MORFOLOGIJA IZVOR PEĆINA U KONGLOMERATIMA VELEŽ PLANINE

MORPHOLOGY OF THE SPRING CAVES WITHIN THE CONGLOMERATE OF THE VELEŽ MOUNTAIN

Srećko BOŽIČEVIĆ, *Geološki zavod, Zagreb*
Institute of Geology Zagreb

Sažetak

U radu se prikazuju rezultati istraživanja dviju izvor pećina izgrađenih u konglomeratima. Morfološki razvoj ispitivanih kanala različit je od ostalih speleoloških pojava formiranih u uslojenih naslagama vapnenaca ili dolomita. Istjecanje vode iz obadvije pećine koristi se za vodosnabdjevanje pojedinih dijelova grada Nevesinja.

Uvod

Za vrijeme speleoloških istraživanja na području Nevesinja speleološka ekipa Geološkog zavoda iz Zagreba ispitivala je nekoliko određenih izvor pećina za potrebe HE Trebišnjica iz Trebinja. Godine 1978. ispitana je izvor pećina Jezduš, a godine 1981. kaptirana izvor pećina Jedreš.

Obadvije pećine nalaze se na jugoistočnim padinama Podveležja, odnosno ispod vrhova M. Veleža. Kako su obadvije pećine formirane u naslagama konglomerata morfološki su interesantne kao speleološke i kao hidrogeološke pojave.

Summary

The report reviews the results of investgations made in two spring caves constructed in the conglomerates. The morphological development of the investigated channels differs from other speleological phenomena formed in the layered limestone and dolomite deposits.

The water from these two caves is used for the Nevesinje water supply system.

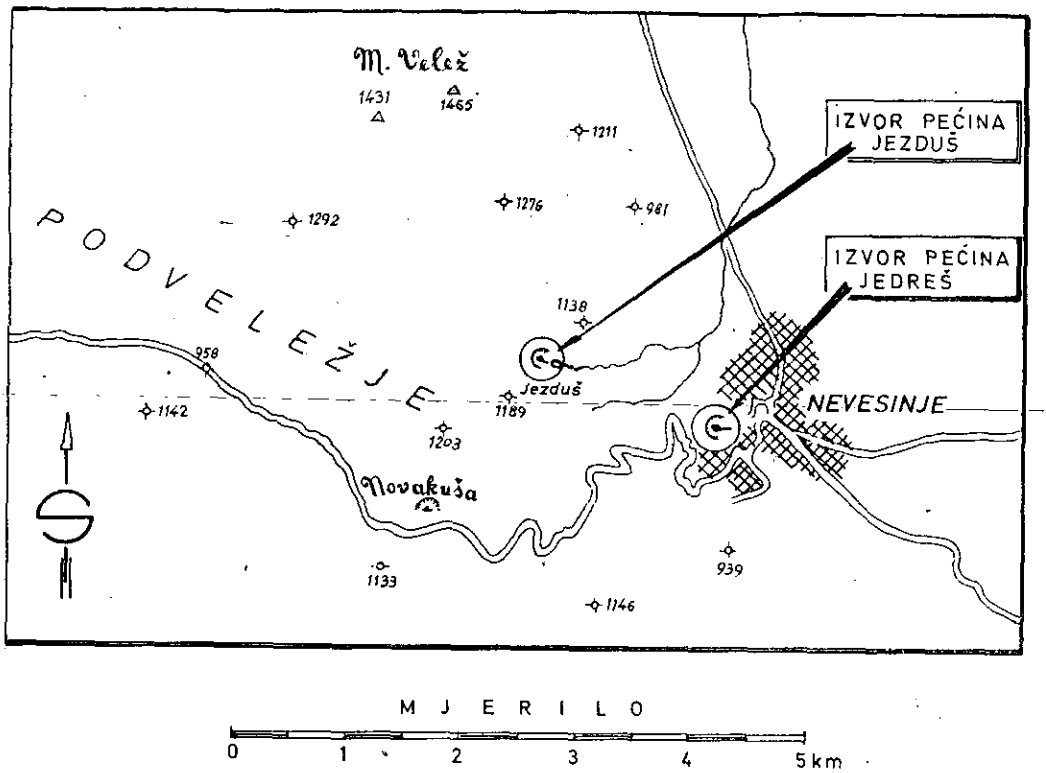
Introduction

During the period of speleological investigations carried out over the region of Nevesinje, the speleological team of the Institute of Geology — Zagreb investigated several spring caves for the requirements of HPP Trebišnjica — Trebinje. The Jezduš spring cave was investigated in 1978 and Jedreš spring cave in 1981.

Both caves are located on the South-Eastern slopes of the Podveležje i. e. below the peak of the Velež mountain. As both caves were formed in deposits of conglomerate they are interesting, in terms of morphology, as speleological and hydrological occurances.

The investigation of Jedreš cave in Nevesinje was carried out only after water pumping from the syphonic depressin below one drilling point and it was

POLOŽAJ ISTRAŽIVANIH PEĆINA



Istraživanje Jedreš pećine u Nevesinju omogućeno je tek nakon ispumpavanja vode iz sifonskog udubljenja ispod jedne bušotine i trajalo je dok je pumpa radila i održavala prohodnost kroz najniži dio pećinskog kanala.

U pećini Jezduš prodrlo se do tada dostupnog dijela kroz vrlo niski kanal, dok bi dodatno istraživanje trebalo provesti na kraju dužeg sušnog perioda i uz pomoć nepromočivog odijela pokušati propuzati kroz nakupinu vode u do sada dosegnutom kraju pećine.

continued during the pump operation because it enabled the passage through the lowes part of the cave channel.

The access to the Jezduš cave was made through very low channel. The additional investigation is to be made during the long rainless period wearing watertight suit and by creeping through the water collected toward the inaccessible part of the cave.

THE JEDREŠ SPRING CAVE

Morphological Description

The Jedreš cave in its natural form had an opening below the outcrop of the rocks and blocks of conglomerate on the

IZVOR PEĆINA JEDREŠ

Morfološki opis

Izvor pećina Jedreš u svom prirodnom izgledu imala je otvor ispod izdanka stijena i blokova konglomerata na zapadnoj strani grada Nevesinja u Kazazića Gaju na koti od 887 m. Preuređivanjzem izvorišta za potrebe vodoopskrbe pred izvorom je izrađen veliki pokriven bazen ili rezervoar s jednom komorom za prečišćavanje, odnosno taloženje doplavljenog nanosa. Uz bok komore za taloženje nalazi se 11 metara dug pokriveni kanal na koji inače izbija višak voda. Kroz vertikalni ulazni šaht moguć je ulaz u umjetno izgrađen tunel dužine 18 metara u kom visina i širina iznosi jedva 70 cm pa je prolaženje moguće jedino puzanjem.

Na kraju ovog tunela počinje prirodni kanal pećine koji je u normalnim uvjetima potpuno ispunjen vodom.

Širina kanala do bušotine J-3 varira od 2 do 3 metra dok je visina jedva 1 metar osim na mjestima gdje dolaze nešto viši dimnjaci i bočni odvojci. Kanal je formiran u smjeru sjeverozapada.

Uz samu bušotinu kanal je širok 2,5 metara, a visina od muljevitog tla do stropa iznosi 1,5 m. Iz profila je vidljivo da do ovom mjesta dopire povišeni nivo vode koji u smjeru izlaza ovaj dio pećinskog kanala pretvara u sifonsku prepreku.

Osnovni zadatak speleološkog istraživanja bio je, da se prodre iza bušotine i izradi detaljan tlocrt i profil do tada nedovoljno poznatog podzemnog prostora.

Od bušotine J-3 i narednih 30 m visina kanala varira od 80 do 120 cm pa je prolaz moguć samo puzanjem ili provlačenjem na koljenima. Novi smjer kanala je u početku prema zapadu.

West side of Nevesinje i. e. in Kozića Gaj, at the elevation of 887 m. After arrangement of the sources for the requirements of the water supply system, a large covered basin or reservoir is constructed in front of the spring. This basin consists of one water treatment chamber i. e. settling of the deposited silt. The covered, 11 m long, channel for the delivery of surplus of water is constructed next to the settling chamber. The entrance i. e. access to the artificially constructed tunnel, 18 m long, is provided through the vertical entrance shaft. The height and width of the shaft are 70 i. e. 80 cm so the creeping is the only way to go in.

The natural cave channel starts at the end of this tunnel. Under the normal conditions this channel is fully filled with water.

The channel width to the drilling point J-3 is 2—3 m, but the height is only 1 m except at the places where larger funnels and side devides are provided. The channel is facing the North-West side.

Next to the very drilling hole the channel is 2.5 m wide and the height from the mud bottom to the ceiling is 1.5 m. It can be seen from the cross-section that raised water level reaches this point and such water level is made as syphonic barrier in the direction of the exit part of the cave channel.

The basic task of the speleological investigations was to reach the part behind the drilled hole and to elaborate the ground plan and cross section of the insignifacantly known underground area.

From the J-3 drilling hole and through further 30 m the height is 80—120 cm, so the creepeing or slowly moving on hands and knees are only possible passage. The new direction of the channel is toward the West, at the beginning, and then it turns toward the North-West. The bottom of this part of the channel is covered with fine sand and gravel silt through which the water course meandered during the lower water levels.

At 90-th meter from the entrance to the vertical shaft the channel suddenly turns and the whole underground area becomes wider and higher at rocky »bridge«.

The underground cave area now takes the former direction and side high channels and funnels raise to the surface. In some of them we reached the height of 14 m above the channel level, but

padu, a iza toga zakreće prema sjeverozapadu. Tlo ovog dijela kanala prekriva nanos sitnog pijeska i šljunka kroz koji meandrira vodeni tok za vrijeme nižih vodostaja.

Na 90-tom metru od ulaza u vertikalni šaht dolazi do naglog skretanja kanala, dok kod kamenog »mosta« čitav podzemni prostor postaje viši i širi.

Podzemni pećinski prostor sada se vraća u prijašnji smjer a bočni visoki kanali i dimnjaci uzdižu se prema površini. U nekima od njih uspjeli smo se uspeti 14 metara iznaad razine kanala, ali u sve te visoke dijelove nismo kompletno prodrli. Svi bočni odvojci i proširenja pod stropom teže su dostupni i za njihovo detaljno ispitivanje potrebno je primjeniti alpinističku tehniku uz obaveznu upotrebu klinova i odgovarajuće osiguranje pri penjanju.

Morfološka karakteristika ovog dijela je pojava kalcitnih saljeva na bokovima kanala, te urezivanje vodenog toka u konglomeratne naslage. Meandriranje potoka je vidljivo u čvrstim naslagama dok u bokovima ima dosta nakupina rastrošenog i naplavljenog materijala. U dvorani ispred zadnje topografski snimljene točke širina i visina podzemnog prostora iznosi oko 6 m. Kameni »most« i ostaci kalcitne ploče ukazuju na postupne faze formiranja ovog podzemnog sistema.

130 m od ulaza u šaht i neposredno ispred tog mjesta u smjeru sjevera odvaja se nekoliko bočnih kanala. Ovdje se zapravo nalazi sistem isprepletenih dijelova podzemnih prostora, a zbog kompliciranosti same morfologije (uski i niski prolazi s vodom i bez nje, te zbog otežanog ispumpavanja sifonskog dijela) daljnji detaljni nacrt nije rađen. Prema gruboj procjeni dužina preostalih rekognosciranih prolaza i kanala iznosi još oko 100 m.

we did not reach all the high parts, completely. All side devides and enlarged parts below the ceiling are hardly accessible. In order to investigate these parts in details it is necessary to apply the Alpinisam method of climbing, with all necessary climbing equipment and protection.

The morphological characteristic of this part is expected in occurance of calcite secretions at the channel sides and cutting of water course through the conglomerate deposits.

The meandering of the course can be seen within the hard deposits but the lateral sides include a lot of friable or flood deposited material. The width ind height of the underground space, in the hall below the last topographically surveyed point, is 6 km. The stone »bridge« and remaining pieces of the calcite plate indicate the successive stages in formation of thhis underground system.

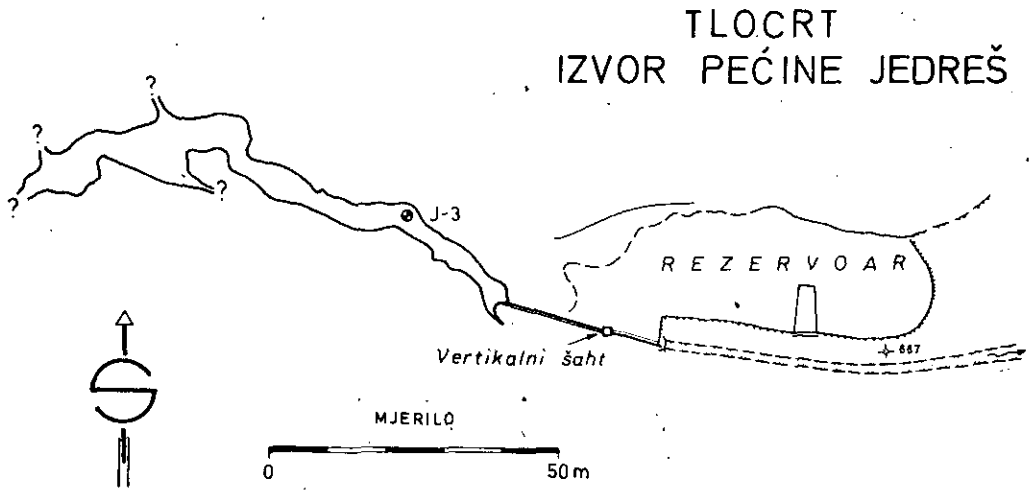
Several side channels branch off at 130 m from the entrance of the shaft immediately below the place toward the North. The system of intertwined parts of the underground areas is located here. The further detailed drawing is not made due to the complex morphology (narrow and low passages with or without water, heavy pumping of the syphonic part). According to the rough estimation the length of the rest recognized passages and channels is approximately 100 m more.

The total length of the surveyed underground areas, in details, from the end of the constructed part of the tunnel to the last surveyed point is 110 m, but 30 m of the covered channel and tunnel is to be added to such length. They are also surveyed in terms of topography.

The difference in altitude between the starting point of the natural part of cave and last surveyed point is approximately 3 m (Point D).

Hydrological Characteristics Of The Caves

As the Jedreš cave is characterized by the constant water course with unstable capacity, it is included in a group of water caves with special regime due to its hydrological characteristics. The water inflow or discharge within this area is provided from the large hinterland of the area and is connected with



Ukupna dužina detaljno snimljenog prostornog prostora od kraja zidanog dijela tunela do zadnje snimljene točke iznosi 110 m, ali toj dužini potrebno je dodati 30 m pokrivenog kanala i tunela koji su također topografski snimljeni.

Visinska razlika između točke početka prirodnog dijela pećine i zadnje snimljene točke iznosi približno 3 m. (točka D)

Hidrogeološke karakteristike pećine

Pošto je izvor pećina Jedreš stalan vodotok promjenljive izdašnosti njezine hidrološke karakteristike stavljaju je u red vodenih pećina sa posebnim režimom. Pritjecanje ili dreniranje vode u ovaj prostor najvjerojatnije dolazi iz šireg zaleđa, a vezano je za raspucale naslage konglomerata jugoistočnih padina planine Velež i nepropusne podloge na kojoj je došlo do izbijanja podzemnih voda na površinu.

Temperatura vode od 7,2°C izmjerena u mjesecu srpnju dokaz je prikupljanja iste iz dubljih dijelova spomenutih naslaga.

the cracks of the deposits of South-Eastern slopes of the Velež conglomerates and impermeable base where the underground waters come to the surface.

The water temperature of 7.2°C, recorded in July, proves the fact that it is collected within the deeper parts of the mentioned deposits.

When carrying out the investigations the water inflow was 2 l/s, but according to the traces in the cave channel the water head is increased by 1 m and more. It can be seen from the Point D (several lower tributaries were recorded) that several inflows appear from the surface flowing to such places during the rainy periods.

During the next stage of investigations it is necessary to carry out the respective measurements in order to record the changes in water flow within a period of one hydrological year. One large drilling hole with installed instruments or one excavation through the enlarged part of the cave for the purpose of direct observations during the whole year, may be used as additional type of measurement.

In addition to the measurements of the flow it is necessary to carry out the detailed measurements of water temperature during the whole year and particularly during the rainy periods. During such periods the type of water and quantity of water flowing directly from the surface can be defined.

U vrijeme istraživanja dotok vode bio je do 2 l/sek, ali prema tragovima u pećinskom kanalu visina vodenog toka poveća se za 1 m i više. Iza točke D vidljivo je i registrirano nekoliko manjih pritoka, ali je uočeno da u kišnom razdoblju s površine na ta mjesta povremeno dotiče još nekoliko tokova.

U narednoj fazi istraživanja bilo bi potrebno u pećinskom kanalu urediti mjerni profil kako bi se moglo registrirati kolebanje protjecanja vode u toku jedne hidrološke godine. Kao pomoć pri tom mjerenju mogla bi se iskoristiti i jedna bušotina većeg promjera s ugrađenim istrumentima ili probiti jedan niskop u prošireni dio pećine radi mogućnosti direktnog promatranja hidroloških pojava u toku čitave godine.

Osim mjerenja protoke potrebno je provesti i vrlo precizna temperaturna mjerenja vode u toku čitave godine, a pogotovo u vrijeme oborinskog perioda. U tim će momentima biti moguće utvrditi koja voda i u kolikoj količini dopire direktno s površine.

Pravilno raspoređena bojenja oborinskih površinskih voda omogućit će određivanje slivnog područja ovog izvorišta, a s time i određivanje potrebne najuže zaštitne zone.

Geneza pećinskih kanala

Iako nismo najdetaljnije upoznali čitav pećinski sistem već je i sada vidljivo da se on sastoji od tri morfološke cjeline:

— odvojeni ili ulazni kanal kao najniži hidrogeološki dio sistema s niskim i uskim kanalom,

— središnji prošireni dio s uočljivim tragovima nakupljanja naplavljenog materijala i urezivanjem kanala,

— prostor stalnog i povremenog dreniranja vode sa spletom uskih kanala u kojima je još uvijek vrlo aktiv-

Properly provided dyeing of rainy surface waters will enable the proper determination of the catchment area of this source area and, therefore, the definition of the shorter zone of protection.

Genesis Of Cave Channels

Although the complete cave system is not investigated in details it can be concluded that the system consists of three morphological parts:

— discharge or incoming channel as the lowest hydrogeological part of the system with low and narrow channel,

— middle, enlarged part with noticable traces of deposited material and cutting of channels,

— area of constant or temperary water drainage with a network of narrow channels still including the stage of erosion of the base and formation of calcite secretions over the channel sides and ceiling.

The discharge or incoming channel with its morphology of the rounded sections and deposited sand and gravel indicates the stage of slow water discharge. The cracks in the deposits of the conglomerate within this part are not so obvious, but the initial cracks, included in the formation of the channels, were gradually enlarged due to the pressure of water running from the hinterland.

The middle enlarged part is formed at the crossing part of the stronger and wetker cracks along which the erosional and corrosional water effects influenced the enlargement of the underground area. According to the silt of the destroyed deposits of conglomerate and settled calcite crust it can be concluded that the stage of filling of the underground area started after the cutting stage. This process indicatis the diluvial climate oscillations in the past. The deposited material was again eroded and carried by a water, after ice melting, during the postdiluvial period then the corrosion and formation of the deposited sintered coatings started.

Within the network of narrow channels and/or zone of drainage of the existing water course the height of the crack channels and their narrowness indicate the still active process of formation of this area. The occurance of the travertine samples within this part of the cave is included in the initial stage of separation of calcite concretions. The pla-

na faza erodiranja podloge i stvaranje kalcitnih saljeva na bokovima i stropu kanala.

Odvodni ili ulazni kanal svojom morfologijom ovalnih profila te nataloženim pijeskom i šljunkom ukazuje na stadij polaganog otjecanja vode. Raspucalost naslaga konglomerata u ovom je dijelu manje izražena, a inicijalne pukotine koje su omogućile formiranje kanala postepeno su širene zbog pritiska vode iz zaleđa odakle je ona dolazila.

Središnji prošireni dio nastao je na sjecištu niza jačih i slabijih pukotina duž kojih se erozijski i korozijski rad vode reflektirao u proširivanju podzemnog prostora. Po nanosu razorenih naslaga konglomerata i po istaloženoj kalcitnoj kori možemo zaključiti da je nakon faze urezivanja nastupila faza zapunjavanja podzemlja što ukazuje na diluvijalne klimatske oscilacije u prošlosti. Otapanjem leda u posdiluvijalnom periodu naplavljeni je materijal ponovo erodiran i odnešen, a u tom je času započelo i korodiranje formiranih i nataloženih prevlaka.

U spletu uskih kanala, odnosno u zoni dreniranja postojećeg vodotoka visina pukotinskih kanala te njihova uskoća ukazuju na još uvijek aktivan proces oblikovanja ovog prostora. Pojava sigastih formi u tom dijelu pećine spada u početnu fazu izlučivanja kalcitnih konkrecija. Na mjestima gdje na njima nalazimo jako izražene korodirajuće procese, znak je prodiranja oborinske vode kroz već proširene vertikalne pukotine koje se nastavljaju prema površini. Tek daljnjim i potpunim ispitivanjem svih dijelova podzemnog pećinskog sistema i detaljnim promatranjem transportirajućeg nanosa uz prikupljanje sigastih tvorevina zbog radiokarbonskog vremenskog datiranja njihove starosti uočit će se kompletan slijed glavnih faza oblikovanja ovog podzemnog prostora.

ces with heavy influences of corrosion process show the break of the rain water (precipitations) through already enlarged vertical cracks running toward the surface. The further detailed investigations of oll parts of underground cave system and the detailed investigativns of transported silt with gathered travertine samples in order to define the age of the radiocarbon, will indicate the complete sequence of the main stages of formation of underground area.

The morphogenesis of the cave system of Jedreš spring differs from any other usual observations of the same processes within the underground areas formed mainly within the layered limestone deposits existing within the rest part of the Dinaric karts.

Final Remarks And Proposals For Future Investigations

The investigated underground area of Jedreš spring cave is located within the West part of Nevesinje on the foothill connected to the reservoir through the of the Velež slopes. The natural spring is capture of spring in order to provide the water supply to one part of Nevesinje.

The speleological investigations carried out in July 1981 proved the following:

— the natural channel and system of cave halls extend to the covered channel and artificially constructed tunnel,

— J-3 drilling hole drilled the low cave channel and has fallen in small deep basin,

— the electrically operated sludge pump was used in order to maintain the lowest water level in basin thus enabling the speleological investigations of other underground parts,

— the total length of the detailed investigated underground area from the end of the constructed tunnel to the last investigated point reaches 110 m. The difference in altitude between these two points is approximately 3 m with fall to the entrance part,

— the hydrogeological characteristics of the water course have been partially investigated and the future investigations of tll changes, within the regime of the existing underground water course, will give more detailed results,

— the water temperature during the investigations was 7.2°C (air temperature at the surface was 35°C, at the same time),

Morfogeneza pećinskog sistema izvora Jedreš različita je od uobičajenih promatranja istih zbivanja u podzemnim prostorima nastalim u pretežno uslovljenim vapnenjačkim naslagama, koje prevladavaju u preostalom području dinarskog krša.

Zaključne napomene i prijedlog za daljnja ispitivanja

Istraženi podzemni prostor izvor pećine Jedreš nalazi se u zapadnom dijelu Nevesinja u podnožju obronaka planine Velež. Prirodni izvor kaptažnim je zahvatom uveden u rezervoar za vodoopskrbu jednog dijela Nevesinja.

Speleološkim istraživanjem izvršenim u mjesecu srpnju 1981. godine utvrđeno je slijedeće:

— iza pokrivenog kanala i umjesto obziranog tunela nastavlja se prirodni kanal i sistem pećinskih dvorana.

— bušotinaa J-3 nabušila je niski pećinski kanal i na tom mjestu upala u omanji udubljeni bazen.

— uz pomoć električne muljne pumpe održavan je najniži nivo vode u bazenu i tako omogućeno speleološko ispitivanje ostalih podzemnih dijelova.

— ukupna dužina detaljno snimljenog podzemnog prostora od kraja obzidanog tunela do zadnje snimljene točke iznosi 110 metara. Visinska razlika između tih dviju točaka je približno 3 metra s padom prema ulazu.

— hidrogeološke karakteristike vodenog toka tek su djelomično ispitane, a detaljnije rezultate dat će naknadna promatranje svih promjena u režimu postojećeg podzemnog vodotoka.

— temperatura vode u vrijeme istraživanja iznosila je 7,2°C (temperatura zraka na površini bila je u isto vrijeme 35°C!).

— the former morphogenetic investigations indicate three morphological wholes:

— incoming low and narrow channel

— middle enlarged part with high »funnels«

— underwater course drainage area with narrow and high channels

When considering the detailed investigations the following works should be carried according to the proposal:

— to define the closest place between the surface and central part and to enter the cave area cutting a relatively short level entry, and, to place a suitable ladders up to the bottom. This should be done in order to avoid the pumping of the syphonic basic to reach the underoround area,

— to install an overflow with automatic recording of the flow or water level, at a suitable place,

— to measure a temperature of water course during different seasons i. e. at the vary spring and at the side underground »tributaries«,

— to investigate in details all other channels and passages in the central part and behind the last investigated point, at the moment,

— to collect the travertine samples from different parts of the cave in order to carry out the necessary radiocarbon analyses and to determine chronologically the age of the particular stages and processes of the cave formation,

— to carry out the bacertiological analyses of water during the dry and rainy periods,

— tio dye the surface torrent flows and observe the appearance of dye in the underground water course,

— to elaborate a detailed geological and hydrological map of the closer or wider area in oder to define the protection zone of the source area.

THE JEZDUŠ SPRING CAVE

The cave is located in the Western part of Nevesinje, on the Southern-Eastern slopes of the Velež mountain. The cave opening is at the elevation of 1.050 m. The spring or location of Jezdeš cave is marked by a name and blue colour in the topographic map M 1:100.000. The old capture of spring providing water supply to one part of Nevesinje is located below the cave.

— dosadašnja morfogenetska promatranja ukazuju na tri morfološke cjeline:

— ulazni niski i uski kanal,

— središnji prošireni dio s visokim »dimnjacima«,

— prostor dreniranja podzemnog vodotoka s uskim i visokim kanalima.

Pri razmatranju daljnih ispitivanja predlažemo, da se izvedu slijedeći radovi:

— utvrditi nazbliže mjesto između površine i središnjeg dijela, te probijanjem relativno kratkog potkopa ući u pećinski prostor i do dna postaviti odgovarajuće stepenice. Na taj način izbjeći će se potrebna ispumpavanja sifonskog bazena radi ulaženja u podzemlje.

— na najpovoljnijem mjestu u pećinskom kanalu postaviti preljev s aautomatskim registriranjem protoke ili visine vodostaja,

— vršiti temperaturna mjerenja vodenog toka u razna godišnja doba kako na samom izvoru tako i na bočnim »pritokama« u podzemlju,

— izvršiti detaljno ispitivanje preostalih kanala i prolaza kako u središnjem dijelu, tako i u dijelu iza za sadaa zadnje snimljene točke,

— prikupiti sigaste nakupine u raznim dijelovima pećine radi vršenja radiokarbonskih analiza i kronološkog datiranja pojedinih faza iz procesa formiranja pećine,

— izvršiti bakteriološke analize vode u sušnom i kišnom periodu,

— izvršiti bojenje površinskih bujičnih tokova i pratiti pojavu boje u podzemnom vodotoku,

— izraditi detaljnu geološku i hidrogeološku kartu užeg i šireg područja radi utvrđivanja zaštitne zone izvorišta.

Morphology Of Cave

The entrance to the Jezduš cave is similar to the entrance into some shapeless pit and at the depth of 3 m the underground system extends as low and narrow channel.

After slow movements on hands and knees through the narrovw channel one can reach the enlarged part and sit there. One part of this enlargement is filled in by a mud deposits and the water is drained below the rock plate.

Ten meters from the entrance the ceiling height reaches 2 m and the width 1—2 m. Twenty meters from the entrance the calcite deposits are found on the bottom and several plastic pipes left after the last hydrological investigations have been found, as well.

Deeper inside the channel its height is lower and lower (1—1.5 m), but it is enlarged on its sides (even to 3 m wide).

At 45 meter from the entrance the ceiling is lowered almost till the water level and the further passage was not allowed without watertight suit or diving suit.

The total length of the investigated part of the Jezduš spring cave, for the time being, is 48 m — the lowest part of the cave is approximately 3 m below the entrance level.

Geology And Hydrology Of Cave

The Jezduš cave is formed in well pronounced conglomerate promina deposits with very pronounced pebbles of limestone.

The erosional and corrosional effects of water along very pronounced cavity toward the North-East-South-West formed the existing underground area of this cave resulting in nerrow and low channel within presently unknown part of the underground system.

The water appearing in the cave has mainly constant characteristic and il is necessary to determine its minimum capacity and to reach the end part of the basin by diving. The next investigation should be carried out during a dry period of a year. The spring capture in front of the cave was earlier better maintained and provided a retention of higher quantities of water to be used for the water supply to the municipal water supply system.

IZVOR PEĆINE JEZDUŠ

Pećina se nalazi zapadno od Nevesinja na jugoistočnim obroncima planine Velež. Otvor pećine je na koti od oko 1.050 m. Izvor ili lokalitet Jezduš označen je imenom i plaavom bojom na topografskoj karti M 1:100.000. Ispod pećine nalazi se stara kaptaža iz koje se vodom snabdijeva jedan dio Nevesinja.

Morfologija pećine

Ulaz u pećinu Jezduš nalikuje ulazu u neku jamu nepravilna oblika i tek na dubini od 3 m podzemni se sistem nastavlja kao nizak i uski kanal.

Nakon 5 m puzanja kroz takovo sušenje kanala dolazimo u proširenje u kom se može i sjesti. Dio proširenja ispunjen je nanosom blata dok voda otječe ispod kamene ploče.

Idući dublje u unutrašnjost deset metara od ulaza visina stropa dostiže i 2 m dok širina varira od 1—2 m.

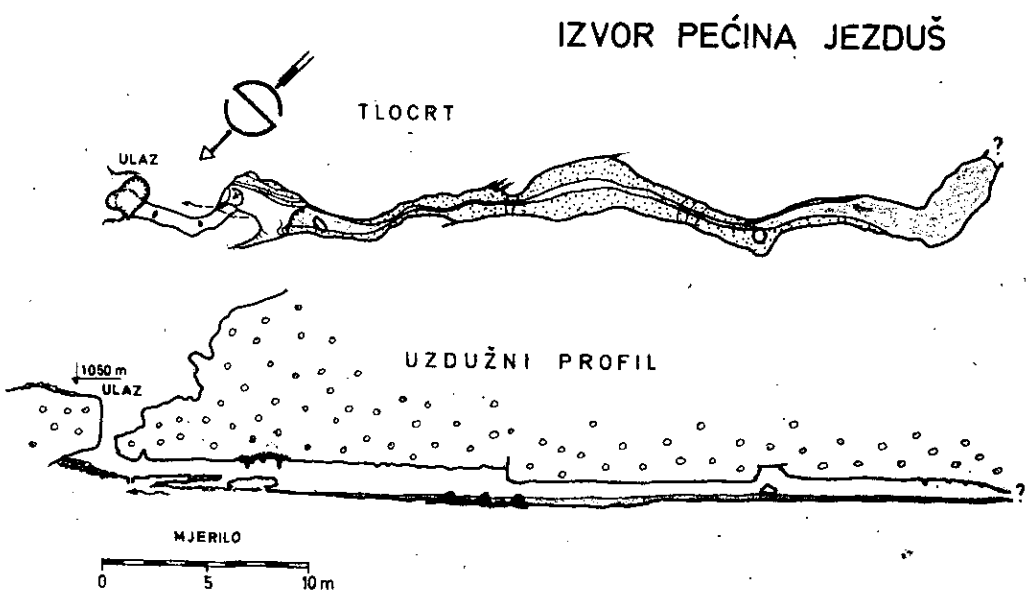
Final Conclusions

During the speleological investigations on the Southeastern slopes of the Mali Velež i. e. part above Nevesinje, two spring caves have been investigated, Jedreš and Jezduš caves. The water course appears from both caves and water is used for the water supply system.

The Jezduš cave has its entrance at the elevation of approximately 1050 m and the Jedreš cave at the elevation of 887 m a. s. l. The investigated part of the Jezduš cave is 48 m and 130 channels of the Jezduš cave system are topographically surveyed and 100 m is recognized.

The entrance cave channel of the Jedreš cave is drilled and this drilling hole is used for the observation of the changes in underground water level. Under the normal conditions the entrance part of the cave channel has a form of flooded syphon and the inside part can be reached after pumping out the water. The maintenance of the minimum water level determines the period of stay in the hinterland of the drilling hole.

The morphology of the investigated caves is unique because these two systems have been constructed in the deposits of conglomerates at the place of



Dvadeset metara od ulaza u tlu su kalcitne nakupine, a ovdje smo naišli i na nekoliko plastičnih cijevi ostavljenih pri zadnjem hidrološkom ispitivanju.

U nastavku pećinskog kanala visina mu postaje sve manja (jedva metar do metar i pol), dok se kanal bočno proširi u nešto veći prostor (čak do 3 m širine).

Na 45-tom metru od ulaza strop se spustio gotovo do vode i daljnje prolaženje nije bilo moguće bez potrebnog nepromočivog ili ronilačkog odijela.

Glavni smjer protezanja pećine je sjeveroistok—jugozapad. Bočna skretanja vrlo su tanja vrlo su male dužine. male dužine.

Ukupna dužina do sada istraženog dijela izvor pećine Jezduž iznosi **48 m.** *Najniži dio pećine je oko tri metra* ispod razine ulaza.

Geologija i hidrogeologija pećine

Pećina Jezduš formirana je u dobro izraženim konglomeratičnim prominskim naslagama s vrlo izraženim valuticama vapnenjačkog materijala.

Erozijski ikorozijski rad vode duž izrazite pukotine smjera sjeveroistok-jugozapad oblikovao je postojeći podzemni prostor ove pećine rezultirajući uskim i niskim kanalom u dijelu podzemnog sistema koji je za sada poznat.

Voda koja se javlja u pećini uglavnom je stalnog karaktera pa je potrebno ustanoviti njezin kapacitet u minimumu, a uz to zaronjavanjem prodrijeti u završni dio bazena. Naredno istraživanje trebalo bi izvesti u sušno doba godine. Kaptaža ispred pećine nekad je bila bolje održavana i osiguravala je zadržavanje veće količine vode za dio gradskog vodovoda.

contacts between considerably broken and more copcat sediments. The erosional and corrosional effects of water enlarged the existing cavities and the flood material deposits point to the fact that such material has been flooded from the hinterland for a long period of time.

In order to provide the better knowledge on the cave system in terms of mentioned speleological occurances the Jezduš cave should be additionally investigated during a dry period with application of suitable equipment. The access tummel should be broken in order to investigate the cave parst behind J-3 drilling hole.

The future investigations of the formation of these interesting spring caves will provide new and better knowledge on the genesis of the speleological sites in the deposits of the conglomerates.

Zaključne napomene

Za vrijeme speleološkog istraživanja na jugoistočnim padinama Malog Veleža u dijelu iznad grada Nevesinja istražene su dvije izvor pećine: pećina Jedreš i Pećina Jezduš. Iz obadvije pećine izbija vodeni tok koji se koristi za potrebe vodosnabdjevanja.

Pećina Jezduš ima ulaz na koti od oko 1050 m a pećina Jedreš na koti od 887 m iznad mora. Istraženi dio pećine Jezduž iznosi za sada 48 m, a od pećinskog sistema pećine Jezduž točno je topografski snimljeno 130 m kanala, i rekongnoscirano još oko 100 m.

Ulazni pećinski kanal pećine Jedreš nabušen je jednom bušotinom kroz koju se osmatra kolebanje nivoa vode u podzemlju. U prirodnom stanju ulazni dio kanala ove pećine ima izgled potopljenog sifona i u unutrašnjost se može prodrijeti jedino nakon ispumpavanja tog dijela. Dužina boravka u zaleđu bušotine ovisi o održavanju najnižeg nivoa vode.

Morfologija istraživanih pećina jedinstvena je iz razloga što su ova dva sistema izgrađena u naslagama konglomerata u dijelu kontakta između znatno razlomljenih i kompaktnijih sedimenata. Erozijski i korozijski rad vode proširio je postojeće pukotine, a nanos materijala u kanalu pećine Jedreš ukazuje na nanašanje istog iz dosta udaljenog zaleđa kroz vrlo dug vremenski period. Prema taloženju sigastih nakupina u pećini Jedreš možemo pratiti neke od faza nastanka ovog podzemnog sistema.

Radi daljnjeg upoznavanja sa spiljskim sistemima ovih speleoloških pojava predloženo je da se pećina Jezduš dodatno istraži u sušnom periodu uz pomoć odgovarajuće opreme, a da se u pećinu Jedreš probije pristupni rov radi mogućnosti ispitivanja dijelova pećine iza sadašnje bušotine J-3.

Daljnja proučavanja postanka ovih interesantnih izvor pećina omogućit će nam nova saznanja o genezi speleoloških objekta u naslagama konglomerata.