

This sign has nothing to do with possession, sadly – rather the Popovo Polje at Vjetrenica Cave after the de-mining crews arrived



PECINA VJETRENICA

Relighting the Wind Cave of Southern Herzegovina

- Neil Kell

Pecina Vjetrenica is located on the west end of Popovo polje near the village of Zavala, in southern Herzegovina. It is only 15km from the Adriatic coast and 50km north of Dubrovnik in the Republic of Croatia. Tours are conducted by appointment, using hand-carried torches and carbide lamps to light the experience of visiting the first 500 metres of the total cave passage length of 6,100m.

Historically the cave is first mentioned in 1461. Most of the cave was explored during the period 1912-1914, followed by path building and tourist cave development in 1939-1940. In 1964 electric lights were installed, pathways renewed, and a motel built. Electric lighting system is destroyed during the fighting of 1991-1996.

This Australian – Bosnia and Herzegovina connection grew from a 2004 conference meeting between Elery Hamilton Smith and Ivo Lucic, the curator of Vjetrenica and author of a superb book on the cave. I was mentioned as a source of comment on cave lighting. From that followed several months of email exchange between Ivo and myself, in which my role expanded from being a commentator on low voltage cave lighting design, through to being asked to be the on-site designer and project manager. I had a small understanding of the significance of Vjetrenica the largest and most important cave in Bosnia and Herzegovina, and one of the most interesting caves in the Dinar mountain range. Much of its current interest lies in its biodiversity – 85 species, including the Human Fish (*Proteus anguinus* L). The role I was to play centred around the desire to redevelop the cave for modern tourism, relighting it with the new emphasis on biodiversity, cave conservation, cave aesthetics, and the international tourism market.

In August I fly out of mid-winter NSW and into the late summer heat of southern Dalmatia. Crossing the Croatian – B/H border reveals the legacy of a war that ended 9 years ago in the Dayton Agreement. Little did I know that within the hour I

would be introduced to living for the next month in the midst of this legacy of bombed villages and roads, with many villages totally abandoned or barely inhabited. Zavala, my home village, had 7 habitable houses - 4 were occupied, and the remaining dozen or more were bombed and vacant ruins, including the once-upon-a-time motel, and the railway station. The national flag flew continuously in the heart of the village, accompanied by a standing cross. Various plastic floral tributes marked the grounds where a life remembered - last stood. The adjacent cemetery is also coloured with floral tributes.

There is electricity, but no telephone lines, shop, public transport, street lighting, or police. The total population came to 8, I was number 9, the sheep numbered about 60, cows 8, goats 12, plus cats, dogs, chickens, and geese! Tucked in under a limestone cliff and cave on the edge of the village is the visually dominant Monastery with its sole resident prior. The next closest village less than 2km away, is totally abandoned. Ravno village another 6 km away prospers with home rebuilding, and boasts a hotel, school, phone lines, and a post office to reopen in the coming weeks - but no shop! Communication here has leapfrogged into the world of the mobile phone.

In the whirl of the next 24 hours I am introduced to Vjetrenica Cave; numerous speleolos working on cave and biota surveys; locals who had the cave interests at heart; a high school graduate who was to be my live-in interpreter/assistant; and the Balkans food that appeared whenever people congregated - along with the pivo and sljiva votka essential to lubricating any event! And indeed this moment was an 'event' for Vjetrenica, as the curator Ivo Lucic and his extended family and friends from Ravno had brought together the teams of speleos, a documentary film crew, an Australian cave lighting consultant, an architect, electricians, local media including Croatian TV, and the potential funding source for the relighting project – USAID.

Neil Kell and his interpreter/assistant, Kristijan Raic, outside Vjetrenica Cave



I barely had time to acquaint myself with the extent of the cave and the lighting possibilities before I became the focus of reporters and cameras seeking the unique grab on an antipodean's experience of landing in the karst of the Balkans. Very quickly I was learning that the relationship between the population and the karst they live with is complex and deep, ranging across the sciences, centuries of history, literature, philosophy, politics, and conflict.

To the visitor the most obvious significance of Pecina Vjetrenica is its wind, which is most likely the phenomenon mentioned by Pliny the Elder in his work *Historia naturalis* of the 1st century AD. The oldest historical reference to the wind of Vjetrenica is by Nikola Gućetić in 1584. Other old texts mention a building at the cave entrance thought to be the summer residence of a prominent family from Popovo polje – and the possible deliberate use of the natural draught for 'air conditioning' the residence.

In the heat of summer the 10°C cave air roars out of the 2.5m diameter cave entrance at speeds up to 14metres per second and extends its refreshing effect far enough for even the passing motorist to park in the shade of a tree outside and enjoy a cool siesta. For the cave visitor this cold gale necessitates extra warm layers of well buttoned-up clothing to be worn for at least the first 100 metres into the cave. Beyond lies the extensive passages ranging from 20m to 30m in both width and height in which the draught is less discernable. One kilometre from the entrance is a siphon feature, though normally dry during summer it can become flooded and stop the draught. A few hundred metres further on is Veliko Jerzo, a 180m long lake which can be crossed by boat. Tours were once conducted beyond this point for another 500 metres.

Dry stone pathways averaging 1.5m in width and up to 3 metres in height have been constructed 1km into the cave. Despite the massiveness of the construction in some places, the positioning of the curved alignment is quite sympathetic to the cave experience as it takes the visitor on a meandering stroll through an undulating cave-scape of breakdown passages, rim pool floors, cascades of flowstones, and underneath roofs of structural and phreatic interest, peppered with dripstone formations.

Only when the natural passage runs straight for some 100 metres in one location does this meandering pathway seemingly run straight. The uneven rock-paved surface of the pathway may unsettle those visitors used to the predictable evenness of concreted pathways, but I had to learn that limestone pavements have been a part of life here since at least the Roman times, and the locals see no reason to upgrade from that.

What is left of the old cave lighting in Vjetrenica is typical of many such installations in East Europe in the late 1960's. Large floodlights from 600mm to 900mm in diameter housing 500w to 1000w bulbs provided the illumination of the big chambers, while the other lighting tasks for smaller features and showing the way along the paths was augmented by strings of smaller bulkhead type luminaires strung along the cave walls.

The fixing of this equipment in Vjetrenica is no different to our Australian experiences of the past, leaving a legacy of damage and pollution for clean up or containment. It may have been a bonus to view the old lighting system operating, but in another way it can be a good thing to have had more than a decade between the last electrically lit tour and the planned new tours to allow a clear approach to designing the new lighting.

While the first few inspections of the cave presented a challenge to imagine lighting possibilities, once a working kit of lighting units had been assembled the actual mocking up of lighting scenes was able to proceed quickly. My interpreter/assistant had just gained admittance to the top electronics technology college in Croatia, so anything electrical and programmable was immediately understood.

As we worked our way along the cave we shared the creative and practical processes of devising lighting scenes, to the point where he would rough out a possible lighting arrangement while I pondered other practicalities. This process worked so well that many of the decisions as to which lighting to use would be confirmed by this young Bosnian Croat - a representative of his generation with the desire to succeed in the modern world, and possibly be part of the next generation of cave tourists.

Within three weeks the lighting design for 500 metres of cave was documented, and tagged within the cave. The total lighting load tallied up to less than 5kw - one third of the 15kw that had been envisaged in the original plan for a new lighting system. In addition a number of other installation considerations were determined:

- Routing of cables for mains and low voltage, data cable, and water pipe.
- Control board locations.
- Handrail installations relevant to path slope, fall factors, and cave protection.
- Stone pathway alterations to include curbing; widening for group accommodation; and a new loop section at the rear of the cave tour.
- Raised stainless steel stairs and walkway to access a richly decorated flowstone passage.
- Lighting of the cave entrance forecourt for night tours.

The final task of this phase of on-site work was to rough out a bill of quantities, an estimate of labour, and a budget for the project. At first thought - a daunting task to approach in an unfamiliar war-torn country. But I recalled the comment from a chance meeting over cold beers with a retired Croatian Diplomat to Australia - and consulting civil engineer, that such projects have roughly the same budgetary value irrespective of where in the world they are proposed. Add to that the local knowledge of pay scales for various personnel, and very easily the final budget is roughed out at about Aus\$260,000.

The final report will be submitted to USAID in Sarajevo to be reviewed by the 'Tourism Sector Specialist' of the 'Cluster Competitiveness Activity' office within the 'Emerging Markets Group' - and hopefully added to the list of selected projects for funding consideration in Washington, USA. I won't be holding my breath, but if the proposal is given the green light I will be returning to manage the full project through to completion. I depart the quiet village life of Zavala in exchange for the next stage of becoming a tourist on the road with no defined agenda other than to see more caves. This is at first unsettling - life in Zavala had been too good! On the road, I drive south into Montenegro to gawk at the limestone landscape that soars towards the heavens in all directions. Kotor town is Montenegro's most dramatic setting in the head of southern Europe's deepest fjord.

This is all quite fine until the road one takes heads skywards, zig-zagging from sea level to the alpine plateau in one series of 26 hairpin-bend switchbacks. Over the top I wipe the sweat from hands and steering wheel, and motor on through rolling alpine karst on my way to Zabljak in Durmitor National Park. I congratulate myself on arrival, because in this land of upheaval - signage if it exists - is rarely conclusive evidence that one is heading the right way. Zabljak village in Durmitor NP a small alpine ski resort by winter, and a focus for walking and camping in summer. I had arrived in the 'shoulder season' and enjoyed walks in forests, views of limestone mountains towering above the tree line, idyllic glacial lakes, and the eyrie-like views into the 1000m deep Tara River canyon. Satisfied, I lay in the sweet soft alpine meadow and soaked up some clear sunshine while cowbells tinkled, and fungi gatherers and meadow scythers conversed in the surrounding forests and fields.

After Durmitor I had made an arrangement to meet up with Messrs Spate, Henderson, and Bourne at Postojna, Slovenia. This was to involve a

2-day traverse across Bosnia and Herzegovina, Croatia, and Slovenia, with the hope of arranging a meeting with the USAID office in Sarajevo along the way. In long-distance Aussie driving mode I leave Durmitor, descend to Niksic, then survive the height challenging 25km drive through the 53 tunnels that lurk in the gorge created at the confluence of the Tara and Drina Rivers.

The Sarajevo connection happens in a morning visit, as I play the guessing game presented to me by signage that chopped and changed between the Roman and Cyrillic alphabets. In the next 7 hours of driving I leave the haphazard conditions of war-torn infrastructure for the comforting predictability of the motorways of Croatia and Slovenia to arrive on time in Postojna for beers and dinner with cave mates. Over the following five days we were enthusiastically hosted to cave visits and karst drives by the staffs of Postojna and Skocjan caves to the point where I for one gave up trying to comprehend the karst connections as circuitous routes revealed successions of dolinas, ponors, poljes, jamas, etc, etc, and train loads of sinter! Having visited Postojnska Jama and the nearby Skocjanske Jama in 2000

I was now looking for evidence of changes with cave lighting, but nothing has happened of any practical note. Skocjan management are researching the composition of their lampenflora and having discussions with Osram in the quest for a light bulb that will not promote the said lampenflora. I suspect this could be a long process with little of significance to resolving the growing lampenflora problem. From what I have observed of European cave lighting design it does not need rocket science to redesign cave lighting and its operation to reduce lighting impacts and energy loads that promote the level of lampenflora that romps around many a show cave here.

Postojna is a site of mass tourism, and they handle that with great procedural detail and operational success. But if your need is to engage with the guide for a memorable cave visit - forget it! Here the 'event experience' is the extraordinary cave, and train ride in and out, supported by the vast array of consumable offerings, and the remarkable Proteus Postojna Speleobiological Station - 'within a cave' where one can cave-stroll at your own pace free of the crowds and discover more of what is special about the Postojna caves.

At Skocjan, with its significantly lesser volume of tourists, there is the potential for a broader cave experience, though once inside the cave it is the cave-scape that dominates. The special experience opportunities here lay within the Skocjan Park itself where one can partake of the various walking trails and stitch together an appreciation of the remarkable surface karst and the connections to the awesome cave underneath. However there are alternative experiences to be had with in the same karst.

There are several caves that though they have been visited for many years, commercial tourism development has passed them by. These are state owned caves managed by local interest groups, usually a speleo/caving club, which provides the guiding, management, and maintenance.

Neil Kell at dinner in Ravno with Ivo Lucic (seated at end of table facing camera) with his brother Andrija, and three veteran Croatian cavers.



The cave can be minimally altered with barely more than a secured entrance, and some track marking, through to constructed pathways, handrails, rubber boat access, and in the case of Jama Vilenica – an electric lighting system.

The caves themselves are not insignificant in either form or content as one explores several hundred metres of passage and chambers that could soak up all the tourist caves of Yarrangobilly with space left over for a truck load or two of sinter thrown in. All these caves are well worth seeking out to visit on the holiday and weekend days that they are open for tours.

From the karst of Slovenia I go south into Istria, Croatia, and pay a visit to Baredine Cave. This cave is privately owned and operated, and sited within a 15 minute drive of the ever popular holiday coast on the Adriatic, and the town of Porec with its Roman and Byzantine heritage evident in the historic old town on a peninsula.

The owners of Baredine (who have caving in their blood) have developed a relative tiny vertical cave into a 45 minute cave experience that corkscrews some 60 metres down under the orchard fields on the surface karst.

There is an abundance of formation, and plenty of enthusiasm in the way the guides present their cave to the visitor in four languages (Croatian, Italian, German, and English) spread over about five viewing stops on the way to the bottom.

Back on the surface they provide a restaurant, an ethnographic museum, and are adding to that: a cave museum, a photo gallery, and a speleoclimbing centre at an adjacent dolina. They also offer 5hour Speleo-adventure tours to nearby caves in the company of members of the Speleology Association from Porec.

Unbeknown to me, news of my work at Vjetrenica had spread through the Croatian cave world and I was welcomed and hosted with the view of providing comment on improving their cave lighting. Here was a second potential cave lighting job except for the fact that I was now in a private

cave, lots of enthusiasm and ideas, but not spare money. However when they send the cave map I will return some ideas to them for consideration in improving the lighting design in the cave.

Croatia has 13 listed show caves, but with the tourist season rolling to its close, and with inclement weather in the mountains I had to give up after 2 days of driving in fog only to find closed caves.

But across two more borders lay Grotta Gigante near Trieste in Italy, I cannot resist – it should be sunny as well! If you are into large challenging underground experiences without going wild caving, do stop at this grotte. The tour is through just one chamber - 107m high, 280m long, and 65m wide, 500 steps down, and 500 back up to the surface!

Every viewing opportunity is afforded as the whole chamber is lit, and irregardless of how many viewing bytes one attempts, it is difficult to comprehend the space – and the fact it has been filled with light!

There is *lampenflora*, and there would be much more of it except that they have installed a system of UV lights which operate overnight to keep it a bay on their most significant formations. If you have a fear of heights skip this cave, the exit staircase is attached to the vertical cave wall so that on nearing the top one has a free-fall view to the cave floor 100m below. I was hoping that the legend of Italians and their concreting skills was a sound one!

For reasons not worth explaining I travel via Slovenia, Croatia, and Austria, to get into Slovakia so I can look at a suite of World Heritage listed show caves. I visit the Caves Gombasecka, Domica, Ochtinska Aragonite, Demanovska Cave of Liberty, and Ice Caves, Dobsinska, and Demanovska, and end up at a Conference on the Research, Protection and Utilisation of Caves, at Demanovska Dolina.

Here there is a brief chance to connect with managers of show caves in Slovakia, and the Moravian Karst of the Czech Republic, and learn of recent cave relighting in Zbrasovske Aragonite Cave, Moravia; and proposals to relight three of the Slovakian caves I had visited in the previous days.

Here in Slovakia show cave lighting is of the same mould as seen elsewhere - Par38 flood lamps. There is some evidence of attempts to shield the lamp and minimise lamp glare for viewing tasks, but these shields are in practice not effective, and considerable spill light still impacts on cave surfaces where such high light levels often contribute to *lampenflora* growth.

Linear rope light had been used in three caves to provide some specific additional lighting to reveal pedestrian hazards, however in all situations the rope light is unshielded and attracts the viewers attention unnecessarily.



Having been drawn to these caves by the World Heritage Area listing featured in the excellent promotional material produced on all the Slovakian show caves, I admit to being somewhat disappointed by the presentation of the caves, and becoming downright annoyed by the number of times I held up my hand to shield lamp glare from my eyes. I mused on being a vandal and taking out all the offending lamps after I realised that the numerous video security cameras installed to monitor visitors did nothing to deter or detect the formation handling that I observed throughout some tours.

After seven weeks of working and talking caves it was time to depart for home. There is a definite limit I now realise to how many PAR38 lamps I am prepared to put up with glaring into my cave viewing tasks. I wonder how many cave visitors might react the same. I wonder also about how many cave managers might value the connections between the lighting system, the viewing experience in a cave and the eventual 'take-home' memory of the cave visit. Wandering around the airport at Vienna I am free of the glare of lamps!

CAVE STATISTICS IN THE WORLD OF COMMERCIAL CAVES

Almost every cave has some kind of statistic highlight, told to astonished visitors by the cave guides. Sometimes it is true, sometimes not, but who cares – there is usually no chance to verify such a statement. There is no institution which collects speleological world records, not even the *Guinness Book of World Records* - although they tried a few times, with questionable success. Many cave owners want to impress their visitors with some kind of superlative. So they try to find some aspect of their cave which is extraordinary. Today such a thing is called a *unique selling proposition* (USP).

1. It is rather easy if you really have a great cave. Many facts are collected in official statistics; hundreds of cavers all over the world distribute information to some institutions like the NSS or the UIS. There are attributes like length and

vertical range, which are well defined and measured by surveying teams.

2. There are historic superlatives like first lit, first mentioned in literature or the oldest cave paintings. This information is also collected by historians and other scientists.

3. Finally there is a third category of superlatives, which are a little strange, but still easy to understand: longest tour path, most visitors, most steps, or longest boat ride. They are not really of any use, but at least they are more or less true. But this is the humour section, and now it starts to become weird and funny. In order to impress their visitors, cave guides often start to develop a certain kind of creativity. They start to make up their superlatives. This is how it works:

1. **Telling outdated information.** Probably it once was the biggest known cave entrance, way back in the first half of the 20th century. Speleologists are still discovering astounding caves nearly every day. Our knowledge increases and we know much more now than we did fifty years ago.

Therefore, all those allegations are only valid for some time. Cave guides tend to repeat things they once learned, and do not update their knowledge very often – the terms ‘tallest stalagmite’ and ‘longest stalactite’ are often used.

2. **Inventing a new type of measuring.** There are various ways to do so. Just try to find a direction that has the most outstanding dimension. Then postulate it was the biggest, tallest, longest, widest or whatever.

The most impressive usage of this kind of creativity was made at Grotta Grande del Vento (Frasassi) in Italy. The huge chamber called Abyso Ancona, although really impressive, is measured from the lowest point of the floor at one side to the highest point of the ceiling at the other side. This is probably the only place on Earth where the dimension of a chamber is measured diagonally.

3. **Ignore all foreign countries.** Some countries tend to think they are the salt of the Earth, the centre of the universe or whatever. This affects the behaviour of the cave guides – they just check if their biggest whatever is biggest in their own country. Then they tell their visitors it was the biggest whatever on Earth.

This has some kind of inner logic, as their own country is the ‘best of the world’, and therefore anything best in this country is at the same time best of the whole world. This is called transitivity.

We found this in all kinds of egocentric countries, in communist Eastern European countries as well as in the USA. We guess they just look in their own country, to avoid being sued....

4. **Inventing a type of speleothem.** Speleothems are extremely various, and they are classified into a few types, like stalactites and stalagmites. So if you do not have a largest stalagmite, how about the largest ‘stableford’ on earth? Just tell your visitors in a trustworthy way what a ‘stableford’ is. It’s okay to make up a plausible explanation, as there is no such thing as a speleothem called ‘stableford’.

An example – A certain cave in the USA owns the largest frozen waterfall, but it does not contain any

ice. They just named some dripstone as ‘frozen waterfall’, and as nobody else does, theirs is the biggest.

5. **Modify the definition.** Often it is possible to reduce the competition by narrowing the definition. If you definitely do not have the tallest stalagmite, how about the tallest blueish stalagmite? There aren’t many blueish stalagmites, so you don’t have many competitors, and it’s such a strange quality, there will definitely be no official list of tall blueish stalagmites.

A certain cave in the USA did this with their impressive cave entrance. After learning that it wasn’t the largest cave entrance in the world, they modified it to widest.

Still it wasn’t true, so they modified it to widest entrance of any commercial cave in the world. This is not true either, so probably they will soon change it to ‘widest entrance of any Cathedral Cave’.

6. **Just lie.** If anything else fails, you can still do this. We found numerous caves on earth, which tell strange things. Almost everybody tries to look a bit better than he really is. The most impressive example in this sense is in a certain cave in the USA.

It seems they lately searched the internet or probably speleological literature, to find new statistical highlights. So they now offer six different world records, which are either a bit complicated, or simply fantastic:

1. It has the widest entrance of any commercial cave in the world, which is a complicated phrase but nevertheless not true.

2. A certain cave is home to ‘Goliath’, the largest stalagmite in the world, 18m tall and 61m in circumference.

3. A certain cave has the largest flow stone wall, which is 9.7m tall and 41m long.

4. Really weird is the largest frozen waterfall (mentioned above), though no size is given.

5. A certain cave has the largest stalagmite forest of any cave in the world, again no dimensions are given.

6. A certain cave has the most improbable formation in the world which is a stalagmite that is 10.6m tall and 7mm wide!

EDITOR’S NOTE: The foregoing article, by an un-named author, is to be found at <http://www.showcaves.com/english/explain/Humor/Statistics.html>. However, as it is clearly in the public domain, I can see no reason why it shouldn’t be re-printed here. I have edited it to a small extent for publication herein. Indeed, the “Show Caves of the World” site <http://www.showcaves.com> is an excellent and very comprehensive resource. The original article names a particular cave (you can check out the URL for yourself if you really want to know...), but for the sake of propriety I have amended the article with the term “a certain cave” instead of the cave name. Of course, nothing of the kind detailed in this article would occur at any Australian or New Zealand cave, would it?