

Shan Plateau Expedition 2012

Final Report

Compiled by the expedition members, August 2012

Summary

The Shan Plateau Expedition 2012 was a six person three week caving expedition to the Southern and Northern Shan States in Myanmar (Burma). The expedition followed on from two previous expeditions to the Shan region in 2010 and 2011.

The expedition was based in two areas. Initially 10 days were spent based in Ywangan Township in the Southern Shan State close to the Mandalay Division border. A number of small caves were explored, as well as the extensive Kyauk Khaung (Stone Cave). After four days of intensive exploration and surveying this was confirmed as the longest and deepest cave then mapped in Myanmar, at 2,355m in length and 92m vertical range¹. The cave was left ongoing in a number of areas.

In the second phase the expedition moved to Lashio to continue the reconnaissance started in this area in 2011. In particular, it was important to build on the local contacts made during 2011, and therefore obtaining further information from the Immigration Department was the first step to exploration in this region. Unfortunately, local unrest close to Lashio meant that we were unable to revisit the major resurgence cave identified during 2011 and this remains as a major objective for future years when the political situation is likely to be more stable. Instead we were able to map around 867m of cave passage to the south of Lashio, close to the Mandalay Road. Exploration further afield was not possible.

This year the expedition included a zoologist and this provided the opportunity to pay greater attention to the wide range of cave life seen in the dark worlds of the Shan Plateau. In particular the expedition captured three fish from different locations near Ywangan and Lashio and conducted photography both on the captive animals and in situ. It is expected that they are new species. All captured fish were returned to their natural habitats unharmed.

Caving in Myanmar requires both national and local permissions and careful liaison with the local authorities and in some cases monks and monasteries. As in previous years our national permissions were obtained in advanced by Phyo Wai Yar Zar and local permissions were negotiated by our guide Yan Naing. In Ywangan, access was typically straightforward, although we were subject to a night time curfew and had to return to the town before dark. Around Lashio we were fortunate to do any caving as the authorities made exceptions for us to leave the town itself and continue our cave documentation project.

In total the Shan Plateau Expedition 2012 mapped 3.3Km of cave at 6 sites and recorded a further 14 sites of speleological interest.

¹ A subsequent expedition in the Pinlaung region explored Mai Lone Kho to a depth of -160m.

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With Thanks

Myanmar is not always a straightforward place to travel and this expedition would not have been possible without the ongoing help and assistance from Mr Phyo Wai Yar Zar, Managing Director of All Asia Exclusive and vice chair of the Myanmar Tourism Promotion Board. We are also indebted to our guide and translator Yan Naing who worked tirelessly to help us achieve our objectives and also to our driver Dan Oo who always made sure we got there regardless of the state of the roads.

We were also fortunate to receive financial support from the Ghar Parau Foundation. Visiting Myanmar is not a cheap activity and we are therefore extremely grateful for this contribution.

This year we needed to call on the assistance of the medical services in Ywangan Township when Pete Talling accidentally dislodged a boulder which landed on the 4th and 5th toes of his right foot. We are indebted to the excellent care he received from, Dr. Aye Lwin, the Township Medical Officer, and his team. Their professionalism and dedication was second to none and helped to bring a potentially serious situation swiftly under control.

Introduction

Background

This was the third Myanmar Shan Plateau Expedition, following on from the successful reconnaissance trips carried out in 2010 and 2011. This in itself had been facilitated by early preparatory work by Joerg Dreybrodt, which had made key contacts and used these to carry out a short expedition to Southern Myanmar.

This year the expedition was split into two parts, with the first two thirds of the time focused on an area around Ywangan Township. This area, in the north western corner of the Southern Shan State (Figure 1) had originally been identified by the team as having karstic potential during early geological research prior to the 2010 expedition. However, differences in spellings of place names between colonial and current terminology meant that it was not until the expedition in 2011 passed through the area en route to Lashio that both the actual location and real potential were identified and a separate expedition was suggested.

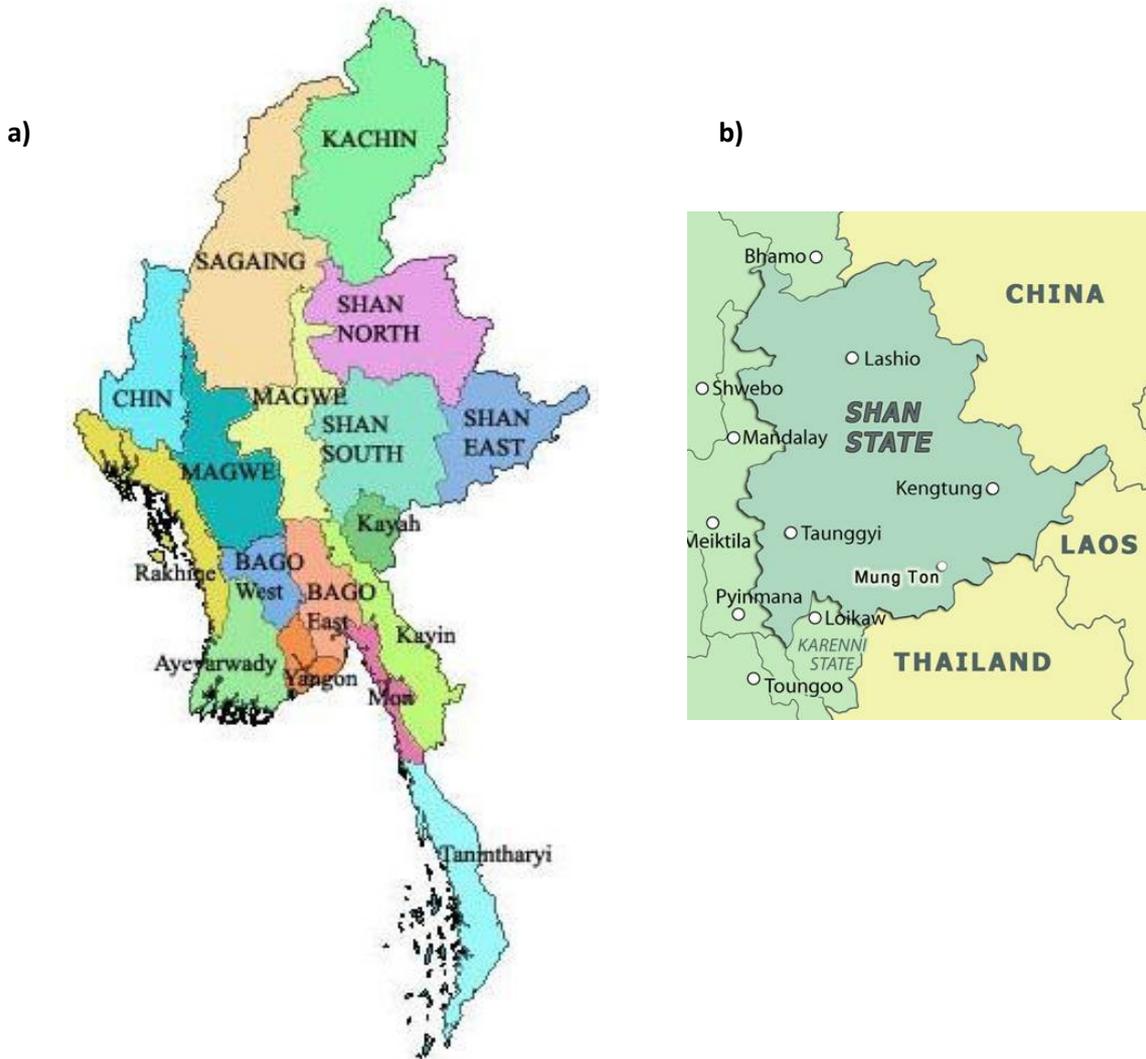
The final third of the expedition was spent in the area around Lashio (Figure 1), capital of the Northern Shan State. This region had been visited briefly at the end of the 2011 expedition, where an important contact with the head of the State Immigration department had been made. In 2011 we had been recommended a cave to us near the village of E-nail. It was a large resurgence cave, but difficult access along poor quality minor roads meant that only one member of the expedition had been able to visit for a short period of time by motorbike. It was the intention in 2012 to return to this area and survey this major cave as well as looking for similar features in the surrounding area.

Permissions

Permissions for the 2012 expedition were obtained at the national level via Mr Phyo Wai Yar Zar, Managing Director of All Asia Exclusive and vice chair of the Myanmar Tourism Promotion Board. Mr Phyo was able to arrange for special permission for the expedition to stay in Ywangan Township, something not normally afforded to foreigners who are required to stay in licenced hotels only. We later discovered that tourist cycles tours do sometimes stay in Ywangan, but with the proviso of passing through and staying for one night only, rather than the facility to base an expedition in the area as we required. Without such special permissions it is clearly impossible to carry out expeditions in these areas and we are grateful to the authorities for facilitating this. Locally, the Immigration department in Ywangan granted permissions day to day with respect to the destinations we wished to visit.

In the Northern Shan State, around Lashio, the State Immigration Department provided advice on areas which were safe to visit. Unfortunately, due to recent unrest in some of the adjoining areas we were more restricted than we had been in 2010 and were unable to revisit the area around E-nail. Normally foreign visitors would be confined to the city only and this was therefore the “end of the road” for tourists. However, despite our tourist visas, we were fortunate to gain special accommodation to continue to visit local caves providing these were located close to the city.

Figure 1 Location of the Shan States; a) Location of the states in Myanmar; b) Area of the Shan States



Travel & Accommodation Logistics

All six expedition members entered Myanmar at Yangon airport having travelled from Britain via Bangkok or directly from China. Internal flights were then taken to Heho, the regional airport which serves the nearby tourist sites around Inle Lake. At Heho the expedition team was met by its guide, Yan Naing, its driver, Dan Oo, and the Mazda pickup truck which was to be our expedition vehicle. We had specifically requested the same support team as in previous expeditions, following their professional and dedicated service to the expedition.

Table 1 Expedition Time Line

Date From	Date To	Comments
24 th Dec 2011		All arrive in Yangon
25 th Dec 2011		Travel to Heho; explore nearby cave before continuing to Ywangan
26 th Dec 2011	4 th Jan 2012	Caving in Ywangan Township
5 th Jan 2012	6 th Jan 2012	Travel to Lashio
7 th Jan 2012		Arranging logistics and permissions in Lashio
8 th Jan 2012	10 th Jan 2012	Exploring caves around Lashio
11 th Jan 2012		Travel to Mandalay
12 th Jan 2012		Travel to Yangon; leave Myanmar

Heho

On route to Ywangan (see below) the expedition made a brief foray to visit a cave near Heho (Area 3 in Figure 2) which had been identified previously by our guide Yan Niang. As this is an “open” area close to the airport, no explicit permissions were required, although we did seek consent from the local village and used a local man as a guide.

Ywangan Township

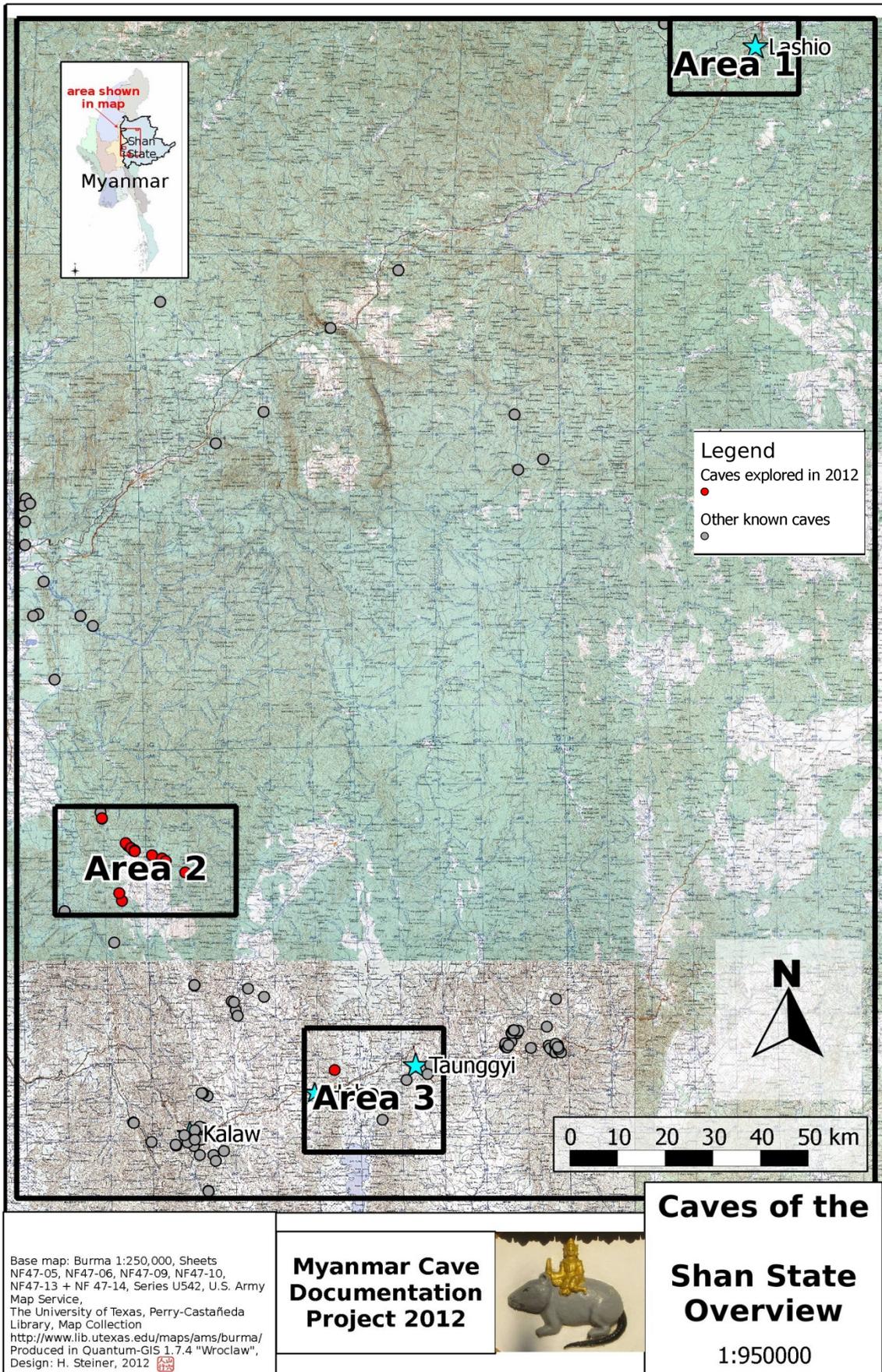
The first phase of the expedition was based in Ywangan Township (Table 1) Area 2 in Figure 2. Although not a restricted area, we required special permission to stay here for an extended period. Local permissions were straightforward and simply required informing the local Immigration officials of our plans for each day and then returning to the town before night fall.

There are no hotels in Ywangan and the expedition stayed in the main guesthouse in the town, a small, but clean and cheerful establishment not far from the main road. Typically the guesthouse catered for those travelling the road from Mandalay to Kalaw, with the occasional addition of passing westerners on cycle tours of the region. We took three rooms in the upstairs of the guesthouse, which in the absence of other guests gave us access to a larger communal room in which we stored our equipment. The guest house did not offer catering, but the town had several excellent restaurants and plenty of noodle and samosa bars for breakfasts. Overall, the logistics in Ywangan were straightforward compared to other areas we have previously visited in Myanmar and it proved to be an excellent expedition base.

The Route to Lashio

Due to constraints related to hospital appointments and some other commitments of our guide, the journey to Lashio was planned to be split into two half days, commencing after lunch on the 5th January with the aim to arrive in Lashio early in the afternoon on the 6th January. In the end we did not arrive until evening on 6th due to consecutive break and tire problems with the truck. This meant a delayed start from Pin Oo Lwin where we had broken the journey and a subsequent roadside delay while a tire inner tube was mended.

Figure 2 Locations of Caves Identified and/or Explored



Lashio Region

We had planned to arrive on Friday afternoon in Lashio (Area 1 in Figure 2) to visit the Immigration department prior to the weekend. Given the delays to our journey we were grateful to be received on Saturday morning instead. While the logistics in Lashio were straightforward – we stayed in a foreigner licensed hotel and made daytrips to the surrounding limestone hills – we were disappointed to be able to visit further afield. The caves which we did visit in this area were all of spiritual significance, having monks living nearby and using the caves as part of their Buddhist practices. Therefore it was necessary to seek permission from these monks to enter and survey the caves. All the monks we met here were exceptionally friendly and hospitable, granting permission without hesitation.

Equipment

Over the three Shan Plateau expeditions we have now built up a supply of rope and rigging gear in Myanmar to allow exploration of small more vertical caves. In Ywangan we encountered more shafts than we have previously in the Hopong Region and the Northern Shan State. However, these were typically less than 40m in depth and were all blocked at the base. Nonetheless, given the relief in this area, and the proximity of the edge of the Shan Plateau to the west and the north, it is possible that more vertical development may be encountered in the future.

Most exploration in Ywangan was carried out in one cave, Kyauk Khaung. Here most progress was horizontal, although a number of small pitches and climbs up in the downstream area did require the use of single rope technique. In addition we regularly used tapes for handlines on smaller climbs. Given the large built up of mud in some areas from the wet season floods, we also discovered that bamboo stakes or stemples provided excellent tools for scaling steep mud banks.

Surveying

All caves were surveyed to BCRA Grade 5 (with the exception of one small cave which was surveyed to a lesser standard) and the entrances logged using GPS. Surveying was by a mixture of traditional (hand held compass and clinometer in combination with a tape measure) methods and digital techniques. The latter used the a “Disto” which allows laser measurement of distances, which particular useful in the larger passages discovered in Kyauk Khaung.

Right: surveying in Lim Nho, near Lashio



Heho

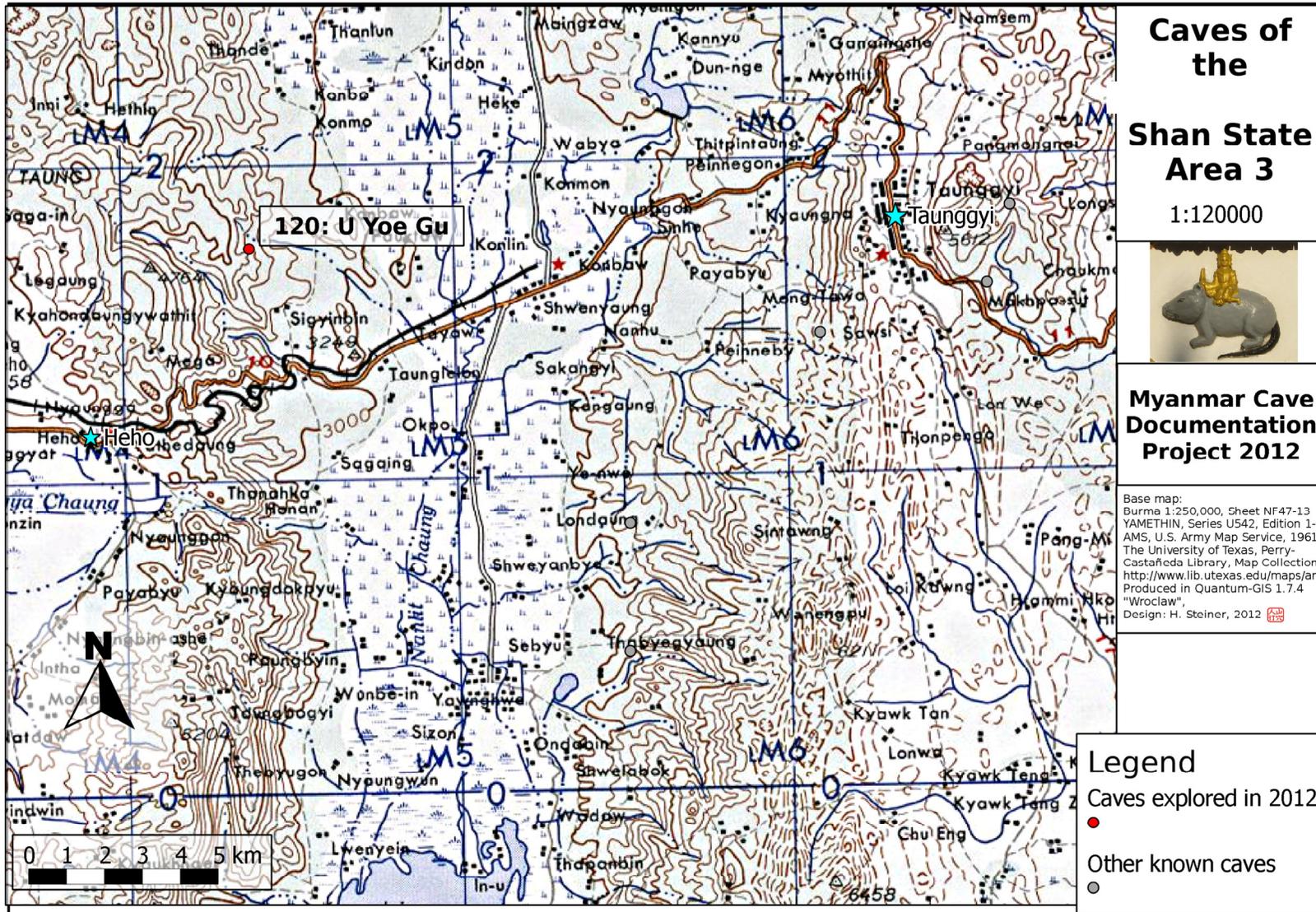
U Yoe Gu

This small cave has been named after the local man U Yoe who acted as a guide to show us the entrance. It is located near Kyauk Te Village, a short drive from the airport at Heho. The entrance is crawling size, but soon opens up into a larger rift. A short pitch (or hard handline climb) is quickly reached which descends to a small chamber and another short pitch. This lands in a larger space, the floor of which contains copious bat guano, the roof of which is an aven. The far side of this space closes down, but close to the base of the pitch a handline descent down a steep slope leads to a body height chimney and a brief grovel to the head of a further drop which was not descended. Due to time constraints (the need to reach Ywangan before night fall) we were not able to survey the cave.



Chris on the hard climb near the entrance of U Yoe Gu

Figure 3 Location of U Yoe Gu



Ywangan Township

Kyauk Khaung (Stone Cave)

The entrance to Kyauk Khaung is a large arch in a limestone cliff into which the Sin Lea (Elephant Whirlpool Creek) flows. It is accessed from the village of Kyauk Ngauk (Stone Bird), being approximately 40 minutes walk down the closed valley from the village.

The river almost immediately flows down a short waterfall and progress is best made by clambering along and down the large mudbanks on the right hand side of the passage as you look down stream. The main river (below) passes around several bends before sumping after approximately 200m. Just before the sump it is possible to climb up to an eyehole, but no way on could be found.



About 100m back from the sump a large highlevel passages, The Catwalk, goes off on the right. Despite being approximately 12m above the streamway The Catwalk, contains large amounts of fresh mud and large flood debris from the monsoon. In this mud, feline paw prints are numerous. The roof of the Catwalk soon rises up into a very large hading rift, the top if which has not been explored. About 100m further on, it is possible to climb up a mudbank to the right and enter Over 18 Series.

Continuing along The Catwalk, the passages becomes lower, crawling in places, but always drafting. After a further 150m a brief flat out section leads immediately to a junction. Right leads to a large chamber from which the stream may be heard but not accessed. It is likely that the far side of the chamber connects through to the area around Enlightenment, but this was not pursued due to a

dangerous slope of mud and boulders. Back at the junction, straight on soon leads to a balcony overlooking the main stream, which flows from left to right.



At the start of the high level sump bypass, The Catwalk

Right Downstream & Enlightenment

The main stream is of noticeably smaller volume and soon splits again at a diffluence. To the right the water sinks into a choke of flood debris. However, shortly back from this it is possible to ascend a large mudbank via The Slayer's Staircase (a line of bamboo stakes) and enter Enlightenment. This huge chamber is effectively a steeply ascending boulder pile, some 60m wide and with 100m vertical range. The boulders can be very loose in places and care must be taken. At the top of Enlightenment the boulders, almost, but not entirely fill to the roof. Here it is possible to crawl between the resulting gap. However, extensive calcite formations make this difficult and stressful. The cave is likely to continue here, but has not been pushed to a conclusion.

The east side of Enlightenment is likely to connect back to the large chamber accessed from The Catwalk. However, as time and the difficult terrain did not allow inspection of all of the wall in Enlightenment this has not been physically verified.

To the west side of Enlightenment it is possible to rig an assisted climb down to connect to the area above the flood debris choke and then enter a small tube. This leads to an undescended 6m pitch.

Left Downstream – The Great Leap Forward

Back at the confluence, the left hand fork of the streamway leads under a low arch to continuing stream passage. This does not last for long, however, as the stream then sinks, and a 3m climb down leads into a dry continuation. 10m further on it is possible to enter an oxbow heading back upstream where a pit allows the last sighting of the streamway.

A further 10m downstream another climb down (~4m) lands in a chamber. The only way out is via a small U-tube which leads to the foot of a climb up to a second chamber. From here further ascent is required, via a very steep mud slope into which steps were cut. As the gradient reduces the climb enters a passage full of boulders, with another climb up and a pitch down. However, ultimately no way on could be found.

Upstream

From the balcony the upstream passage continues for approximately 150m to a junction with an inlet. In these 150m, some of the flow sinks behind a stal boss. At the junction, an inlet comes in from the right. To the left, the main streamway continues unexplored through deep water, but is at this point only 50m from the downstream sump.

The inlet passage, The Road to Mandalay, continues for over 500m to the south west. For the first 150m the “inlet” is actually dry, but then water is finally met cascading down a rocky section before sliding into a rift on the left (true right). Above the climb the stream continues in fine style, past calcite formations and flowstone. Several times the water sinks and reappears. After a short constricted section, walking passage resumes, but remains unexplored.



Fleur sketching at the start of Over 18 Series

Over 18 Series

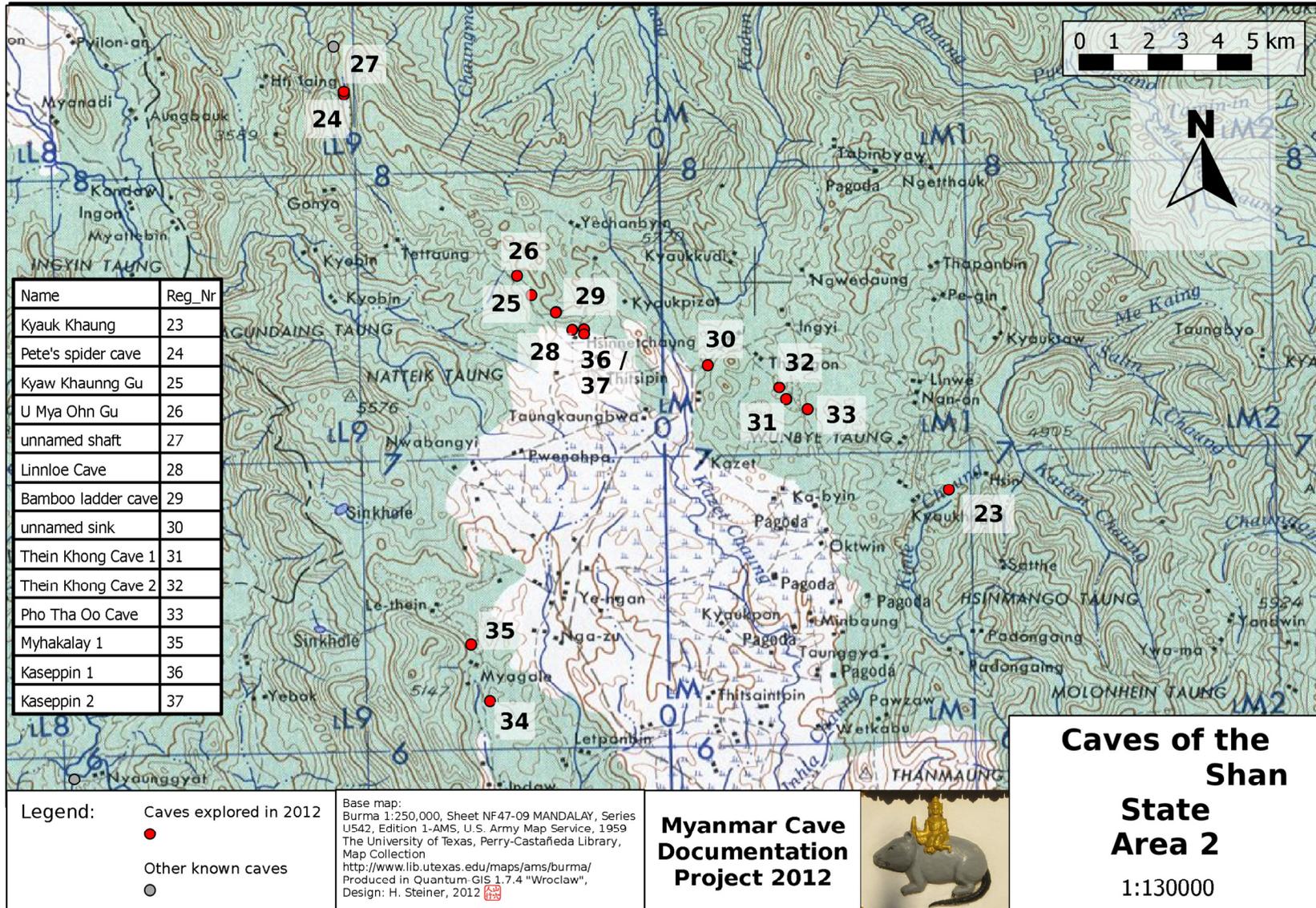
Back in The Catwalk, Over 18 Series is entered by scrambling up a mudbank. To the right, this may connect back to the high hading rift encountered earlier in the Catwalk, although this was not explored. To the left a large beautifully decorated chamber is entered. This leads, on the left, into a wide passage with numerous stal columns and a mud floor. After around 100m a very large junction, Ooo La La, is reached. To the left leads via a smaller section of passage, to the impressive Independence Day. This large passage-chamber contains an untouched mud floor and many columns, other calcite formations, and some idyllic crystal pools. There is no major route out of Independence Day, but a small descending muddy slope was not explored.

Right at Ooo La La leads over large house sized boulders to another beautifully decorated chamber. Climbing down at the eastern end of this chamber, enters a smaller muddy passage, Off the Page. This continues as mainly walking and stooping passage for over 100m and was left at an open drafting crawl.



In Independence Day

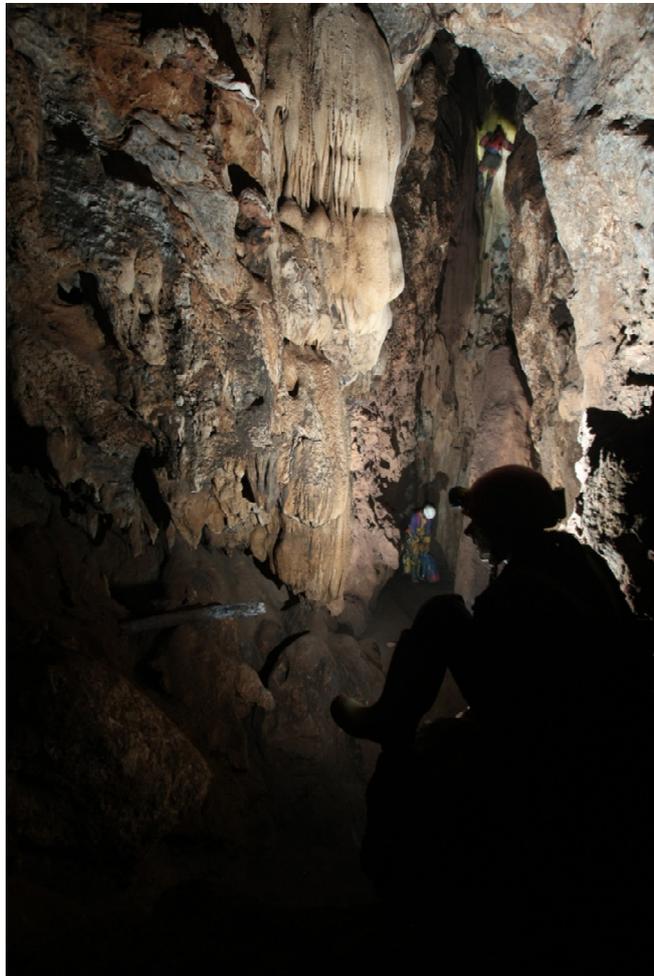
Figure 4 Caves around Ywangan Township



Other Caves Explored

Kyaw Khaung

This entrance is located immediately adjacent to the main road some 10km to the north of Ywangan. It was identified on the first day of exploration (26th December) and at that time descended to a short pitch. The cave was not returned to until the 31st January, when two short pitches were descended to a small mud filled chamber. There was no significant draught and no way on could be determined.



Looking up at the first pitch in Kyaw Khaung

U Mya Ohn Guh

A large rock arch located nearby to Kyaw Khaung. There is no way on due to infill with sediment and substantial flowstone deposits. The features does not have a local name and so has been named after the local women who pointed it out to us.

Pete's Spider Cave

A source of some confusion during the first day of expedition, this cave had been first identified by Pete Talling during our journey to Lashio in 2011. However, it was somehow incorrectly located at this time, because of an unexplained error in the original GPS reading, and was subsequently rediscovered on the 26th December. The cave is a descending tube, which passes down a small climb to reach a low point choked with mud. It is clearly a wet season sink, but provides no way on for cavers. There are abundant "pulsating" or "bouncing" spiders located in the cave in a number of dense "motherships".



The main passage in Pete's Spider Cave

Linnloe Cave (Bat Cave)

We were shown this low arched entrance on route to the "Bamboo ladder cave". After stooping into the cave, the passage enlarges at the head of a large and steep boulder slope. At the base of this initial chamber is a handline climb down to a very large chamber. Just before the climb it is also possible to squirm through boulders on the left to reach a balcony overlooking the chamber. The large chamber can be followed to a further climb down, but as CO₂ levels reached 3% in this area the remainder of the cave was left unexplored.

Bamboo Ladder Cave

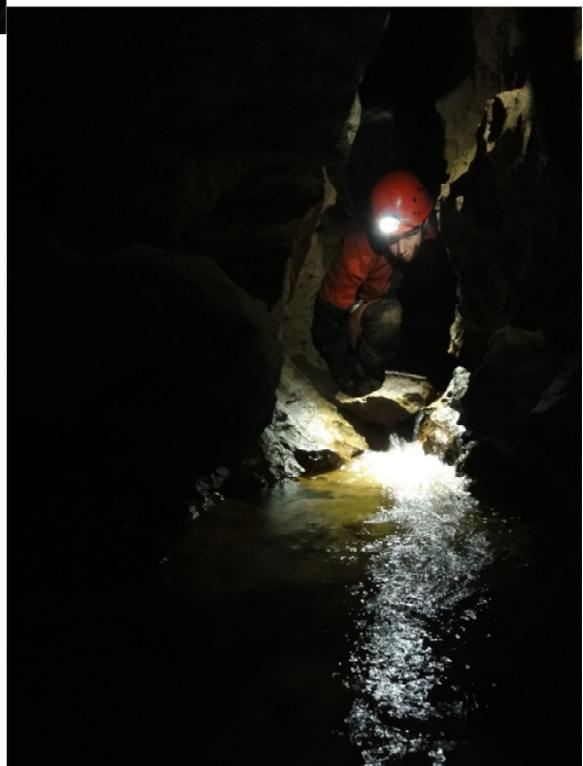
Also known colloquially to the expedition as “1000ft ladder cave”, we had originally been told that this cave had been descended by locals on bamboo ladders, but that they had not reached the bottom. When asked to estimate the depth, the locals suggested 1000ft. Contrary to these suggestions the cave had be bottomed by the locals, and comprised two parallel shafts approximately 30m deep. The two shafts were linked near the base, but we could not repeat the connection without either aid climbing equipment, or perhaps some bamboo ladders.



Descending one of the shafts at Bamboo Ladder Cave

Thein Khong Caves 1 & 2

Close to the village of Thein Khong we were shown two small caves, both shallow, with active water courses which sumped after short distances. Both these caves were claimed to contain white fish, but we only observed fish in cave no. 2. From this cave we sampled a single individual for description and photography; it was returned unharmed to its natural habitat.



Right: The habitat in Thein Khong Cave 2

Pho Tha Oo Cave

A shaft at the base of a ridge near Thein Khong. A sloping descent of approximately 20m is followed by a 15m vertical pitch. This lands in a 5m by 3m choked chamber and there is no way on.

Myhakalay 1

A medium sized stream sink from which the locals extract water. The walk in entrance leads to a chamber and a 3m climb down to another chamber containing a pool. Right hand side of chamber contains loose boulders. A short undescended pitch follows.



The entrance to Myhakalay 1

Myhakalay 2

A descending ramp leads to a short crawl into a low wide chamber. To the right water enters a small pool. To the left is a large pool with active crystal rafts. Substantial spider and fish populations, the latter of which was photographed in situ.

Kaseppin 1

A rift at the bottom of a doline goes off sideways. Due to steep sides and loose rocks equipment would be required to enter.

Kaseppin 2

A 20m blind shaft near the village of Kaseppin. Clearly used as a rubbish dump.

Lashio Region

Khaung Ka I

The settlement at Khaung Ka was inhabited by three monks and two novices. It backed onto some remnant tower karst with a high density of passages. The first cave was entered via some steps down to a door which led into a passage containing an alter. From here, a complex network of interconnecting passages led off, some of which had been dug open. There are also a further 2 entrances to the cave where it interest the hill side. In total the cave was around 200m long and proved to be an important habitat with several different species of spiders and crickets.



By the alter in Khaung Ka I

Khaung Ka II

The second cave at Khaung was shorter, at only 70m in length, but with no less wildlife. In addition to the spiders and crickets, this cave contain moths, a “hairy mary” and a sizeable mammal, though to be a porcupine of some sort. From the stooping entrance a descending drawl/rift leads to the lower level. Right soon ends un a muddy chamber, while to the left it is possible to climb up to a chamber with a narrow passage leading off. This leads to a climb down to cross rift from which their appears to be no way on.

Khaung Ka III

Very short cave not surveyed.

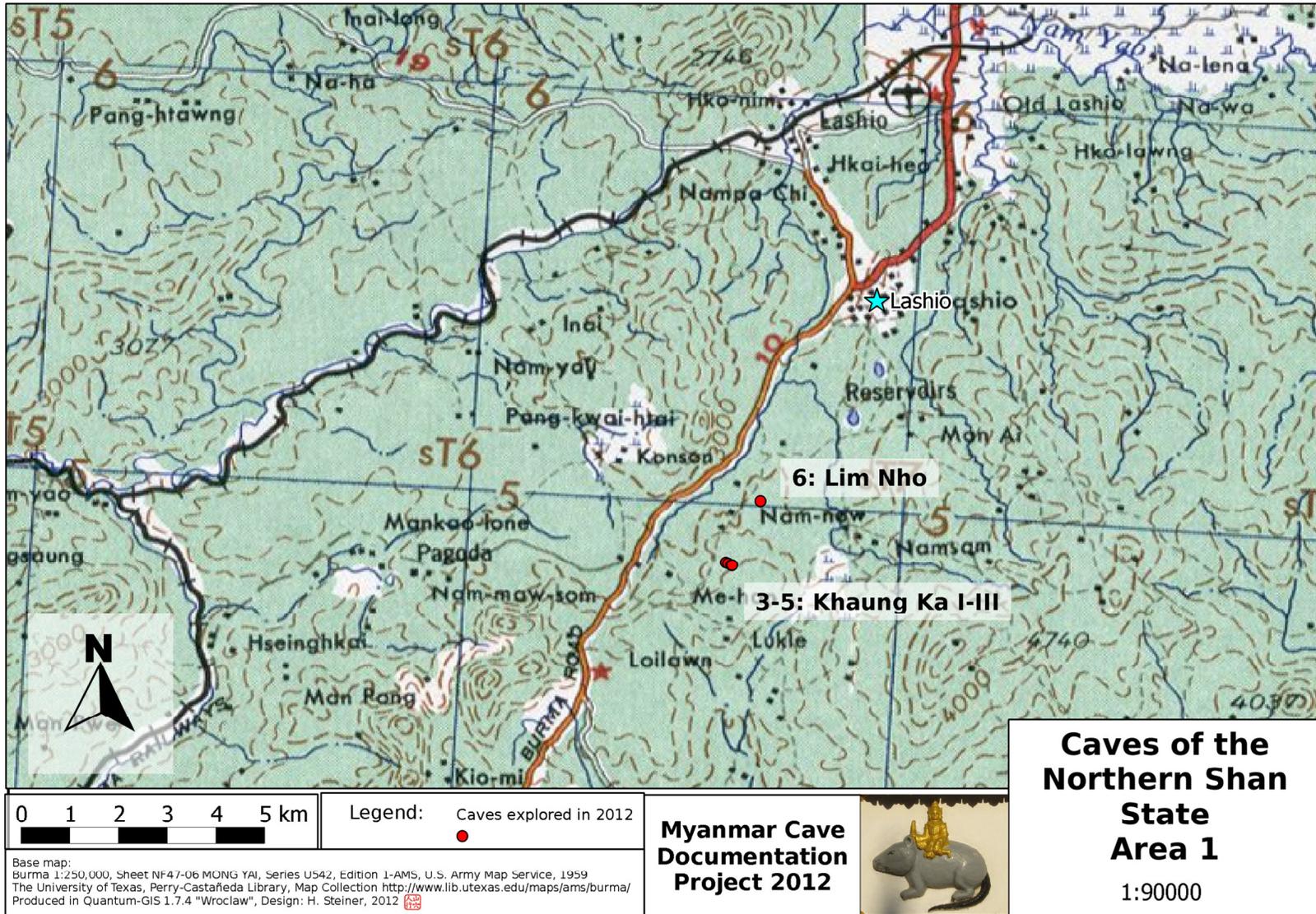
Lim Nho (Bat Cave)

A stream rises and sinks again in the same doline. Downstream the passages continues, mostly as crawling and stooping for around 200m until it finally sumps. The stream contains an abundance of wildlife including shrimps, fish (not cave adapted), crabs and leaches. Upstream from the doline the cave passage is larger and continues for around 400m in total. Initially the streamway is pleasant walking passage with occasional pools. However, it later lowers to a long low duck which was not pushed to a conclusion.



Upstream in Lim Nho

Figure 5 Caves around Lashio



Environment

Geology and Geomorphology

The Permian and Triassic carbonate sequences of Eastern Myanmar are extensive and large tracts of the Shan Plateau are comprised of these sediments (Figure 5). Although the main lithology throughout is limestone, this is often dolomitic rather than calcitic. The stratigraphy and ages of these deposits were uncertain for some time, with the major carbonate units variously referred to as the Plateau Limestone², or the Shan Dolomite Group³, in older publications. More recently, a revised stratigraphic assessment has been made⁴ which divides the carbonates into two main units:

1. The Thitsipin Limestone Formation, named for a type section at Thitsipin village near the township of Ywangan in the Southern Shan State. The Formation comprises five main lithofacies:
 - a. Poorly bedded conglomerate
 - b. Laminated calcareous shale and other fined grained carbonate sediments
 - c. Massive fined grained calcareous sediments
 - d. Thick bedded calcareous sandstone with some calcareous mud
 - e. Massive or poorly bedded cherty wackestone (matrix supported calcareous grains within carbonate mud)

Some sections of the formation are partially dolomitised and comprise fine grained dolomite.

2. The Thitsipine Limestone Formation then passes transitionally upwards into the Nwabangyi Dolomite Formation
 - a. Calcareous conglomerate and sandstone with some carbonate mud.
 - b. Poorly bedded dolomitic wackestone
 - c. Thin bedded dolomitic and bioclastic wackestone
 - d. Thinly laminated turbiditic dolomitic mudstone

The formation often suffers from shattered and brecciation.

² Geological Map of the Socialist Republic of the Union of Burma, Prepared under the auspices of the earth science research division, research policy direction board, Government of the Socialist Republic of the Union of Myanmar, 1:1,000,000 March 1977.

³ Bender, F. (1983) *Geology of Burma*, Gerbruder Borntraeger, Berlin.

⁴ Oo, T., Hlaing, T. & Htay, N. (2002) The Permian of Myanmar, *Journal of Asian Earth Sciences*, 20, 683-689.

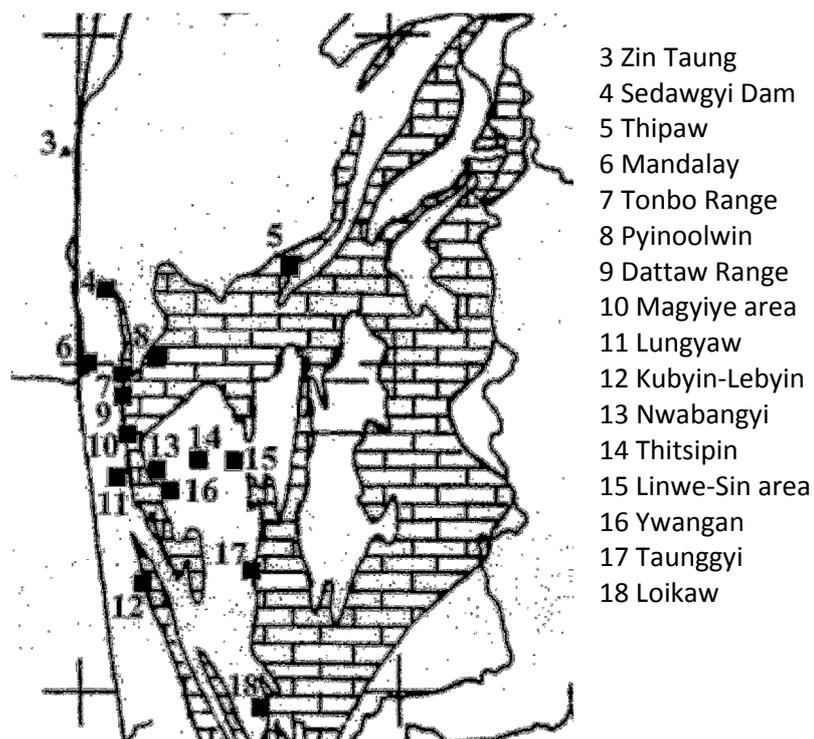
The overlying Triassic limestones tends to be more crystalline and less sandy than the underlying Devonian strata. The younger limestones also contain a greater proportion of calcium carbonate, up to 98%⁵.

The sequence of carbonate rocks is thought to be of considerable thickness, with estimates in the range of 5000ft (approximately 1650m) in the Northern Shan State¹ and up to 1000m in the Southern Shan State⁶.

The presence of these abundant carbonate beds has a major impact on the scenery in the Shan States, leading to “dramatic scarp and ridge scenery and with spectacular karstic features”³. The carbonates that form the Shan Plateau also form a natural geographic break between the elevated and cooler plateau states and the hotter lowlands to the east.

As well as the Permian and Triassic calcareous sediments, less extensive limestones have been deposited at other geological times included the Ordovician, the Jurassic and the Cretaceous-Tertiary. The Jurassic limestones are known to be cave developing and are seen in the caves in Kalaw and the surrounding area.

Figure 6 Extent of the Permian and Triassic Carbonates in Eastern Myanmar



⁵ Chibber, H. L. (1934) *Geology of Burma*, MacMillan and Co Limited, London.

⁶ Robertson Research International Ltd (1997) *Burma, South East Asia Geological Map Series, 1:2,000,000*, with explanatory notes, June 1997.

Observations from Ywangan

The main cave explored during the expedition, Kyauk Khaung, sinks in the Thitsipin limestone. It is not known where the water from the cave resurges, although a closed basin of Quaternary sediments some 5km to the north is one possibility. On the basis of the cave passages explored in Kyauk Khaung the Thitsipin limestone is suitable for well developed karst systems and will be a focus for future expeditions.

From geological maps, the water which feeds Kyauk Khaung appears to rise at a faulted boundary with the older Chaung Magyi Group, a Pre-Cambrian unit comprises sandstones, mudstones, dolomites and green limestones. On first inspection this does not appear to be a highly developed karst formation, but will required future investigation.

The majority of the other caves explored around Ywangan appear to be within the Ordovician Doktoye Limestone Formation and are not so well developed. The exception to this are the entrance near Myhakalay which are believed to be in the Jurassic limestones.

Hydrology and Hydrogeology

Around Heho we saw very little surface water and none underground in the sole cave we visited. It was not clear from the limited time we spent in this area whether it had extensive karst potential.

Ywangan is situated near a seasonal lake. This is reported to fill up following the rainy season but with a slight lag. We interpreted this feature to be similar to the Irish term “turlough” also representing a karstic seasonal lake. However, it is possible that there are superficial quaternary sediments in the fertile basin around Ywangan which complicate the local hydrogeology.

Apart from the aforementioned lake there are few surface water features around Ywangan. As the road from Kalaw to Ywangan ascends the plateau there are some small streambeds which the road crosses. However, we have not traced these nor found resurgences. In a number of small caves we encountered a shallow local water table and it is these caves which appear to be important for the local cave adapted fish species. These areas, due to their shallow water table, do not appear to have extensive large cave passage development, although it is clear that the underlying rocks are karstic.

The large river which enters Kyauk Khaung is known to come from a resurgence although we did not have time to visit this. However, on the whole we saw very few resurgences and none of any size. We do not know where the water from Kyauk Khaung is seen again and this question remains a key one for future expeditions.

The internal drainage within Kyauk Khaung also remains of interest. The main stream, and its inlet in the Road to Mandalay, shows great propensity to split and sink or partially sink on its route downstream. Thus the volume of water at the downstream limit is significantly smaller than that at the cave entrance.



The seasonal lake at Ywangan

Weather

Contrary to previous experience we saw colder and wetter weather in Myanmar this year due to the passage of a significant front through the area at the start of the expedition. It rained for around three days and nights near the beginning of our time at Ywangan. This saw only little influence on the water levels in Kyauk Khaung, although it did have a large impact on the weather the local roads were passable. When the weather conditions were overcast and rainy it was also cooler than on previous visits. Later in the expedition, conditions did become warmer, but only during the day with cooler conditions continued to be experienced at night.

Incident Report

This accident occurred on the 30th December and resulted in a severely squashed and broken little toe on Pete Talling's right foot. The little toe has since made a complete recovery, which is mainly due to the excellent medical treatment received from local villagers immediately after the incident, and then from Dr. Aye Lwin and his colleagues at the Public Hospital in Ywangan Township. Pete would like to record his sincere thanks for their really outstanding efforts and skills.

Pete went into a reasonably large cave with a sinking stream, accompanied by Chris and Liu Hong. Within sight of daylight, a small (~3 m) easy climb was encountered that led to a deep pool, beyond which was a chamber. Chris went down the climb first, and traversed the pool on the left. Pete thought it looked easier to get past the pool on the right. However, he gently pressed on the loose rocks on the side of the pool, dislodging what he rapidly discovered was a large boulder that he could just get his hands around. Unable to push it back, he jumped backwards into the pool. Unfortunately, the boulder landed on his right little toe. He hopped back out to daylight, assisted by Chris and Liu Hong. From above the toe looked bruised if a little floppy. However, from below it was apparent that the toe had split open and there was a large wound.

The villagers in the nearest village, about 300m away, assisted with cleaning the wound with iodine. Pete did not realise how deep the wound was, and handed out Ghar Parau cards to say thank you. Dan then brought the truck, and Pete was driven back to the main village. Fleur, Tim and Lou were chasing fish in another cave at the time, but were summoned back. In the meantime, the local villagers had found a local man who had been a paramedic with the Myanmar Army, and he had with him a well stocked first aid kit. He gave Pete an injection of antibiotics with a new needle, and cleaned and bandaged the toe up very effectively and professionally.

Pete was then driven to the Public Hospital in Ywangan where he immediately received very skilled treatment from Dr Lwin and his staff. They cleaned the wound very thoroughly in the sterile operating theatre, and subsequently took a rudimentary x-ray. Pete then continued to have his wound dressed and cleaned every day, and then every second day, until the team left for Lashio a week later. He obtained some very nice teak crutches from one of the doctor's brothers, and recuperated at the guest house (drawing cave surveys). The standard of care at the Ywangan Public Hospital was outstanding.

The incident caused Pete (assisted by Fleur) to come back directly to the UK, rather than travelling on to China. Back in the UK, an X-ray at Winchester Hospital showed that a piece of bone had actually fallen out of the bottom of the toe. However, the toe has now made a full recovery.

Pete would like to thank all who assisted him after the accident. Apart from avoiding dislodging boulders, the incident stresses the need for cleaning such wounds to avoid infection.

Appendix A: Cave Database & Surveys

Appendix B: Expedition Log

Date	Who	What
24/12/11	All	Arrive in Yangon
25/12/11	All	Fly to Heho, met by guide and driver. Explore and photograph cave near Kyauk Te Village. Named after our guide U Yoe. Drive on to Ywangan.
26/12/11	All	Drive north from Ywangan in search of Pete's cave from 2011. On way visit Kyaw Khaunng Gu and U Mya Ohn Gu. Discover 2011 GPS error and subsequently refind Pete's cave full of spiders 1500m further south than though.
27/12/11	All	Guides take us to the 1000ft bamboo ladder cave. En route we are also shown Linnloe Cave (Bat Cave) but this has elevated CO2 levels.
28/12/11	All	Went to Thein Khon village. Explored two short caves with white fish. Sampled and described a fish. Descended Pho Tha Oo Cave cave.
29/12/11	All	Went to Stone Bird Village (Kyauk Ngauk) and walked to Stone Cave (Kyauk Khaung) where the river sinks. Followed river to sump, but dry overflow channel continues.
30/12/11	All	Went ~10km south from Ywangan towards Satchan, before road becomes too bad for van and turned back to Ywangan. Then went west to Myhakalay Village. Shown a small hole which contained cave fish. Shown (ongoing) cave where boulder bent Pete's toes. Pete evacuated back to village, and then to District Hospital in Ywangan, excellent treatment was much appreciated.
31/12/11	All, except Pete	Back to first cave on 26/12 (Kyaw Khaunng Gu), which choked after two pitches. Then two caves near Kaseppin Village, one undescended, one choked and full of rubbish.
01/01/12	All, except Pete	Returned to Stone Cave and explored the dry overflow channels past much flood debris. Cave left with 3 ongoing leads after a further 300m surveyed. Photographs taken in stream cave section and start of higher level.
02/01/12	All, except Pete	Returned to Stone Cave. CD and LH surveyed the river while FL, TG & LM searched the high level and found and huge chamber.

03/01/12	PT, FL	Hospital visit, survey drawing
03/01/12	LM, TG, LH, CD	Return to Stone Cave. Explore downstream and upstream Beatle Drive (muddy inlet).
04/01/12	All, except Pete	Return to Stone Cave. Explore downstream to conclusion and Over-18 high level series. Discover large series of chambers and leave cave ongoing at draughting crawl.
05/01/12	PT All	Final hospital appointment in Ywangan Travel from Ywangan to Maymo
06/01/12	All	Travel from Maymo to Lashio
07/01/12	All	Visit immigration officials and hospital
08/01/12	All, except PT	Visit Khaung Kha village and map three caves full of spiders. Make initial inspection of Lim Nho caves, sink and resurgence.
08/01/12	All, except PT	Map Lim Nho caves and sample and describe fish.
09/01/12	FL, TG, LM, LH	Vehicular based reconnaissance of areas to south and little east of Lashio
10/01/12	All	Travel to Mandalay
11/01/12	All	Leave Myanmar

Appendix C: Equipment in Myanmar

1 bag of thru-bolts

21 cones

12 spits

Slings: 3m, 8m, 2m, 10m, 2.5m, 3m, 3m, 7m

Ropes: 100m,, 25m, 15m, 70m, 55m

36 hangers

35 maillons

1 surveying tape (50m)

2 snaplinks

3 screwgates

1 bolting hammer

1 bolting driver

1 grappling hook

1 bag of blue string

2 tyre inner tubes