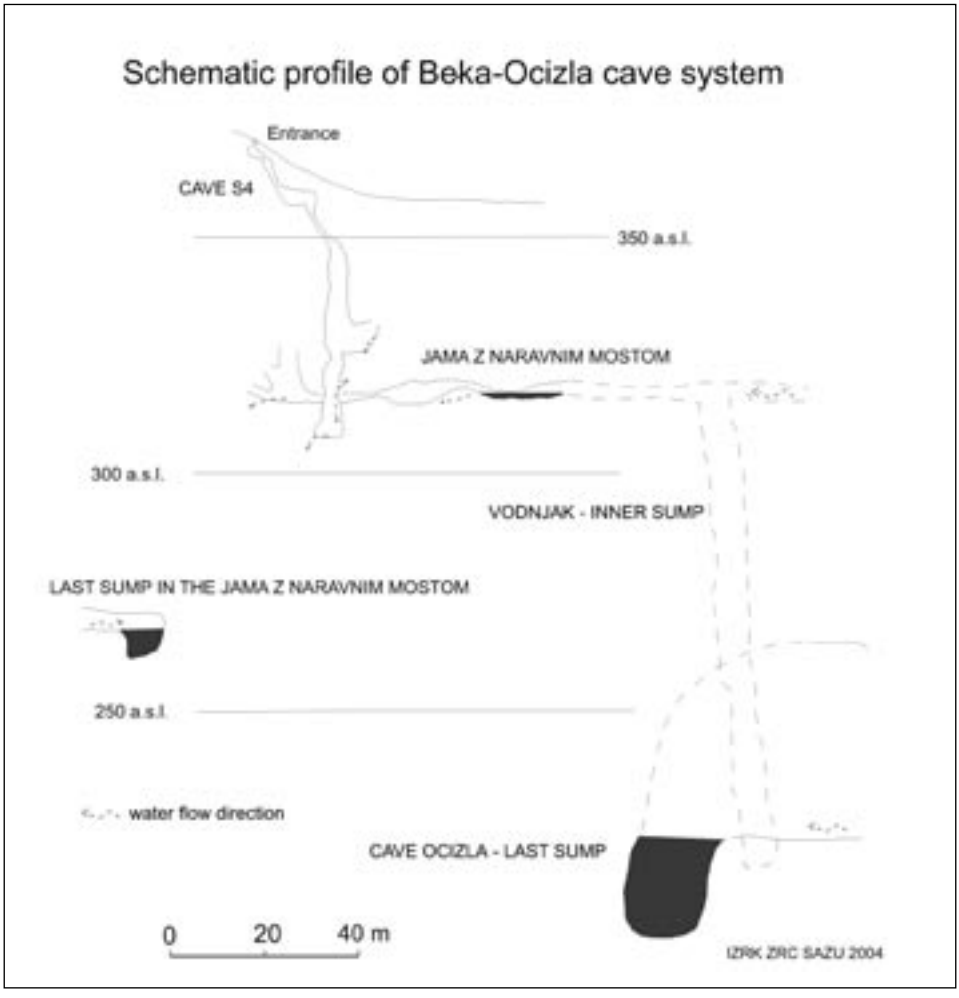

Figure 7: The schematic profile of the part of the Beka and Ocizla cave system. The water flows simultaneously at various heights. The water in Ocizeljska jama after heavier rain rises approximately 50 m.

Slika 7: Shematski prerez dela Beško- ocizelskega jamskega sistema. Voda se pretaka istočasno na različnih višinah. Po obilnejših padavinah se voda v Ocizeljski jami dvigne za okrog 50 m.

The collapse doline is formed in marly limestone and the passages are formed in Foraminiferal limestone. In the sloping sides of the doline there are bigger quantities of deposited sediments, pebbles of flysch sandstone, sand and clay. The large scallops on the walls of the passage at the bottom of the collapse doline indicate slow water flow through the passage. The main passage is full of the remnants of old cave sediments, which some period filled up all the passage. The big pebbles of flysch sandstone, sand and silt are in some places partly cemented. There are also many remains of the disintegrating and eroded older flowstone. Nowadays after rain there is some water in the lower part of the passage, before it ends in the big collapse doline of Ocizla.

Maletova jama s slapom (Maletova cave with waterfall)

(Reg. No.: 729; synonyms: Maletova jama, Koroščica na hribu, Jama s slapom. The coordinates of the entrance: y = 5414 177, x = 5050 448, z = 352; length 78 m; depth 26 m.)

At the entrance a periodic stream falls into the cave as a waterfall through marly limestone 8,5 m deep. Perpendicular to the waterfall and the entrance to the cave there is a long trench, the bottom of which rises towards the south-west and is filled with gravel. Regarding its shape and position these could be the remains of the previous passage of the cave, which was filled up with alluvium and the ceiling of which is denuded, and not the tectonic trench. The fact that the beds (with dip 70/20) at the entrance to the cave are not damaged and are without fissures speaks in favour of this assumption. The cave continues underneath the waterfall further on towards the west, while in the last part it turns toward the north. The cave is approximately 80 m long and descends for 26 m to the 326 m a.s.l. They traced the water in the cave in 2001 (Gabrovšek et al. 2001); the tracing test confirmed that the water flows toward Boljunec (Kogovšek & Petrič 2003).

Jama z naravnim mostom (Cave with natural bridge)

(Reg. No.: 723; synonyms: Miškotova jama v Lokah, Miškotova Jama z naravnim mostom. The coordinates of the entrance: y = 5414 124, x = 5050 497, z = 346; length 447 m, depth 79 m.)

The water flows into Jama z naravnim mostom through the smaller canyon formed in marly limestone from the small gorge under the Beka village. The entrance part of the cave is in marly limestone, which continues into Foraminiferal limestone. The strike of the beds is toward NW with dip 70/20. The main parts of the passages follow the tectonic structures in the "Dinaric" direction, with dip toward SW or they are vertical. In the cave they are also fissures with dip 310/70-90. Between the end of the canyon and the collapse doline in front of the entrance to the cave a natural bridge occurs as part of an old denuded cave passage. The water flows into the cave through the 2 m wide and 8 m high entrance. Measurement of the entrance part of the cave to the occasional siphon was done again and it was found that the lengths and the directions of the passages are identical with the existing plan and therefore we did not measure the other parts of the cave again. At approximately 200 m behind the occasional siphon, the side passage branches off in a SW direction. In this side passage there is an approximately 100 m deep inner shaft named Vodnjak (Fountain). The bottom of this deep shaft stretches under the level of the siphon in Ocizeljska jama. After a further 80 m the connecting passage from the cave Jurjeva jama joins the main passage. From there the passage continues at approximately the same level to the former final siphon, named Končni Sifon, which is now removed. Behind this ex-siphon the passage continues on the same height for 150 m and then it descends in more steps for 50 m. In the bottom of the steps there is a small chamber with a lake of unknown depth at approximately 267 m a.s.l.

Jurjeva jama v Lokah (Jurjeva cave in Loke)

(Reg. No.: 636; synonym: Brezno v Beki. The coordinates of the entrance: y = 5413 974, x = 5050 698, z = 360; length 65 m; depth 41 m.)

The entrance to the Jurjeva jama is the occasional ponor of the stream, which flows from the small gorge under Mazarija. In the entrance shaft a natural bridge made of flowstone is presented. Shaft is 23 m deep, the 5 m wide bottom of which is filled up with gravel. At the southern wall between the wall and gravel the fissure is dug up, which finishes after some metres. The cave continues through the narrow section in the northern part of the cave where 8 m of narrow meander follows, which continues into shaft, which is 10 m deep. Under it is a small chamber of 5 x 5 m in diameter. 20 m of low passages follow, which lead to Jama z naravnim mostom. We measured 65 m in the part, which connects Jurjeva jama with Jama z naravnim mostom. The upper part of the entrance shaft is in cleavaged marl and marly limestone, which at the bottom of the shaft proceed into Foraminiferal limestone with dip 70/40. The entrance shaft stretches along the fissure with dip 310/90. The meander, which leads to the lower parts of the cave is open at the fault plane with dip 220/50, the chamber under the 10 m shaft is also formed along fault plane with dip 220/80.

Cave S-4/Socerb

(Reg. No.: 5772. The coordinates of the entrance: y = 5413 943, x = 5050 783, z = 371; length 90 m; depth 63 m.)

The entrance to the cave S-4/Socerb is 40 cm wide and is open on the slope some metres above the dry riverbed of the stream, which occasionally sinks into the Jurjeva Jama. The entrance shaft is 3 m deep and its bottom opens to the smaller chamber. The entrance and the entrance chamber are formed in the marly limestone with dip 70/40, which alternate with the cleavaged marl in the upper part and at the fault plane with dip 210/80. In the chamber under the first shaft the beds of marly limestone are directed toward NE – 70/40. The narrow passage descend for approximately 20 m through to the collapse chamber, where is the entrance to the 47 m deep shaft. The shaft is widened along fault plane with dip 210/80. The bottom of the shaft, at 308 m a.s.l, measures 5 x 2 m and is covered by flysch clay. A continuation of the shaft is possible under the clay. About 18 m above the bottom of the shaft is a 13 m long horizontal passage with the small water flow. Water falls on the bottom of the shaft as a waterfall and disappears in flysch clay. This water probably flows toward Jama z naravnim mostom, which is distant only a few metres from the passages of the cave S-4/Socerb. A chamber behind the second passage and the collapse chamber before the entrance into the shaft are formed under one fault plane with dip 100/50.

HYDROGEOLOGICAL CHARACTERISTICS

Three bigger streams and one smaller one flow from the flysch to the depression, and sink into marly limestone. They drain together approximately 3,5 km flysch surface (Mihevc 1991). The surface waters get lost in the karst at the contact, which is at 350 m a.s.l. Some of the cave entrances function as occasional ponors of the surface waters, which flow under the villages of Beka, Ocizla and Petrinje.

The stream, which at high waters flows under Petrinje into the Ocizeljska jama, is otherwise

already lost along its riverbed. The stream, which flows through the gorge north of Ocizla village sinks into the Maletova jama s slapom immediately when it reaches the limestone. The parallel stream, which flows through the gorge south of Beka sinks into Jama z naravnim mostom. It flows on the surface also after contact between flysch and marly limestones and has excavated a small canyon in them. On the bottom of the riverbed travertine is precipitated, especially along barriers made of branches and leaves. The last surface water flow is small stream under Mazarija which only after heavy rain flows towards Jurjeva Jama and sinks into it.

The water from the whole cave system flows toward Boljunec (Sancin 1988) with the spring at 80 m a.s.l. The connection was confirmed also with the tracing test in the year 2001 (Gabrovšek et al. 2001), which was done by the Karst Research Institute of the ZRC SAZU. Tracer was injected into Maletova jama s slapom (on the slope of Korošica hill). An occasional stream flows into the cave, but there is the permanent water flow in it. Discharge at injecting was 32 l/s, the tracer needed 84 hours to the springs in Boljunec (Kogovšek & Petrič 2003).

In the cave system the water flows on various levels at the same time (Fig. 7). The water table (floods in passages) oscillates in regard with the quantity of rain, which afterwards drains into the system. For example when the water level in the system is high in Ocizelska jama the level of the water table rises for 50 m above the siphon lake at 219 m a.s.l. (Sancin 1984) but the permanent final siphon at Jama z naravnim mostom is at 267 m a.s.l. also exists at low waters.

CONCLUSION

The caves of the contact karst of Beka and Ocizla are formed on the contact between limestone and flysch in the small depression named Loke. The entrance parts of the caves are developed in marly limestone but the main parts of the passages are in Alveolinid-nummulitid limestone with dip of the beds 70/20. Phreatic forms of some passages in the Ocizelska jama show that the parts of the cave developed in phreatic conditions. Phreatic formed passages were later used by the ponor water and were transformed and these waters also formed new passages. Regarding the remains of the cemented clastic sediments and old eroded flowstones, we can think about the period when sinking waters completely filled up some of the passages and when entrances functioned as the main ponors. Big scallops at the entrance passage of Blažev spodmol show the large quantities of slow flowing waters, which flowed into it. Thick deposits of gravel and clay from the flysch suggest at the intensive filling up of the bottom of the whole Loke depression.

The most important geological structural elements, which influenced the development of the cave system and the directions of its passages, are:

- the contact between limestone and flysch (in the direction NW-SE);
- the system of parallel fault planes with the dip 220/50(80) is the most important for the flow of water and the general directions of the cave passages;
- the fissures with the dip 310/80(90) are important for the orientation of shorter sections of passages.

The speleogenesis of the cave system can be, with regard to the above-mentioned facts, explained in the following development stages, which are connected among themselves and also contemporary:

- the initial development of the cave passages in the phreatic zone along important geological structures;
- the change of gradient and lowering of the level of water table (the waters from the flysch started to sink in the existing passages), the transformation of passages with the ponor water and sediments, filling up with fluvial sediments, the deepening of passages due to gravitation, the development of vadose shafts, rinsing of old sediments;
- the relatively new functioning of the system as occasional ponors (more entrances), the contemporary washing of sediments, the collapsing of caves' ceilings in the vicinity of the surface and denudation of the surface (the parts of passages without a ceiling). Part of the system still functions epiphreatically, because the lower parts of the cave system are occasionally flooded.

Together with the development of the cave system the development of surface area on the contact between limestone and flysch occurred. In the period when the Podgorski Kras was dammed with flysch, the rivers flowed on the surface at the contact between flysch and limestone, which is confirmed by the big quantity of deposited sediments in the depression and the levelling of the surface in its lowest (Mihevc 1991).

The later sinking of the Trieste bay (or the elevating of the Podgorski karst) enabled drainage toward the west with the increase of a gradient this is toward the springs in Boljunec. Consequently, the surface of the karstic water table fell, the bigger channels descended deeper and the surface water from flysch started to flow underground through the ponors. The recent condition in the contact karst in Loke is that the water flows off only in the karstic way, and at the same time the valley of Grižnik is fluvial cut.

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