TEN YEARS OF EXPLORATION AND OVER 100 KM OF CAVES SURVEYED IN NORTHERN LAOS

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The karst areas of northern Laos have been systematically investigated by the "Northern Lao-European Cave Project" since 2002. Annual cave expeditions were conducted in eight regions of five different provinces. These regions host a variety of karst landscapes ranging from highly karstified areas to tower karst and high altitude limestone plateaus. Major river caves of several km lengths were found including the Tham Chom Ong System in Oudomxay province. With a length of 17,150 m it is currently the 3rd longest cave of Laos and 10th longest in Southeast Asia. The total length of surveyed passage reached in 2012 was over 103 km with a total of 254 caves. The cooperation with authorities, villages and international development projects proved to be very useful and is one of the main reasons for a variety of research results in cave documentation, ecotourism development, paleoclimate studies and biospeleology.

1. Introduction

The Northern Lao-European Cave Project is an international group of speleologists with the mission of sustainable exploration and documentation of the major caving areas of northern Laos. This is achieved by:

- inviting interested cavers to participate
- fruitful cooperation with the local authorities and international development projects
- including local villagers as scouts and guides
- maintaining good contacts with other active caving groups in Laos
- strictly publishing all results

Apart from the famous tower karst of Vang Vieng, which is a domain of French colleagues and therefore not covered by this article, northern Laos for many years was a blank spot on the caving world map as most speleological activities focused on the Khammouane karst in central Laos. However, in 2000 a Dutch expedition achieved some good discoveries in the Luang Prabang province with 7.4 km of passages surveyed in 16 caves (Eskes et al. 2004).

In February 2002 the German speleologist Joerg Dreybrodt travelled to Laos and visited Luang Prabang as well as the karst regions further north along the Nam Ou river. He visited some caves at the shores of the Nam Ou upstream of Muang Ngoy village. Having established contact with David Eskes, the initiator of the Dutch expedition of 2000, he prepared for a lightweight expedition in 2002, accompanied by Michael Laumanns. Twelve easily accessible caves were surveyed. A follow-up expedition was conducted in 2003/04 reinforced by Helmut Steiner and Wolfgang Zillig. This was the start of annual caving expeditions to northern Laos with participants from various countries and a team continuously increasing in size. A major breakthrough was the 2005 expedition to Phou Khoun (Luang Prabang province) and Vieng Phouka (Luang Nam Tha province) where three long horizontal caves of 2.6, 3.1 and 3.5 km respectively were surveyed within only ten days. After that the average length of surveyed cave passage was typically about 11 km during 15 expedition days. Table 1 shows the ten longest caves in northern Laos. A clear trend showing the discovery of a significant cave each year is apparent. The longest cave found so far is the Tham Chom Ong System (Oudomxay province) with a total length of 17,150 m. It is currently the 10th longest cave in Southeast Asia and the 3rd longest in Laos.

Table 1. The longest caves of northern Laos.

No.	Cave name	Location	Length (m)	Explored
1	Tham Chom Ong	Oudomxay	17,150	2009–2011
2	Tham Na Thong	Oudomxay	5,010	2010
3	Tham Nam Long	Vieng Xai	4,981	2007–2008
4	Tham Nam Lot	Sayabouli	3,560	2011
5	Tham Nam Eng (resurgence)	Vieng Poukha	3,460	2005
6	Tham Nam Eng (fossile)	Vieng Poukha	3,120	2005
7	Tham Nam	Vieng Xai	3,064	2007–2008
8	Tham Seua / Tham Nam Lot	Phou Khoun	2,650	2005
9	Tham Pasat System	Vieng Poukha	2,332	2005–2006
10	Tham Doun Mai	Nong Khiaw	2,090	2012

This article provides an overview of the geo-settings, the visited areas, major caves and exploration results from northern Laos as well as biospeleological studies. Furthermore the attitude of the Lao people to their caves is presented. A conclusion and an outlook on the future activities of the Project conclude this article.

2. Geo-settings

According to Kiernan (2009) little reliable broad-scale geological information is published, the most detailed work being commercially-confidential mapping by overseas mining companies. In northern Laos much of the limestone is of Permian-Carboniferous age but Jurassic limestones occur locally around Luang Prabang. The total carbonate sequence may reach 5,000 m thick but noncarbonate interbeds are common in some areas. The regional situation is complex and the exact extensions of the limestone areas are barely understood. The systematic search for karst features on topographical maps scaled 1:100,000, available from the National Geographical Institute in Vientiane, has proven its usefulness with regard to the location of caves (Steiner, in print). Also literature studies were invaluable. Laumanns (2010) provides the most comprehensive overview on the karst-related geo-settings of Laos.

3. Karst areas

- Four major karst areas are distinguished (see Fig. 1):
- The northwest with Vieng Phouka (Luang Nam Tha province) and Oudomxay province;
- Three distinctive areas in Luang Prabang province, stretching from Nong Khiaw to Phoukhoun;
- Vieng Xai and Vieng Thong in Houaphan province;
- Sayabouli in the extreme west.

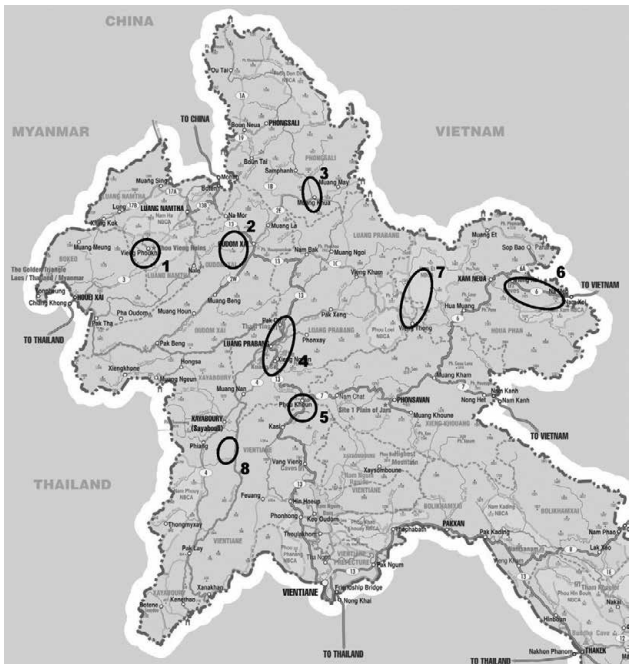

Figure 1. Karst areas of northern Laos covered by this article: 1. Vieng Phouka, 2. Oudomxay, 3.Nong Khiaw, 4. Luang Prabang, 5. Phoukhoun, 6. Vieng Xai, 7. Vieng Thong, 8. Sayabouli.

3.1. Vieng Phouka and Oudomxay

Vieng Phouka and Oudomxay are located in the northeast of Laos on major roads connecting to the important China-Lao border town Boten. The northwest region is highly karstified with the rivers incised into the limestone forming a landscape of valleys with small rivers and low mountains covered by a monsoon forest (Fig. 2).

Figure 2. Typical karst hill between rice fields near Vieng Phouka.

The Project became aware of caves by development projects that promoted rural based ecotourism along the main tourist trail from the Thai border town of Houaysay

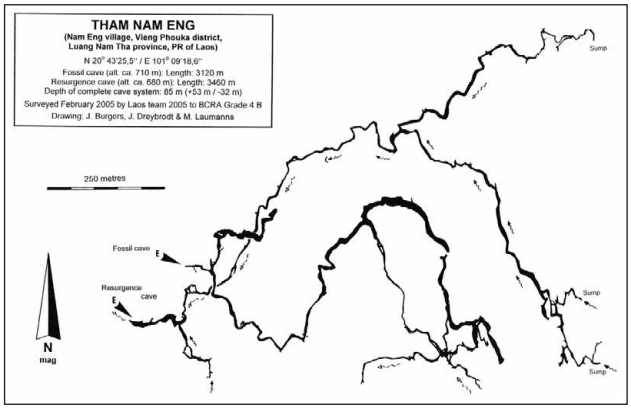

Figure 3. Map of the Nam Eng Caves. The active river cave and fossil cave are overlaying, but not connected.

to the ancient capital of Luang Prabang. Before that the area was not expected to have a significant potential for caves, but now it hosts 5 out of the 10 longest caves of northern Laos. The caves near Vieng Phouka were mainly surveyed in 2005. Most important is Tham Nam Eng with two overlying systems of an active and a fossil level, 3,460 m and 3,120 m in length (Fig. 3). Both cave levels remained unconnected. The 3rd longest system of the area is Tham Pasat 2,332 m in length. It consists of a through cave with a scenic sinkhole entrance and three upper fossil levels with separate entrances connecting via shafts to the active cave level. Three expeditions in 2005, 2006 and 2012 extended Tham Pasat to its current length and discovered several other river caves several hundreds of metres in length blocked by boulders or mud.

Figure 4. Sinkhole entrance of Tham Pasat during the dry season.

The highlight since the Project started in 2002 was the exploration of the Tham Chom Ong System. The provincial tourism office in Oudomxay reported on its website a large cave developed for ecotourism. No end of the cave had been reached by the local villagers. A contact was made and the project was invited to survey the cave in 2009. It was found to stretch along a 4 km long mountain ridge with an underground river and fossil passages with dimensions

20 m wide and 25 m high (Fig. 5 and 6). The cave is a through trip and the whole traverse takes 3.5 hours with an additional 1.5 hours to return from the northern entrance to Chom Ong village. The cave river and the fossil level are connected by steep passages and shafts in places. A large tectonic fault resulted in two huge overlaying chambers measuring 100 m by 30 m in length/width and a height of up to 50 m each. In only 5 days the system was surveyed to a length of 11.3 km. At the last day a connection between the six known entrances was achieved. The cave system was extended until 2011 to its final length of 17,150 m (Fig. 7). Its southern section is now operated as a show cave with LED spotlights and an information display. Visits with overnight stays can be arranged through the tourism office in Oudomxay.

Figure 5. Michael pointing at the inconspicuous limestone ridge hosting the Tham Chom Ong System.

The speleogenesis of Tham Chom Ong appears to be similar to many other caves in northern Laos, especially to those in the Vieng Phouka area, where a strongly developed karst was buried and subsequently uplifted showing many remnants of sediment infillings (breccia) and calcite floors. The latter also occurs in Tham Na Thong, which is located a few kilometres further north. Tham Na Thong is a river cave with a straight passage (10–15 m wide and 25–35 m high) 5 km in length.

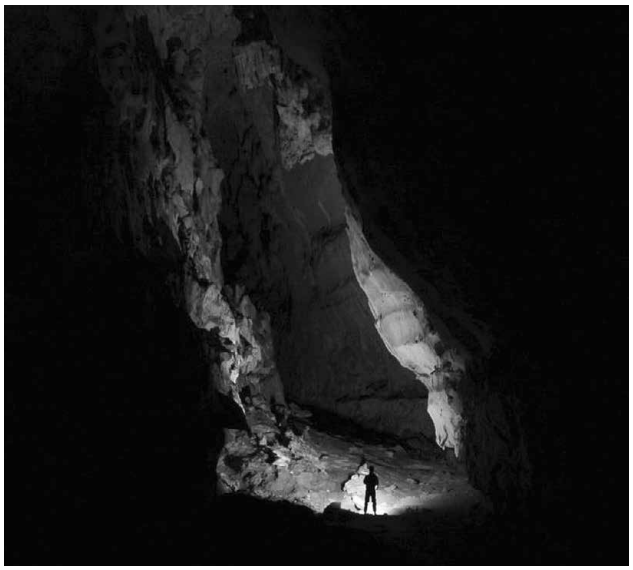

Figure 6. Fossil passage of the Tham Chom Ong System close to the southern entrances.

3.2. Vieng Xai and Vieng Thong

The tower karst area of Vieng Xai in Houaphan province is well known for its historical significance as former headquarters of the ruling communist party (Pathet Lao) during the American Vietnam war (Fig. 8). Consequently, it was the subject of intense air bombing from 1964–1973, forcing about 23,000 people to leave their villages and use the surrounding natural caves as shelters. The caves were enlarged, tunnels were dug, concrete ceilings inserted and caves were used as bank, bakery, hospital, garage, and even as a theatre (Kiernan 2012) (Fig. 9). Its remoteness in the extreme northeast of Laos and its secrecy made the area off limits to foreigners for a long time until the government decided to develop the site as national monument (memorial caves). We succeeded in 2007 to be the first permitted to survey the caves. Beside the historical caves, underground river courses with huge and well-decorated cave passages were found. Many of them are through caves where a river enters a karst hill, resurges and enters the next karst ridge. Within three expeditions in 2007, 2008 and 2012 seventy-four caves were surveyed with over 28.7 km of mapped passages. The region now holds the third and seventh longest cave of northern Laos (Tham Nam Long at 5 km, and Tham Nam at 3.1 km [Fig. 10]). The caves also attracted the media and a film documentary was produced for the French/German TV channel ARTE during the 2008 expedition highlighting a fascinating combination of karst landscape, cave exploration and war time history.

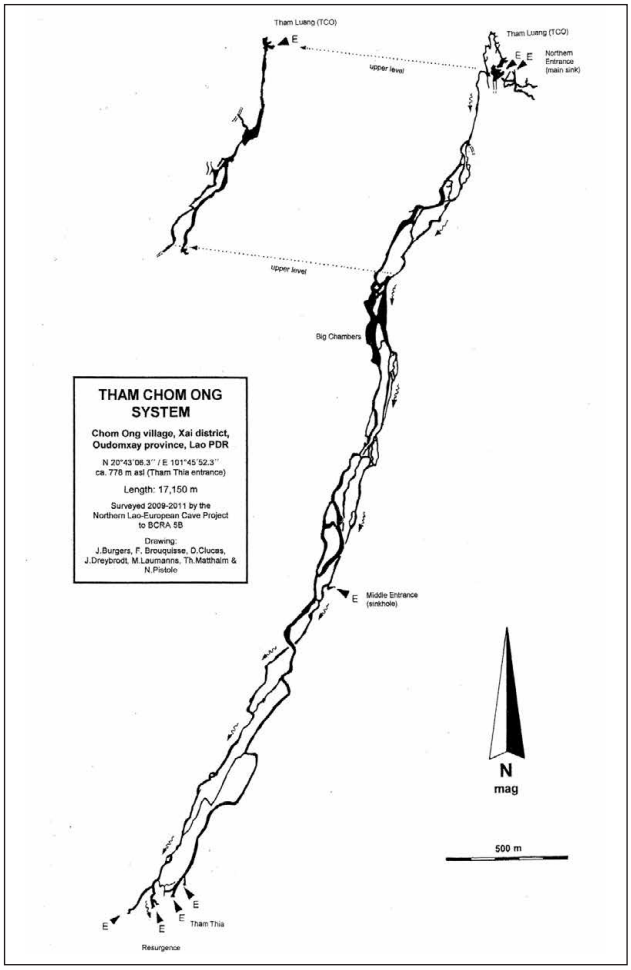

Figure 7. Map of Tham Chom Ong System showing its final length of 17,150 m.

Further west in Houaphan province, the caving area north of Vieng Thong was visited three times, mainly during stop-overs. This region belongs to the Nam Et Phou Louey National Park famous for its tiger preservation project with caves mentioned in a World Wildlife Society report. The area is also known from archeological excavations during colonial times in 1923 (Tham Hang) and more recent times. The road heading north to the Vietnam border was systematically checked and many caves were surveyed, the longest of which is Tham Thia Thong 1,360 m in length and well decorated. Vasile Ersek from Oxford University collected stalagmites for speleothem dating from this cave in order to reconstruct the Quaternary history of the Southeast Asian monsoon (Ersek 2011). Another surprising discovery was Tham Kokai (1,125 m long), featuring a main passage with its floor covered for hundreds of meters by dry rim stone basins filled with calcite pearls.

Figure 8. Scenic tower karst near Vieng Xai.

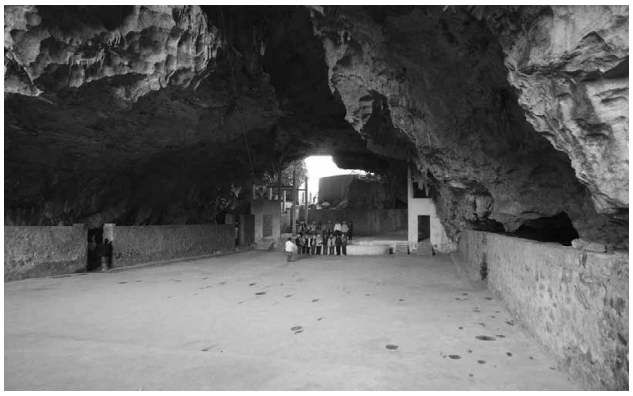

Figure 9. Theatre in Memorial Cave Tham Khamtay

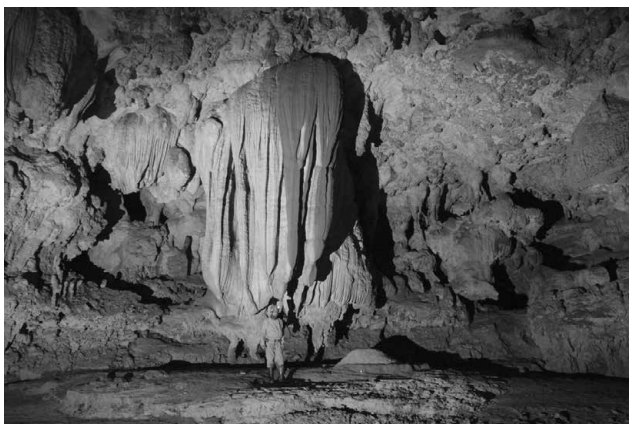

Figure 10. Main passage in Tham Nam Long.

3.3. Luang Prabang

Luang Prabang province of northern Laos resembles a classical karst region. Early travellers reported on their findings from this area, mainly on Pak Ou cave near Luang Prabang city, famous for its thousands of ancient Buddha statues. The first full scale Dutch expedition confirmed good cave potential by mapping 7.4 km of cave passages in the Nong Khiaw area along the Nam Ou river (e.g., Tham Pageo at 1.5 km). The impressive landscape has steep limestone cliffs covered by primary rain forest (Fig. 11). The depth potential is considerable with the elevation of the valley at about 360 m whereas the mountains summit at 1,700 m. The same applies for the table mountains around Luang Prabang where karst ridges stretch over tens of kilometers in a NNE to SSE direction with sparsely populated plateaus. A three week expedition investigated the valleys and the mountains by long walks and overnight stays in villages. One cave of significant length was found on the plateau (Tham Loum, 1.6 km). Most of the other caves are a few hundred meters long, with a depth not exceeding 60 m and they are of various forms including single chambers, short fossil hill-top passages and maze-like systems near river level. The absence of any deep caves still lacks explanation.

The longest currently known cave is Tham Doun Mai (Muang Ngoy, 2,090 m, Fig.12), which is the upstream section of 679 m long Tham Doun from which it is only separated by a ~60 m long undived sump. The 2nd longest is the Tham Seua/Tham Nam Lot System (2.6 km long) near Phoukhoun, a village at the road junction of the highway 13 to Xieng Khouang province. Two other caves 1.2 and 1.3 km in length (Tham Dout and Tham Deu) are located not far towards the east. At the time of exploration in 2007, the area was a stronghold of rebels and was only accessible with a police escort.

Although Luang Prabang province seems to have limited potential for caves it is of great archeological interest. Since 2005 the Middle Mekong Archeological Project (MMAP) from Penn University (USA) has investigated cave entrances based on the published expedition book from 2005.

Figure 11. Karst scenery along the Nam Ou river upstream from Nong Khiaw.

3.4. Sayabouli

This area was only briefly visited in 2011. Like in Oudomxay the project co-operated with the provincial tourism department and a development aid project. The investigations took place around the villages of Ban Keo and Ban Nathang, about 40 km south of Sayabouli town. Within only 5 days about 9.5 km of new passages were mapped, including the 3,650 m long Tham Nam Lot – a through cave with an underground stream and a long semi-fossil extension. The cave potential remains high and also concerns other districts like Khop and Paklai. Interestingly, the deepest cave of Thailand (Tham Pha Pueng, -367 m) borders the Khop district, which indicates depth potential. Regrettably, permission for a return visit to this province has not yet been granted.

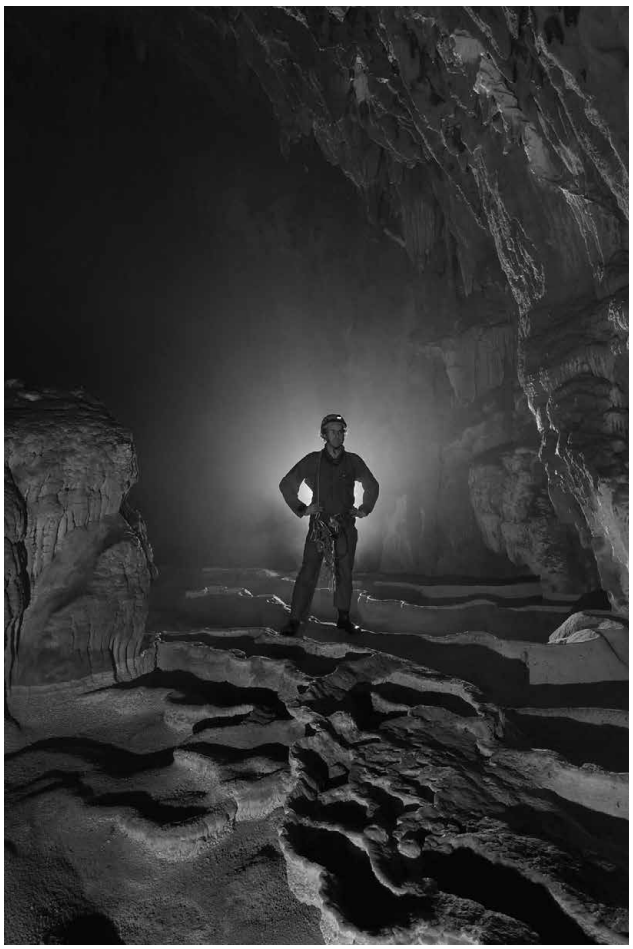

Figure 12. Fossil passage of Tham Doun Mai featuring rimstone basins.

4. Biospeleogy

Surveys of the cave fauna have been an integral part of expeditions from the beginning, because nothing on this topic was previously known. The principal elements are similar for all Laos caves. Cave crickets (*Diestrammena* or closely related genera) of all sizes are found in almost any cave. They most probably feed on fungus growing on guano and other decaying organic material and constitute the main prey of various predators. Other common consumers of organic material and/or its fungi are millipedes and woodlice. Cockroaches occur mainly in caves with substantial guano buildup. A multitude of spiders, opiliones and various insects prey on these. Top predators are the longlegged centipede (*Thereuopoda longicornis*) and the large huntsman spiders (*Heteropoda* spp and *Sinopoda* spp.). Heteropoda show a distinct geographic pattern, the species found in the Northern Laos caves being *H. simplex*, while Vang Vieng and Khammouan caves harbour different species. The more cave adapted *Sinopoda* species are restricted to a single or a few caves. In Northern Laos six different species are found, all only recently described. They include *Sinopoda tham* from the Tham Chom Ong system and *Sinopoda peet* from the recently found Tham Doun Mai.

To date, eleven new species have been described from specimens (see table 2 for Northern Laos).

Much of the collected material is still awaiting classification, thus offering the prospect of more exciting discoveries. Our inventory has to be regarded as being still superficial, and every future collection will greatly add to our understanding of the Lao cave fauna.

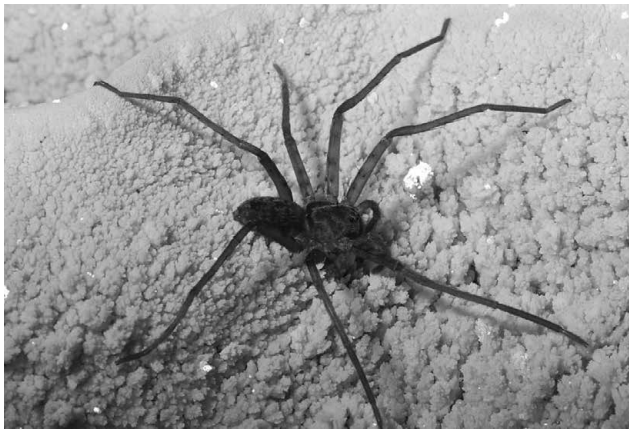

Figure 13. Sinopoda tham, a new species of huntsman spider discovered in Tham Chom Ong.

Table 2. New species from caves of Northern Laos.

Species and Tax.	Province and Caves
Spiders:	
Fam. Psechridae	
Psechrus ancoralis Bayer and Jäger, 2010	Luang Namtha: Tham Nam Eng, Tham Pasat Thia 1&2; Luang Prabang: Tham Seua-Tham Nam Lot; Huaphan: Tham Mue; Oudomxai: Tham Na Thong
Fam. Pholcidae	
Pholcus steineri Huber, 2011	Oudomxai: Tham Chom Ong, Tham Na Thong, Tham Mokfek
Pholcus namou Huber, 2011	Luang Prabang: Tham Muay; Luang Namtha: Tham Roj Ru
Pholcus namkhan Huber, 2011	Luang Prabang: Tham Pha Man
Fam. Sparassidae	
Sinopoda steineri Jäger, 2012	Luang Namtha: Tham Nam Eng
Sinopoda tham Jäger, 2012	Oudomxai: Tham Chom Ong, Tham Na Thong, Tham Mokfek; Luang Namtha: Oung Pra Ngiene; Luang Prabang: Tham Luang
Sinopoda sitkao Jäger, 2012	Luang Prabang: Tham Doun Mai
Sinopoda taa Jäger, 2012	Luang Prabang: Tham Nguen
Sinopoda suang Jäger, 2012	Huaphan: Tham Ho Neung
Sinopoda peet Jäger, 2012	Huaphan: Tham Ma Liong
Diplopoda, Fam. Sinocallipodidae	
Sinocallipus steineri Stoev and Enghoff, 2011	Luang Prabang: Tham Gia

5. Caves and Culture

Caving in Laos involves getting in touch with the local villages and experiencing a diversity of hill tribes and rural life. Caves are often known from fishing in the underground streams or catching bats at the cave entrances. The Hmong minority, who lives high up in the mountains, enter the caves and know them very well. The Khmu, who are peasants, usually know the cave entrances but have a limited understanding of cave extensions. The impact of the American war is easily visible in the heavily bombed regions of Houphan, Xieng Khouang and Luang Prabang provinces. Villagers are very reluctant to disclose information since caves were used as shelters and hiding places. The locals believe in ghosts and bad spirits that influence life. Any visit to such a cave without the permission of the nearby village can have serious consequences for an expedition. Also unexploded ordnance (UXO) might be present and the villagers are the only ones who are aware of potential danger in the field.

6. Conclusion and Outlook

After ten consecutive annual expeditions the Northern Lao – European Cave Project has succeeded in developing an understanding of the major karst areas and caves of northern Laos. The total length of surveyed cave passage exceeded the 100 km mark in 2012 in over 250 caves surveyed, the longest of which is the Tham Chom Ong System with a length of 17.1 km, currently the 10th longest cave of SE Asia. The karst areas are very diverse with morphologies ranging from highly karstified shallow ridges covered by jungle to steep (almost alpine) limestone cliffs and classical tower karst. The longest caves are river caves in shallow ridges partially resembling through caves. A significant depth potential has not yet been realised despite limestone plateaus with over 1,000 m of relief above the known karst springs.

Co-operation with community-based development projects proved to be very sustainable as the knowledge gained by the extensive field work and publication efforts of the project improved the development of ecotourism, stimulated archeological and paleoclimate studies as well as biodiversity capacity-building by the identification of cave fauna.

Although most karst areas of northern Laos were at least partially investigated, the only major untouched province is Xieng Khouang featuring significant karst in its eastern part.

Future work will aim to understand the detailed extent of the karst areas and presence of caves. This will be achieved by small and flexible expedition teams. We are open to cooperation. If you wish to contribute to the project, please contact the authors.

Acknowledgements

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