

# Karst and Cave Conservation in Myanmar

Joerg DREYBRODT, Urs ETTER, Nyi Nyi AUNG, Naw Yuzana WIN & Fleur LOVERIDGE

Myanmar Cave Documentation Project, [joerg.dreybrodt@myanmarcaves.com](mailto:joerg.dreybrodt@myanmarcaves.com), [www.myanmarcaves.com](http://www.myanmarcaves.com)

## Abstract

The karst of Myanmar is one of the most extensive in Southeast Asia. The largest part of this karst is located in Shan Plateau bordered by China, Laos and Thailand. A systematic exploration has been performed by the Myanmar Cave Documentation Project since 2009. Large river caves of 3-10 km length were found. The results were published in books and a database has been established. The biodiversity in this karst area is one of the highest worldwide. Researchers have identified new species of cave geckos, scorpions and blind fish as described in associated publications. This initiated a karst conservation program by the NGO Fauna & Flora International with focus on the Ywangan and Hpa-An karst areas. These sites, and a total of 24 Key Biodiversity areas, were identified for listing in an IUCN database. The Myanmar karst areas also offer significant potential for local tourism. Caves in Ywangan and Kayah State are now the basis for community development as ecotourism sites by NGO and other authorities.

## 1. Introduction

Myanmar contains 80.000 km<sup>2</sup> of karst. This is the second largest karst area in Southeast-Asia after Indonesia (DAY & URICH 2000). Most of this karst is located on the Shan Plateau, with limestone ridges stretching North-South over 1500 km down to its southern extension in the Myeik Archipelago. The limestone is of Carboniferous to Lower Triassic period, with some earlier Ordovician elements, and is underlain by Devonian strata that are up to 2 km thick (OO 2002). The karst and caves of Myanmar are one of the least studied in Asia due to the country's former international isolation and in places poor infrastructure. Most karst is located in mountainous areas, which are controlled by local minority militia. Due to ongoing armed conflicts they are accessible for foreigners only with special government permissions. Only a small number of speleologists and bat researchers had the opportunity to explore Myanmar's karst between 1986 and 2004. Their work indicates great potential for long and deep caves comparable to those in its neighbouring countries. After co-operation had been established with the Myanmar Tourism Promotion Board, the first full-scale expeditions were conducted to the Shan Plateau east of Taunggyi, and the Myanmar Cave Documentation Project (MCDP) was founded. Two years later, the team split into a British and German-Swiss teams to obtain a faster overview of the vast karst area. The British team focused on the North-West and North of the plateau, and the German-Swiss team explored along the main ridge in the southern direction. The network of local partners increased over time with contacts established with NGO, GO and local authorities. This caused a broader research

approach beyond documentation and led multidisciplinary karst and cave training events, which were first conducted in 2017. The core participants have joined multiple annual expeditions, and a karst and cave community has formed with local groups in Yangon, Kalaw, Hpa-An and Mandalay. The MCDP consists of about 50 international members from thirteen countries and has undertaken twenty expeditions since 2009.

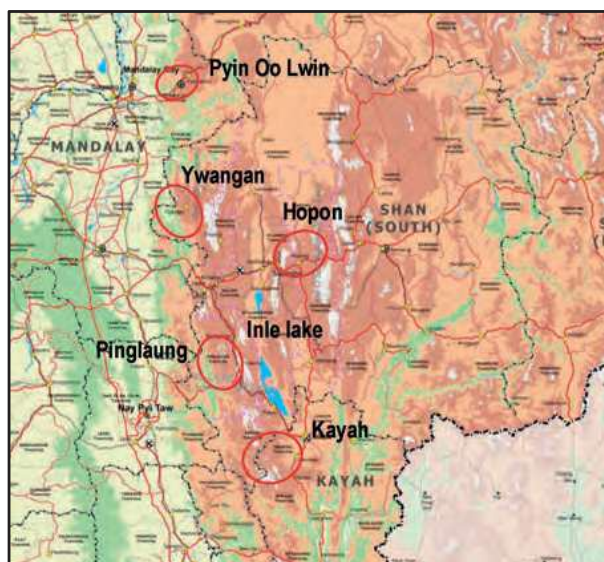


Figure 1: Map of the Shan Plateau and exploration areas

## 2. Karst Areas

Due to the large size (300 km x 500 km) of the Shan Plateau, three times the size of Switzerland, specific areas for exploration had to be prioritized. These areas are mostly located towards the western edge of the plateau near Ywangan, and its southern part within Kayah state. Infrastructure from tourism sites around the Inle Lake, and

a fast developing road network since 2016, made some areas more accessible. The major caving regions are from north to south: a.) Mandalay with Pyin Oo Lwin, b.) Shan State with Ywangan, Hopon & Pinlaung districts, c.) Kayah State and d.) Kayin State with Hpa-An district (Fig. 1). A

selected overview of the major areas relevant to karst conservation is now provided.

#### **Ywangan**

The landscape with large dolines was visited from the British-Myanmar expedition team from 2012-17. The major town is located near a seasonal depression that fills up in the rainy season. This area currently contains the second longest horizontal cave of Myanmar, called Khauk Khaung (Stone Cave), which has a length of 4.9 km length. It contains a sinking river, and its monsoon overflows. Other nearby river caves include the Linwe Sink Systems with 1.9 km and 0.9 km length, which are hydrologically connected to Stone Spring Cave. Ywangan is developing community-based ecotourism within Stone Cave, and Ye Win & Wu Dwin Cave (FFI 2019).



Figure 2: Main passage of Phruno Cave (Phil Bence)

#### **Hopon**

The area of Hopon was visited during 2010-2013 and revisited in 2017 and 2018. It is well known beyond the Shan State as religious site because of Tham Sam Cave. This 1 km long cave has been developed by the local head monk of the Pa-O tribe as a pilgrim destination with concrete pools, snakes, dragons and Buddha statues with extensive modification of its speleothems. The nearby cave cluster at the village Parpant is a small scenic pit karst area with caves of an upper fossil and a lower active level. These caves are

between 500 m and 1300 m long and connected by an underground river.

#### **Kayah**

The karst of Kayah is the core expedition target of the German-Swiss team since 2015. It is a rugged area with limestone ridges covered with hundreds of sinkholes. The presence of suspected long river caves was immediately confirmed. The Hpruso district hosts the Phruno River Cave, which is 4.6 km long, and the third longest cave of Myanmar (Fig. 2). Northward is a scenic karst spring at Demeso that emerges from a lake at the edge of a mountain ridge and flows into the river passing Loikaw town. A large underground network of passages is suspected to drain the Hpruso karst. A systematic hydrological study is a high priority for this karst area.

#### **Hpa-An**

The scenic tower karst of Hpa-An, the extension of the plateau into the lowlands (Fig. 3). The limestone is already eroded into isolated karst hills. Almost every hill hosts a cave; all of them are monastery sites. The entrance areas are decorated with Buddha statues and stupas. The longest cave is Saddan Gu with 800 m length followed by several others of 400 m length. This area was selected by the British Nature Conservation NGO Fauna & Flora International (FFI) as its first karst conservation and fauna research site.



Figure 3: Tower karst of Hpa-An with the Bayin Nyi Cave entrance and monastery (Joerg Dreybrodt)

### 3. Karst Conservation

Indo-Myanmar is a globally recognized biodiversity hotspot that supports many species unique to Southeast Asia (CEPF 2020). At the same time, it is one of the most threatened due to a high population density (TORDOFF *et. al.* 2012). The limestone habitats with caves can be home to uniquely-adapted flora and fauna that have evolved in the special geological, hydrological and associated micro-climatic conditions.

The main mission of the project is the documentation of Myanmar's karst and caves by publishing the results as basis for further studies and research. Results of the MCDP are recorded in a Karst Database with extensive metadata, which contains about 800 karst objects as caves, sinks and

springs with 110 km of cave passages. The surveys from the expeditions are published in three books of the Berliner Hoehlenkundliche Berichte (BHB) in English (LAUMANN 2010; DREYBRODT & LAUMANN 2013; DREYBRODT & LOVERIDGE 2017). They contain cave maps, cave descriptions and detailed access information. The Nature Conservation NGO Fauna & Flora International (FFI) contacted the project in 2013 for support on a Karst Biodiversity Conservation Program (FFI 2014). The karst database from the MCDP and books helped in identifying key focus areas for the FFI project. It efficiently allows expert studies for cave and limestone fauna. The subsequent field campaigns conducted by Frank Bréhier and Neil M. Fury in



2015 investigated invertebrates and bats with focus on the Hpa-An Caves, Stone Cave and the Parpant Cave Cluster. These areas were revisited in 2016 by S. Panha for snails and L. Grismer for amphibians.

The campaigns resulted in discoveries of several new species. The major results include the following: Nineteen new species of bent-toes and dwarf cave geckos (GRISMER et al. 2018) (Fig. 4). Other discoveries are a new scorpion species in Sadan Gu in Hpa-An (LAURENCO 2017), millipede species and beetle species from Stone Cave in Ywangan. Recent findings include new species of snail and a cave fish from Kayah (KOTTELAT & GREGO 2020). These new species confirm the high biodiversity within the caves, requiring immediate measures for the conservation of these habitats. The responsible monasteries in Hpa-An were involved, and cave management guidelines for separating pilgrim from preservation areas were developed. Information boards were erected at the entrances pointing out the ecosystem karst and its sensitivity (Fig. 5 a). The second focus site is Ywangan and Stone Cave, where karst conservation workshops were conducted and guidelines for community based ecotourism are established.

Based on all available fauna data, FFI conducted an analysis for key biodiversity areas following international standards.

#### 4. Karst Education

Knowledge of the karst ecosystem is very poor to non-existent in Myanmar. In 2016, a multidisciplinary approach based on Agenda 2030 of the United Nations was taken as a guiding framework. Partnerships with universities and NGO were founded to share knowledge and to increase the awareness of the vulnerability of the karst ecosystem by pollution. The first important step was the 1<sup>st</sup> Myanmar Cave Training in June 2017 in cooperation with FFI and German Development Agency GIZ, which took place in Parpant (DREYBRODT 2017). Twenty-two participants from several regions in Myanmar were trained in survey and exploration techniques, karst science, hydrology, and fauna identification. They originated from a wide range of

In total, 24 new KBA karst sites (with many of them hosting caves) are in the process of being included into the World Database of Key Biodiversity Areas of the IUCN (CEPF 2020). Hpa-An caves, Stone Cave, Parpant Caves and Phruno Cave are included.



Figure 4: Cave Gecko in a cave on the Shan plateau (Urs Etter)

ministries, local tribes, NGO, CSO, nature lovers and mountaineers. The training resulted in formation of local cave and karst groups that since 2018 participate in the annual expeditions. The joint Myanmar-International teams are now more effective in communication with the local population, and permissions are more easily obtained for further research. The Myanmar Cave groups' core members are regularly included as cave specialists in karst conservation workshops for local governments and civil society organisations in Ywangan and Hpa-An (Fig. 5 b). They contribute also to local ecotourism projects from nature travel agencies with emphasis on conservation.



Figure 5: a.) Karst information board in Hpa-An with the Yangon caving group members (Nyi Nyi Aung), b.) Participants of a Cave conservation workshop in Hpa-An in March 2019 (Nyi Nyi Aung)

## 5. Conclusion & Outlook

As a result of the systematic exploration since 2019, Myanmar is one of the better-documented countries for karst and caves in Southeast-Asia. Three books with detailed cave descriptions are published, and a database with 800 objects and 110 km of cave passages is established and shared with partners. This documentation provides a valuable base for subsequent fauna research, designating Key Biodiversity Areas (KBA) for conservation, and ecotourism resulting from activities around selected caves. Knowledge about karst and caves being developed via Cave Training where core participants organized in local groups and shared their knowledge publicly. The resulting joint Myanmar-International expedition teams are more effective in cooperation with local communities, authorities and institutions.

Future aims are to strengthen karst education activities with local universities and documenting additional unexplored

areas on the vast Shan Plateau. This is guided by the holistic approach of the Sustainable Development Goals (SDGs). The SDGs most relevant for karst are life on land, clean water & sanitation, quality education and creating partnerships with stake holders. Such approach is urgently needed. The opening of the country that started in 2012 with a new foreign investment law, accelerated with the change in government in 2015. This places increased pressure on this karst ecosystem, with one with the highest biodiversity in the world (BHAGWAT *et al.* 2017). Infrastructure and industry are rapidly expanding with a risk of unintended pollution of water resources and biodiversity degradation. Currently Myanmar has one of the lowest percentages (6.7%) of Protected Areas in Asia. Designating sensitive karst areas as Protected Areas would be an important step for karst conservation.

## Acknowledgments

We express our deep gratitude to the numerous Myanmar people who supported our project. These results would have been not achievable without local guides, determined drivers, skilled translators and generous village hosts. The European Union of Speleology (FSE) granted Euro-Speleo Project Status with equipment from AV, Korda's and Scurion. The Ministry of Tourism, Forest Department and Kayah Government supported us with permissions to restricted areas. We thank FFI with CEPF and Helmsley for funding the 1st Myanmar Cave Training, and GIZ for continuous support.

## References

- BHAGWAT T., HESS A., HORNING N., KHAING T., THEIN Z.M., AUNG K.M. *et al.* (2017) *Losing a jewel—Rapid declines in Myanmar's intact forests from 2002-2014*
- CRITICAL ECOSYSTEM PARTNERSHIP FUND (CEPF) (2020) *Ecosystem Profile - Indo-Burma Biodiversity Hotspot 2020 Update*, retrieved from <https://www.cepf.net/our-work/biodiversity-hotspots/indo-burma>
- DREYBRODT J. & LAUMANN M. (2013) *Berliner Hoehlenkundliche Berichte Karst and Caves of Myanmar*, Vol. 51
- DREYBRODT J. & LOVERIDGE F. (2017) *Berliner Hoehlenkundliche Berichte Karst and Caves of Myanmar*, Vol. 75
- DREYBRODT J. (2017) *Myanmar Cave Documentation Project*, Final Report 1st Myanmar Cave Training, July 2017, DOI: 10.13140/RG.2.2.10022.22089
- FFI (2014) *Conserving Myanmar's karst biodiversity*, retrieved from <https://www.fauna-flora.org/projects/conserving-myanmars-karst-biodiversity>
- FFI (2019) *CEPF Final Project Completion Report, Mainstreaming Karst Biodiversity Conservation into Policies, Plans and Business Practices in the Ayeyarwady Basin*, Myanmar, Grant 66332
- GRISMER L. L. , WOOD P. L. JR. & MYINT KYAW THURA (2018), Three more new species of Cyrtodactylus (Squamata: Gekkonidae), *Journal of Natural History* Volume 52, 2018 - Issue 19-20 ,
- KOTTELAT M. & GREGO J. (2020) *Kayahschistura lokalayensis*, a new genus and species of cave fish from Myanmar (Teleostei: Nemacheilidae), *RAFFLES BULLETIN OF ZOOLOGY* Supplement No. 35: 179–185, March 2020.
- LAUMANN M. (2010) *Berliner Hoehlenkundliche Berichte, Karst and Caves of Myanmar*, Vol. 39.
- LOURENÇO W. R. (2017) *A new genus and species of scorpion from Burma [Myanmar]* (Scorpiones: Scorpiones: Scorpiones), Volume 340, Issues 6–7, June–July 2017, Pages 349-357, DOI : 10.1016/j.crv.2017.05.003
- TORDOFF A.W., BALTZER M.C., FELLOWES M.C., PILGRIM M.C. & LANGHAMMER P.F. (2012) Key Biodiversity Areas in the Indo-Burma Hotspot: Process, Progress and Future Directions, *Journal of Threatened Taxa* 4(8):2779-2787, DOI: 10.11609/JoTT.o3000.2779