

Preliminary Report – April 2011

Mulu Caves 2011 was the 19th Anglo-Sarawak Expedition to Gunung Mulu National Park and operated in the field between 15th February and 30th March 2011. The expedition based itself at National Park headquarters for the first two weeks before moving up to a base at Camp 5 for the remaining month. The team was led by Tim Allen and included a total of seventeen members from the UK, together with a number of participants from our hosts at Sarawak Forestry. The expedition was further assisted by National Park Management, staff and local people.

The expedition undertook some ambitious technical objectives which included a 3D laser scan and panoramic photograph of Sarawak Chamber, radio location of underground passages, geodetic GPS locations and exploration of new passages and increasing the length of the Clearwater System. The scientific programme continues in the laboratory and analysis of samples collected during 2009 and 2010 is on going. However, no further scientific work or sample collection took place on this expedition.

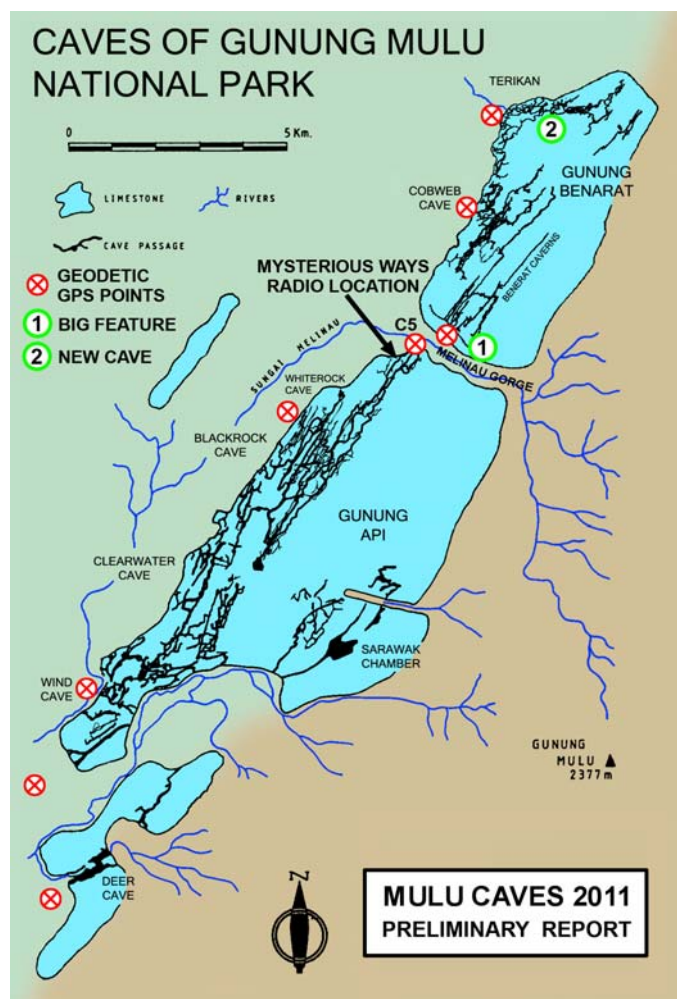
The Mulu Caves Project is very pleased that all the major objectives were successfully completed.

Laser Scanning

Three years ago Kevin Dixon began making plans to make a laser scan of Sarawak Chamber and create a 3D model of the world's largest chamber. When he teamed up with the Mulu Caves Project in 2011 this ambition soon became a reality.

Before the team committed to the Sarawak Chamber scans, trials were carried out in the more accessible Deer Cave. The concern was that in the moisture laden atmosphere of the tropics the laser pulses would not penetrate the large distances involved. In the end the scanner worked well, reaching distances of up to half a kilometre. So successful were the Deer Cave trial and Sarawak Chamber scans, that time allowed scans of Deer Cave to be made from end to end. This may considerably help Deer Cave's claim to be the largest cave passage in the world.

The Sarawak Chamber scans took place over a four day camp. A total of nine scan stations were used and 13 million points



measured. This work will allow exact measurements to be calculated once post expedition processing work is completed, although scanning has already revealed the existence of a near perfect dome in the upper portion of the chamber. This should be of interest to structural geologists and engineers who like to draw inspiration from the natural world.



Laser scanning in Sarawak Chamber. Photo © Robbie Shone

This additional work includes processing each individual laser scan into a common coordinate system to produce one master dataset for each cave. A 3D surface can then be calculated to fit each dataset. This surface will allow the calculation of a volume and the creation of cross sections which can be further analysed for their area, thus determining the location of the largest cave passage or chamber section. The two models will be compared with available digital terrain models to determine the distance from the surface to the cave features. In order to put into context the tremendous size of Deer Cave and Sarawak Chamber, comparisons will be made with 3D models available for globally well known structures.

Photography and the big picture

While the scanning work was taking place it seemed an obvious opportunity to take a new photograph of the world's largest chamber. Photographer Robbie Shone decided that a panoramic shot of the great chamber would capture the immensity better than previous attempts. The main attempt, using 115 PF300 Megaflash bulbs proved highly successful, with an alternative shot made using just the powerful Scurion caving lights. The image captured the scale of the lower half of the

chamber and it is hoped that this can be used as an 'impact photograph' at the National Park visitor centre.

A similar panoramic image was taken in Deer Cave as preparation for the Sarawak Chamber shot. This has also captured the enormity of the passage. Other photographs were taken during the course of the expedition as normal.

Geodetic GPS

With the assistance of Kevin Dixon, the expedition was able to establish a series of geodetic (dual frequency) GPS locations along the limestone margins between the Terikan Resurgence in the north and Deer Cave entrance in the south. This will enable the project to fix the survey cave model to these points and increase the overall level of accuracy. It is important to note that this method differs significantly from normal hand held GPS devices as it has certainty of accuracy to within a decimetre when a full range of satellites are visible.



Setting up the GPS in a testing location at the Terikan Resurgence. Photo © Robbie Shone.

The locations used (north to south) were; Terikan resurgence, Cobweb Cave entrance, Benarat Caverns upper entrance, Camp 5, Whiterock Midnight entrance, Wind Cave resurgence, National Park HQ and Deer Cave helipad. Accuracy ranged between 0.02m at Camp 5, and 1.09m at the Terikan resurgence which had significant tree cover. Further post expedition work is required to make full use of this data.



Radio location fixed point

Radio location equipment was taken out to Mulu with the specific objective of locating 'Mysterious Ways', a high level passage which ended close to the surface in the Melinau Gorge. The aim was to increase the accuracy of the survey cave model at the northern end of the system, specifically in relation to surface features.

The underground equipment uses a magnetic field which introduces a current into the ground and can be detected as a magnetic field again once the current reaches the surface. By using an antenna, the 'null point' can be located directly over the underground beacon. Further calculations, using surface distances and the angle of magnetic flux, can be made to give a depth below the surface and hence the location of the underground passage.

The co-ordinated effort required the use of Hey Phone communications and an underground team camped in the far reaches of Whiterock Cave. The null point was soon found, only 50m from the Pinnacles' track, and the depth established 38m below this point. Once the field calculations had been made and tied to the survey model it was confirmed that the surface Melinau River was 70m higher than the underground Whiterock River. This is a fascinating phenomenon, and one that should excite karst geomorphologists studying in the area. The other advantage of this exercise is that it better confirmed the position of all the northern passages and this assisted the team in the search for a northern entrance to the system.

New exploration

The expedition was successful in finding significant new passages. Most of these were discovered in Whiterock Cave and increased the length of the Clearwater System from 11th to 8th longest cave in the world. In total, the expedition surveyed 15,157m of new passage of which 13,365m was located in Whiterock Cave. In addition, a new cave was found in Northern Benarat and another cave surveyed higher up the Melinau Gorge on the Gunung Api side.

Expedition Total		15,157.25
Whiterock total after 2009	67,041.96	
Whiterock current total		80,407.07
Clearwater total after 2009	175,706.46	
Clearwater current total		189,071.57
Clearwater System World Ranking		8th

In Whiterock, over 5km of cave passage was discovered off the Whiterock River, including an extension to the downstream river of 1.8km, making the Whiterock River by far the longest section of open river passage in the National Park. From Pointless Junction in the north to the southerly terminal sump is an unbroken conduit **5.1km** long.

Over 3km of passage was discovered running parallel to Firecracker in the lowest level of the cave. This included passages below 'Out of Africa' which ran all the way to the 'Racer Series' in



A cracked mud floor in Zahara Dessert, a new passage running parallel to Firecracker. Photo © Robbie Shone

Blackrock Cave. Another 2km was a surprise discovery off 'Lemon Squeezy', between the mid and lower levels of the cave.

In southern Whiterock the 'Makita Ramp' was climbed but only revealed a few hundred metres of passage and another connection to 'Janet's Way'. Other leads soon closed down in this area.

In northern Benarat, the Gawai feature was partly investigated and a new cave discovered in the vicinity. The cave was close to 'Blue Moonlight Bay' and appears to be the missing piece between the major trunk route of 'Casting Vote' and 'River of Sound'. Named 'Paradise', the cave was 1192m long.

Also in Benarat, the major cave-like feature in the Melinau Gorge cliffs was investigated. This involved a 500m climb up the ridge and a traverse along the top of the cliffs before a final 150m abseil descent. Unfortunately the feature proved to be an enormous alcove with only a very small cave at its base.

Higher up the Melinau Gorge, 'Red Tip Racer Cave' was explored and surveyed for 556m. Also in this area a small draughting cave was investigated which one day may provide the key to opening a northern entrance to the Clearwater System. In addition, 3.5km of surface survey was made, mostly



between the Pinnacle track radio location point and the doline sinks east of Camp 5, as unsuccessful efforts were made to locate a northern entrance.

In the Melinau Paku Valley an arduous climb up the cliffs gained access to a large entrance first noticed in 1998. Unfortunately, Red Tree Cave choked completely after only 40m.

Underground, some resurvey work was completed between Clearwater 3 and Clearwater 1 in order to check the accuracy of the dataset in that area.

In conclusion, the expedition took on a number of multi-disciplinary tasks and was successful in all of them. New cave was explored and the length of the Clearwater System increased in ranking with the other longest caves of the world. Perhaps the greatest success of the expedition was the diversification into new survey projects, which will provide continuing interest in the jewels of the National Park crown.

Acknowledgements

From Sarawak:

The Chief Minister of Sarawak

The Sarawak State Secretary

The Director of Forests, Sarawak

Protected Areas & Biodiversity Conservation Unit, Sarawak Forestry Corporation

G.Mulu National Park Management & Staff

Local organisers and assistants

Oswald Braken Tisen

Rambli Ahmad

The expedition is very grateful for the support of the following sponsors and organisations.

Leica Geosystems UK

Makita (UK) Ltd

Sealskinz Ltd

Mount Everest Foundation

Buffera Ltd

Scurion

Ghar Parau Foundation

Megaflash Ltd

A full list of acknowledgements will be published in the final report

Contact for further information

Tim Allen

Expedition leader

jndraisey@aol.com

Kevin Dixon

Laser scanning and GPS

kdxn@yahoo.com

Matt Kirby

Cave survey model

mattkirby99@hotmail.com

Robbie Shone

Photography

robbie@shonephotography.com