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2010 EXPEDITION TO THE KAMENO-MORE REGION, MONTENEGRO: FURTHER EXPLORATION IN CAVE PIŠTET 4

by

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ABSTRACT

A summary is presented of a second multi-club expedition to the Kameno-More region, 'Sea of Rock', of Montenegro to continue exploration of Pištet 4 and resolve questions that remained from the 2009 expedition. In 2009 a short, muddy pitch at the base of impressive mud banks approximately 20 m high marked the limit of exploration although a large chamber appeared visible ahead. The 2010 expedition successfully reached that chamber, which mostly comprised a significant sand dune approximately 50 m x 20 m in a large collecting chamber with a side stream passage leading to three pitches and a second smaller sand dune chamber ending in a sump.

INTRODUCTION

Following the original discovery and exploratory work commenced in 1999 (Božovic, 2004) and subsequent exploration in 2000, 2004 and 2009 (Binding, 2010) a 13 person team spent two weeks revisiting and pushing the cave known as PT4. The team comprised U. Akšamović, D. Appleing, T. Baker, C. Backhouse, C. Binding, M. Bottomley, J. Duxbury, F. Hartley, C. Smith, J. Stephens, P. Taylor, M. Tringham and R. Weare.

In total, six days were spent underground, rigging, exploring, surveying, photographing and filming, and significant discoveries were made, culminating at a sump at a depth of -455 m).

The outstanding aims of the 2009 expedition, namely to push the cave to a conclusion, complete the surveying work and gain some representative photographic records of the cave were all completed satisfactorily. The sump, while serving as an end point, is not the end of the cave as it is a reasonable supposition that a large subterranean river exists as with a resurgence flood flow rate approaching 500 m^3/s (Milanovic, 2007) and a remaining additional depth potential of over 250 m to resurgence level, the indications are that further significant prospects for discovery are good.

DISCUSSION

The cave known as PT4 is located in the Presjeka region, overlooking Boka Kotorska bay and the seaside town of Risan, nearby the village of Velji Pištet. It lies in an uninhabited karst valley, speleologically unexplored prior to 1999, and is the wettest place in Europe with an average annual precipitation in excess of 4,500 mm/m^2 (http://en.wikipedia.org/wiki/Crkvice Binding, 2010). For a location map, see Binding (2010).

PT4 is an impressive cascading pit leading to areas of considerable breakdown followed by a deeply incised, yet minor, streamway, with a boulder collapse chamber en route. This chamber is possibly the result of a section of roof fracturing from seismic events (Milanovic, 2001). A second area of very muddy boulders at the approach to a large collection

Figure 1. *Pištet 4 Entrance pitch.*
Photo. M. Tringham.

chamber with an impressive sand dune as the main feature, the walls of which have mud deposits over 20 m up their sides; testifies to the depth of water during times of significant flooding. However no evidence of recent flooding from the surface, such as vegetation detritus etc. was seen.

A small stream runs into a side tunnel leading off from the lower edge of the sand dune and opens, after a pool, to a clean-washed split pitch, waterfall gullies and a secondary smaller, yet still impressive, sand dune collection chamber where the stream ends at a sump at a depth of -455 m, placing PT4 as the 7th deepest known cave in Montenegro (Binding, 2010).

The vertical shafts en route to the main sand dune chamber are semi-fossil inlets for surface water. This was demonstrated during the exceptionally wet conditions experienced by the 2009 expedition (Binding, 2010).

In the course of the 2010 expedition, the weather was particularly dry and hot with no rainfall during the two weeks. Surface temperatures were routinely in excess of 35ºC. It is worth noting that the discoveries made during 2010 may therefore be of cave passage that might otherwise be impassable in poor weather conditions and thus these merit a cautious approach until further investigations can confirm or deny this.

DESCRIPTION OF THE 2010 DISCOVERIES

From the end point of 2009 expedition, (the undescended 15 m pitch), rapid progress was made on the second day of rigging. The mud trench pitch was rigged from available natural belays, to regain the narrow entrenched streamway that soon opened between impressive boulders to the base of a sandy slope, more akin to a sand dune, being in the region of 50 m long, and reaching a height of approximately 30 m.

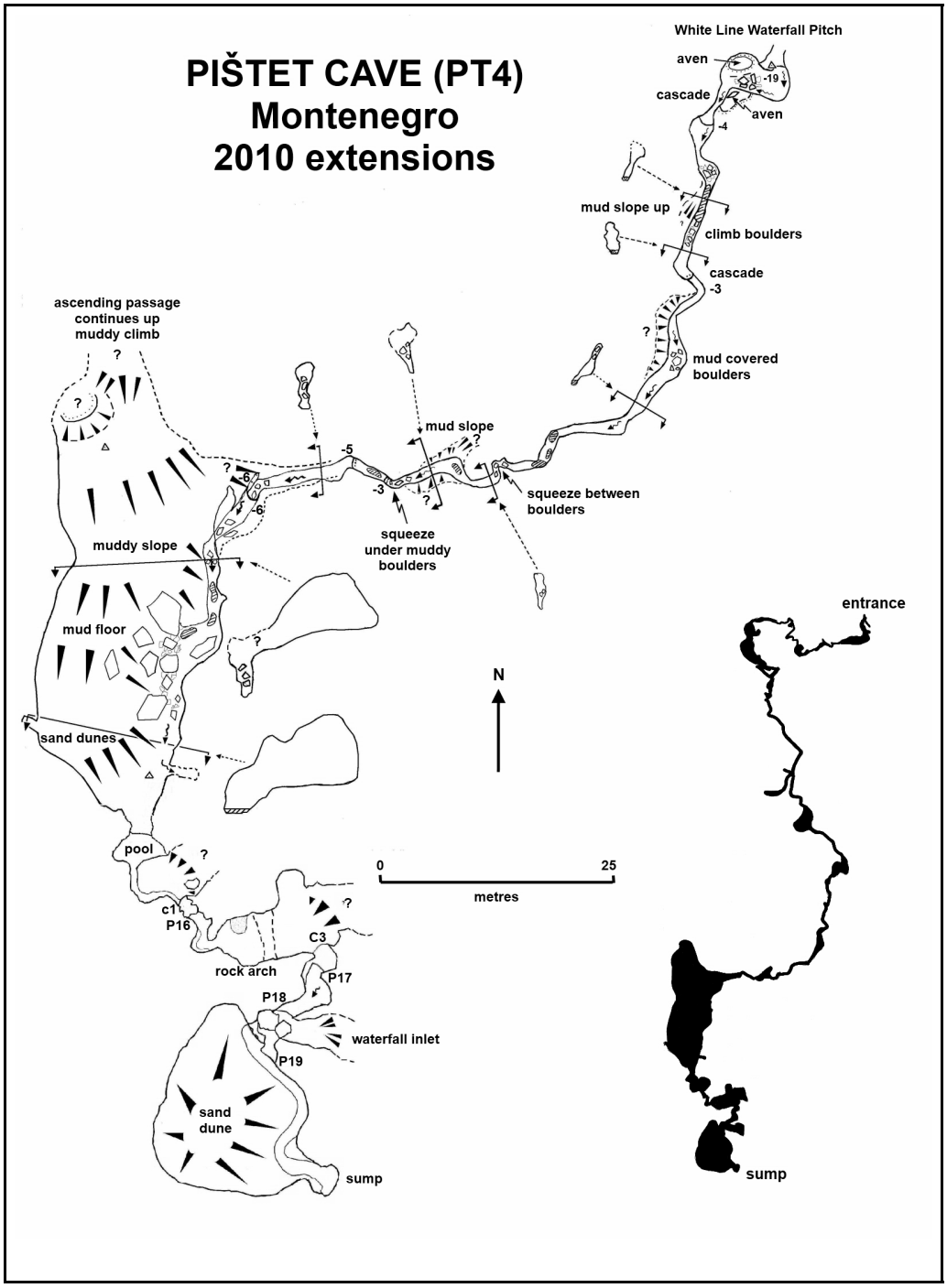

Figure 2. *Plan survey of Pištet 4*.

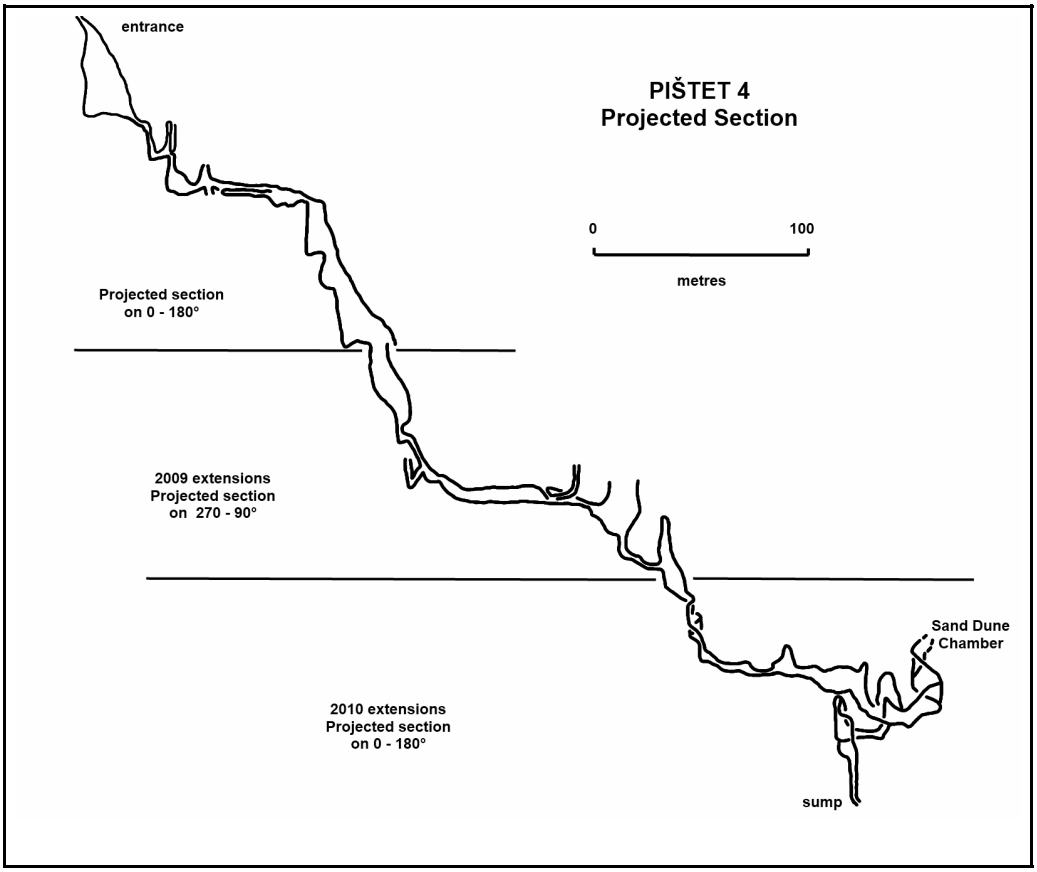

Figure 3. *Projected section of Pištet 4*.

The eponymous Sand Dune Chamber may be a large settling tank with various high level inlets augmenting the streamway but with only a single low-roofed outlet (Figure 5). This would restrict the outflow rate, resulting in the deposition of sand in the central section and the finer mud sediments coating the walls. Alternatively, given the hypothesised link to a major river passage at a greater depth, it may be that the dunes have been deposited by flood waters rising from below under pressure. This latter mechanism would produce a 'dune' opposite its point of entry, where it is, whereas the former would tend to produce more horizontally bedded deposits. However evidence from scallop orientation is equivocal as to whether the principal flow direction is from below or above.

The upslope end of the Sand Dune Chamber was too steep to climb and the sand deposits changed to sheer thick dry mud, thwarting attempts to scale it.

Back at stream level, a low side passage quickly led to a chest-deep pool and a 7 m pitch that then opened to a further series of clean-washed pitches, named Waterfall Series, respectively 11 m, 18 m and 10 m deep, the last one with distinct characteristics of a major wet weather inlet, descending to another, smaller (c.15 m x 20 m) sand dune collection chamber

where the stream following the wall quickly led to a sump. En route there are various unclimbed roof voids and the slight draught remains a constant feature throughout the cave, suggestive of continuing passage.

Figure 4. *Part of the c.50 m long dune in the main Sand Dune Chamber*.
Photo. Chris Backhouse.

CONCLUSIONS AND FUTURE WORK

The returning 2010 PT4 expedition was successful in all its primary objectives, namely extending the cave, completing the survey and obtaining comprehensive photographic records. PT4's surveyed depth to the sump, is -455 m and the cool air/draught continues throughout the cave to the current termination point suggesting that a bypass exists, perhaps at a higher level, and that the cave is therefore eminently worthy of further exploration. The predicted significant streamway that PT4 was hoped to intercept still remains to be found with the cave approximately 230 m above sea level (Duxbury and Binding, 2010). The known cave retains hallmarks of simply being a feeder to a larger collector and the expectation is that significant passage, both upstream and downstream, remains undiscovered, therefore a two

pronged approach for a future expedition should include diving the sump and bolting the nearby avens, in search of bypasses and higher level continuations.

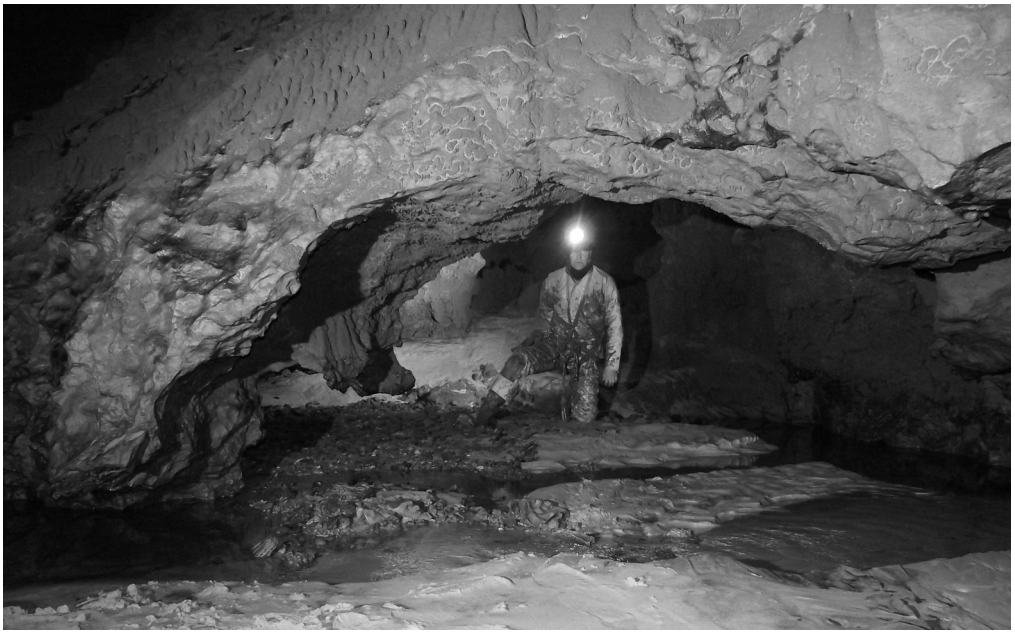

Figure 5. *Side stream passage off the main Sand Dune Chamber*.
Photo. Dave Appleing.

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