THE KARST PONOR-MILLS AND PONOR-MILL CAVES AT DOBROMANI (Popovo Polje, Eastern Herzegovina, Bosnia & Hezegovina)

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BACKGROUND ADMINISTRATIVE DATA TO THE PROJECT

On 12 August 2000 the Project has been formally designated the code: DKRS-II / BiH-IH / 120800DPMPP.

The Society has a number of projects underway in Eastrnm and South-eastern Europe. Many are of a short-term duration (maximum 5 years) or of medium term duration (5-10 years). There are presently no long-term projects (10+ years). The *Dobromani Karst Ponor Mills Project* is of a short-term duration.

Where individual projects are **not** part of the Society's Foreign Policy (*Foreign Assistance Programme*), we will publish all relevant details. This Project is not part of the Society's *Foreign Assistance Programme.*

More extensive details of this Project will be available on the Society's Website in due course. It should also be noted that the Society is unwilling to undertake any ***original*** speleological exploration in BiH without the consent or approval of the Speleological Association of BiH or that of the Speleological Society "Bosansko-hercegovački krš" – Sarajevo. However, in undertaking the work detailed below, we do continually strive to locate and involve local speleologists and others who may be interested.

LOCATIONAL DETAILS

Dobromani is a small village situated in Popovo Polje, Eastern Herzegovina, 21km. (13 milles) from Trebinje on the road Trebinje – Ljubinje. The lower edges of the settlement reach down from the slopes of the Bjelašnica Mountain to the main road near the junction with a minor road crossing Popovo Polje from the direction of Jasenica Lug. This location is a few metres from the Trebišnjica Karst River over which the road to Jasenica Lug is carried by a narrow bridge and beside which is also located a roadside restaurant.

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Of the three recorded karst ponor-mills at Dobromani, two are the subject of this Article. They are located on opposite sides of the Trebišnjica River in that part of Popovo Polje known as Trebinjska Šuma (Trebinje Forest), which is an ancient karst corrosional plain.

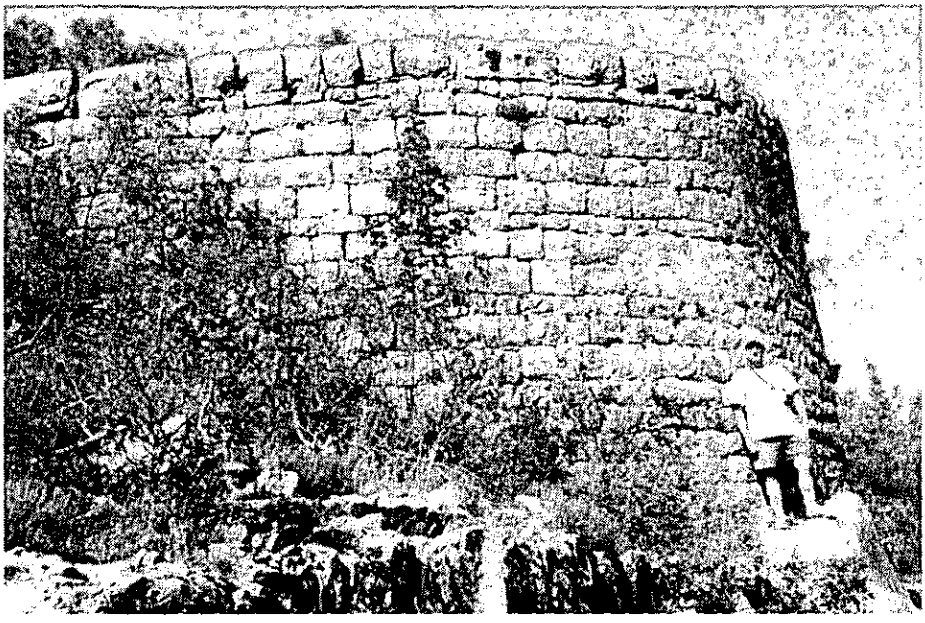
The DRAPIĆA PONOR-MILL / DRAPIĆA PONOR-MLIN is the first to be encountered about 100 metres from the main road and about 100 metres downstream from the road junction beside the restaurant and the narrow bridge. If viewed from the main road, it looks as if it is crouched beside the Trebišnjica River. When viewed from the opposite side of the river, it is a massive structure. It has associated ancilliary outbuildings which are located immediately beside the main road.

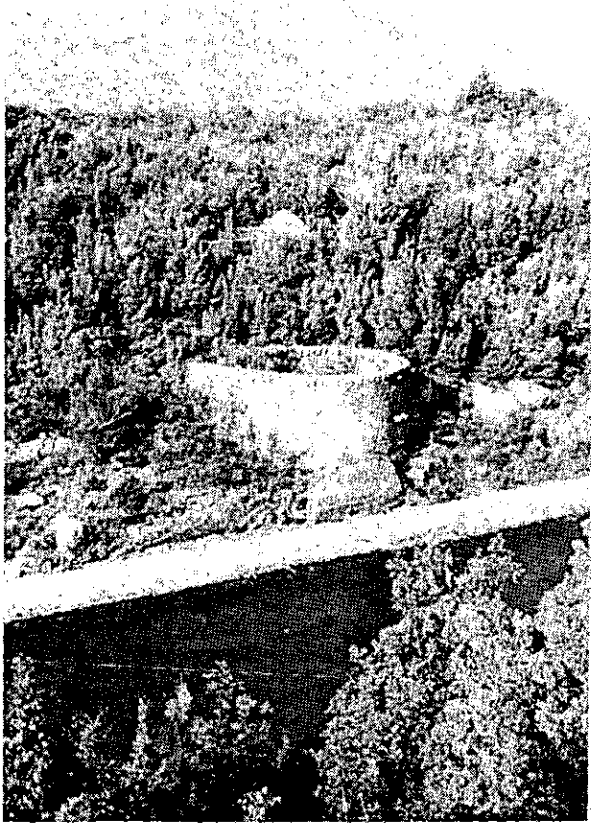




Photos 1. & 2. The Drapića Ponor-mill beside the bed of the Trebišnjica in Popovo Polje (Dobromani)
Drapića Ponor-mlin uz korito Trebišnjice u Popovu Polju (Dobromani)

The **WEST PONOR-MILL / ZAPADNI PONOR-MLIN** (we have not yef. found its name) is the more photogenic and well-recorded structure and is located about 400 metres downstream from the Drapića Mill, on the opposite side of the river. Access is easily gained by walking across the narrow bridge beside the roadside restaurant and following a track down to the river and the ponor-mill. Again, ii is a massive structure, easily seen and ideally photographed from the main road at a higher level on the opposite side of the river.





Photos 3. & 4.

The West Ponor-mill beside the bed of the Trebišnjica in Popovo Polje (Dobromani)
Zapadni Ponor-mlin uz korito Trebišnjice u Popovu Polju (Dobromani)

(Photos by M. Hardman, August 2000.)

It also has associated ancilliary outbuildings.

The third or **EAST PONOR-MILL / ISTOČNI PONOR-MLIN** structure (we have not yet found its name) has not yet been directly located by us and so is not ineluded in this Articlce. It is situated upstream (in the direction of Trebinje) about 300 m from the road junction beside the restaurant. It is our intention to include this structure in the reconnaisance of summer 2001.

All the Dobromani Karst Ponor-Mills are located well within the geographical area of the Bosnian-Serb Administration.

DEFINITION AND DESCRIPTION OF A KARST PONOR MILL

A karst ponor-mill may best be described as a structure built on and over the mouth or entrance of a karst ponor, with the intention of hamessing the hydro-energy of the surface water which naturally discharges into the ponor and its caves beneath. To be effective, the ponor would need to have a good water-adsorption capacity, to enable the mill to function as an on-going event.

The water discharging into the base of the mill structure through special channels, would drive a turbine, usually of wooden construction and this in turn would be connected by a drive shaft to a set of mill-stones set on a platform above the turbine.

The quantity of water or rate of flow delivered to the turbine would be regulated by the raising or lowering of a sluice-gate or "water-gate" on the outside of the cylindrical outer wall. The control for this sluice gate was situated at the top of the outer cylindrical wall directly above the gate.

The cylindrical outer wall is of massive, waterproof construction, enveloping the mill infrastructure. When the mill is in operation, this wall is partly submerged, acting as a coffer-dam (Bos.=bent).

In Popovo Polje, this ingenious use of hydro-energy was employed to drive ponor-mills that were used to grind grain into flour from the local corn crop. In Popovo Polje, the harvest would have been mainly of the special "100 day" com crop, which, as its name suggests, would have been planted, grown and harvested within the 100-day cultivation period in the central and lower parts of the polje, when the polje floor was not inundated by the periodic lake.

The mills could only operate when the flow of the Trebišnjica River resumed in the rainy period. Milanović (1986) states that estavelles were not used for mill construction. In a personal communication, he also states that he has visited many mills which had varying types of construction.

Such ponor-mills were also built in Livanjsko Polje and Lipovo Polje.

HISTORICAL AND CULTURAL HERITAGE NOTES

Historical

The karst ponor-mills along the Trebišnjica River in Popovo Polje were constructed before the period of the Austro-Hungarian Administration. Mikulec and Trumić (1976) seem to indicate that they have survived from the earlier period of Turkish Rule. In a personal communication, Milanović seems to agree with this.

According to Petrović and Kovačina (1984), who have questioned the owners of some of the ponor-mills, the then owner of the Dučića Ponor-mill near the village of Lug said that his ponor-mill was the oldest and had been purchased for gold from Turkish Noblemen by his Slavic family ancestors in the year 1819.

It is well documented that the Dual Monarchy employed the services of several karst engineers during their Occupation of Bosnia & Herzegovina, to devise and implement hydromelioration projects on the karst. We have seen no evidence that these ponor-mills were built by the Austro-Hungarian karst engineers. Although we are of a mind to believe that they are of Turkish origin, we have seen no direct evidence or documentation to support this. That they are of Turkish Origin is not a theory supported anyway by the present Curator in the local municipal museum in Trebinje, (much as we would have expected). The museum does however contain an interesting exhibit of the karst ponor-mills, which includes a cross-seetional model of a typical ponor-mill construction and an old, undated monochrome view of the West Ponor-mill detailed above. The photographic view indicates the presence of a submerged dam beside the mill.

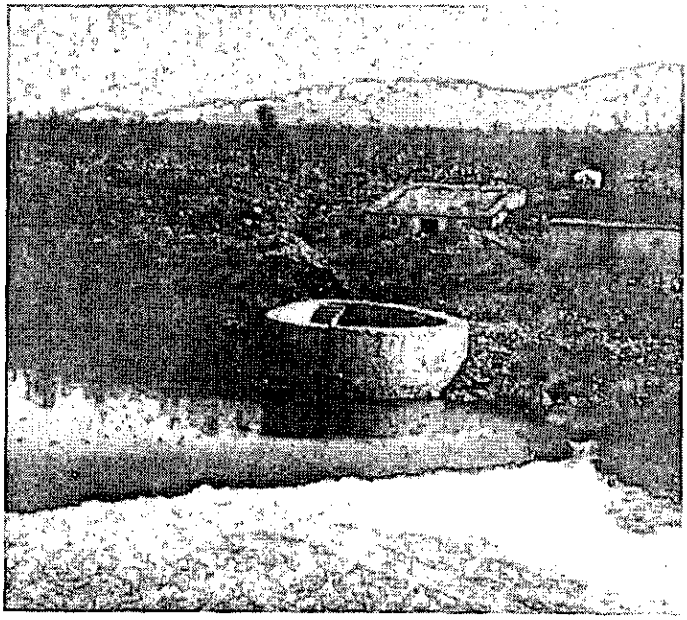


Photo 5. The West Ponor-mill, from an un-dated photograph in Trebinje Museum.
Zapadni Ponor-Mlin na nedatiranoj fotografiji u trebinjskom muzeju

It is interesting to compare this old view in Photo 5. with the present situation as given in photos 3. and 4.

Milanović (1979, 1981) published a view of the West Ponor-mill in his classic publication *Karst Hydrology*. Although no date was given for the photograph, it was clearly taken **before** the lining of the Trebišnjica Riverbed with concrete and long after the ponor-mill had fallen into disuse. The 1981 English Language Edition of this publication gave a much better quality image. Interestingly, it showed a complete absence of tree and bush growth inside the structure.

A further view of the West Ponor Mill was published by Bonacci (1987), obviously showing the same structure some time after Milanović had recorded it. There is now an indication of the invasion of trees and bushes inside the structure. Božičević (1992) offers an even later view in full colour, showing the concrete-lined riverbed of the Trebišnjica.

Milanović, in a personal communication, also states that along Popovo Polje, more than 20 ponor-mills were still operational after World War 2. Petrović and Kovačina have actually counted at least 50 disused structures in this Polje. The final demise of the ponor-mills was due to the construction of modern bulk-processing flour mills.

Cultural Heritage

Certain of the ponor-mills such as the Drapića Ponor-mill were also localised centres of cultural activity and were the focal point of "market days", holidays and for times of celebration for the villagers of the isolated communities on the karst. Petrović and Kovačina (1984) have also discovered that they were the secret meeting places for partizans in World War 2.

We can confirm that the Drapića Ponor-mill was also used by the Bosnian Serb militia in the recent Bosnian War.

GENERAL CONDITION OF THE PONOR-MILL STUCTURES

This is analysed in great detail on the Society's Website. There is growing cause for concern at the worsening condition of both mills, which were supposed to have been preserved after the concreting of the Trebišnjica Riverbed. We should be grateful that the ponor-mills were not destroyed during this operation but they are both now greatly suffering from neglect and the structural damage caused by tree and bush growth within ihe ponor-mill.

Tree growth in particular is dislodging major parts of the masonry and causing collapse of the stone construction in both ponor-mills. The Drapića Ponor-miil is also suffering as a refuse dump.

The West Ponor-miil structure is still in good enough condition to raise the possibility that it could be made to operate again. The Drapića Ponor-mill is not operable without considerable work beforehand. In both mills, the Turbines would have to be replaced as would all the other wooden structures. In both cases, the outer cylindrical walls are in good condition and would need minor attention.

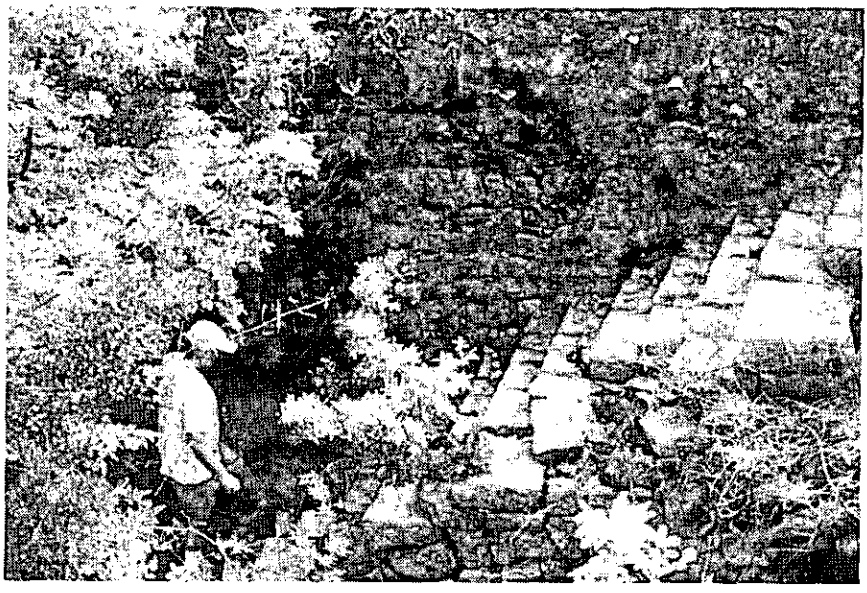


Photo 6. Interior view of the West Ponor-mill, showing the spiral stone staircase, tree growth and the damage to the masonry from the tree growth.
Unutrašnjost Zapadnog Pomor-mlina sa spiralnim stepeništem, drvenim rastinjem i oštećenjima

(Photo by M. Hardman, August 2000.)

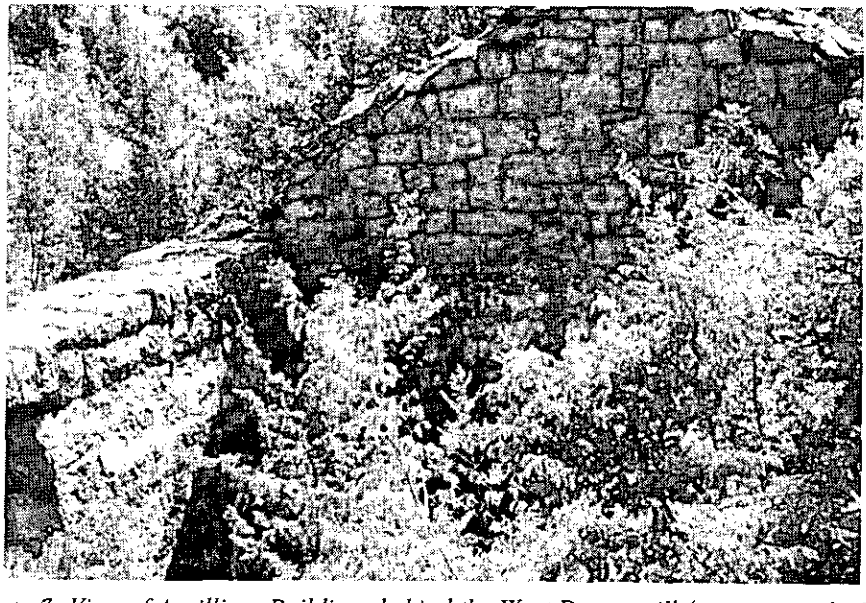


Photo 7. View of Ancilliary Buildings behind the West Ponor-mill (compare with photo 5. above)
Pogled na pomoćnu zgradu iza Zapadnog Ponor-mlina (uporedi sa fortofrafijom br. 5)

(Phofo by M. Hardman, August 2000.)

As for the ancilliary outbuildings, those belonging to the West Ponor-mill would need re-roofing and internal refurbishment. Those belonging to the Drapića Ponor-mill would need similar treatment except for one, which seems to be occupied.

SPELEOLOGY – THE PONOR-MILL CAVE SYSTEMS

The ponor cave systems are supposed to have been thoroughly investigated before the concreting of the Trebišnjica Riverbed. We have been unable to locate any surveys of these caves and we are unable to identify their names.

The West Ponor-mill Cave System

This ponor has seemingly two caves which are still accessible through the base of the Ponor- mill structure.

Access is gained by entering the Turbine Chamber beneath the mill-stone plafform.

i) By turning to the right, access is gained to a neo-horizontal cave system of several hundred metres in length, declining at an approximate angle of 45°. The cave is well decorated and in very good condition, with very little evidence of pollution. There are several small sections of cave passage and some large chambers. We noticed that someone had been using explosives in the bottom of this part of the ponor system.

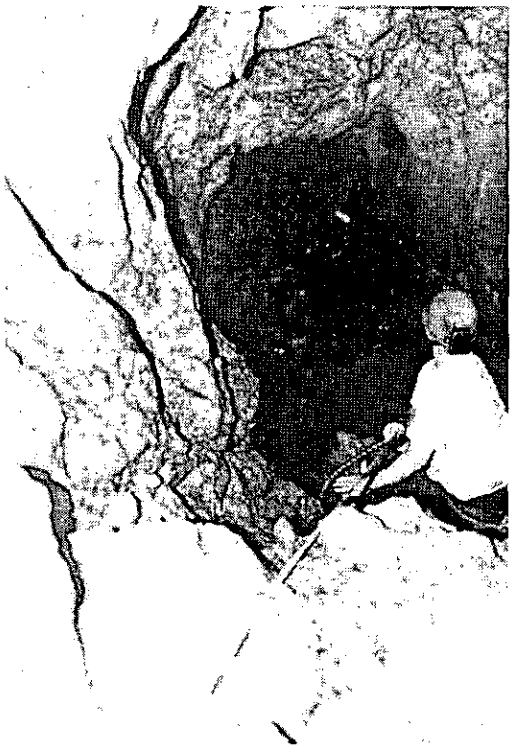


Photo 8.

The author seen entering the neo-vertical ponor cave system below the West Ponor-mill.
Autor gleda ulaz subvertikalnog ponorskog pećinskog sistema ispod Zapadnog Ponor-mlina

(Photo by M. Hardman, August 2000.)

We took note of the presence of the endemic fauna *Apfelbeckia hessei* and one representative of the species of bat (šišmiš), *Rhinolophus euryale*, both of which were captured on film and as digital images. There was no evidence of any water in this part of the ponor cave system.

ii) By turning diagonally left when first entering the Turbine Chamber, access is gained to neovertical ponor cave system of enormous dimensions. We were not able to reach the bottom of this vertical system due to a lack of equipment. There was no evidence of any pollution. Again, we did not observe any water, although there is a good chance of water being found somewhere in this part of the system. We are also sure that the two separate cave passages are hydrologically connected at depth.



Photo 9.

The author using a handline to descend the first free-climbable 17m drop at the beginning of the West Ponor-mill cave system.
Autor je koristio struk za spuštanje niz 17 m pad na početku pećinskog sistema Zapadnog Ponor-mlina

(Photo by M. Hardman, August 2000.)

The Drapića Ponor-mill Cave System

This was also accessible via the Turbine Chamber undemeath the mill-stone platform. Unlike the other ponor-mill caves, this was awash with water immediately upon entering it. A lack of time prevented further exploration. We observed that there were military ammunition boxes scattered around.

This is a possible *Proteus* and *Niphargus* Habitat.

THE PROJECT

Fundamentally, the Project is centred around the future protection of the Ponor-mill structures, which in themselves are important historical, scieniific and cultural monuments, which co-incidentally offer access to specific ponor cave systems of the karst underground of EasternHerzegovina. As such, and by virtue of their relatively isolated position in the Trebinjska Šuma, they are actual or potential habitat sites for the many endangered species of endemic karst underground fauna.

Failurc to protect the ponor-mill structures from deterioration will also threaten future access to the ponor caves, by virtue of the fact that the ponor-mill structures will eventually collapse into the ponor caves and block them.

Having initially identified this situation in August–September 2000, the next stage of the Project is to intervene and pro-actively become engaged in arresting this deteriorating situation, whilst simultaneously persuading others in the local community to become involved on an on-going basis.

In respect of this Project, our proposals for August–September 2001 are:

a) Through our relationship with the Director of the Hidroelektrane na Trebišnjici Company in Trebinje (HET) and other Company Officers, we intend to explore the Company records for all possible information relating to ownership of the Ponor-mills at Dobromani and elsewhere, as well as searching for any other relevant information;

b) To trawl through the HET Archives for surveys of all relevant ponor-caves;

c) Using the formal support we have already gained from the BiH Embassy Consular Staff in London, we propose to meet with the Local Authorities in Trebinje to gain their support on an on-going basis for this and other Projects we are undertaking in their area of jurisdiction and to try to link up with any relevant nature protection and karst conservation organizations in the area;

d) To try again to locate and engage with local speleologists and karstologists outside the HET. There is reputed to be a speleological group in Začula;

e) Using a translator, we intend to locate and question the actual or former owners of the ponor-mills, with a view to extracting historical data;

f) To investigate the Ponor-mill Cave Systems as Habitats;

g) To seek permission to remove all tree and bush growth which is threatening the Ponor-mill structures;

h) To locate and investigate the third ponor-mill and ponor cave system at Dobromani.

With the current severe socio-economic problems prevailing in this part of Bosnia & Herzegovina, nature conservation is not necessarily a high priority. However, as I have previously stated in my General Introduction, the Dinaric Karst itself could become the economic salvation of the State, if someone in Government only had the forward vision to realize it. We, for our part, will make our contribution now and we can only hope to impact positively and lastingly upon the consciousness of those in Authority whose concern these matters should be.

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