

Thailand 2001

A caving expedition to NW Thailand planned for April, 2001 and organized by the NYU Cave Biology Research Group (CBRG).

(Coordinated with a parallel expedition led by Mark Cosslett.)

Interests and Challenges of NW Thailand

- **The cave fishes** of the area are truly remarkable. There are two species of hill-stream loaches that have become so well adapted to cave life and so specialized to different niches in the cave, that they are able to coexist. This is unusual for cave fish species in the food limited and highly competitive cave environment. *Cryptotora*, the waterfall climbing fish, is specialized for fast flowing water and is so different from other surface loaches in SE Asia that it was assigned its own genus. *Schistura oedipus*, the other species, has become specialized for slower water within the cave. DNA evidence we have gathered suggests that these are the most ancient cave fish lineages in Thailand, having separated from surface fishes 1.0 to 1.5 million years ago.
- **The Golden Triangle**, the region where Thailand, Burma and Lao border each other, has sustained tides of human movement for centuries. It is rich in ethnic diversity with only a minority of people true Thai. Most of the people of the area are Shan or hill tribesmen of southern Chinese and Burmese origin: Lisu, Lahu, Karen, etc. The area was, and remains, a trunk route of the opium trade. The Mae Hong Son region is still subject to incursion by Burmese bandits and irregulars seeking to harass Karen refugees, and the Thai authorities maintain a constant, vigilant, armed presence.
- **Mysteries remain** from the area's long history of diverse human occupation. One of the most compelling is that of the **ancient teak coffins** found in caves and hillside niches throughout the area. These boat-like coffins, carved from solid logs, have been dated by C₁₄ to between 2200 and 1600 years before present. Little is known about them: who made them, why they were placed in caves, the status of those interred, whether they were primary or secondary burial sites, are all mysteries.

- **Virgin cave passage** remains for the explorer because of the area's relative inaccessibility and because high carbon dioxide levels make some areas impenetrable.

Elements of the expedition

- The **key element of this expedition is a push beyond the CO₂ barrier** to allow scientific exploration in previously unsafe and/or unexplored regions of these caves.
- Penetration of the CO₂ barrier will be accomplished using **newly designed lightweight air scrubbers** based on existing rebreather technology. Thus, the expedition will introduce new technology that will broaden the scope of tropical speleology, as well as accomplish our region-specific scientific objectives.
- *Schistura oedipus* is found in five caves that currently have limited or no underground connections. DNA evidence shows that these populations have diverged from one another over the course of about 100,000 years. Limited observations show that the cave populations differ in color patterns and eye rudiment development. Using the air scrubber technology, we will be able to **study the populations at leisure** and determine the degree of color and eye rudiment divergence. This, combined with the existing DNA data will allow us to **calibrate the rate of cave adaptation and evolution**.
- **White Cliff Cave is the deepest pit cave** in Thailand, with explored passage having over 300 vertical meters. Its full extent is currently unknown, because its lower reaches are guarded by CO₂, and impenetrable. Using the air scrubber technology, we will help the Cosslett team **push this cave and map new passage**.
- **Over thirty caves with evidence of prehistoric occupation** are known from the area. Some of them, like Tham Susa, have entrance halls which still yield new discoveries of potsherds and tools, or coffins and fragments of wood from prehistoric cultures. Tham Susa is particularly interesting because it has episodes of CO₂ that inhibit exploration of otherwise easy horizontal cave passage. Thus, there is the possibility that it might have been entered frequently in prehistoric times and that **undiscovered artifacts await a critical investigation** beyond the CO₂ barrier. We will visit Tham Susa to study *Cryptotora* in its type locality and will spend some time looking for such artifacts on that trip. (Photo of *Cryptotora* at <http://homepages.nyu.edu/~rb4/>)

- As part of a **long range study on the prehistoric peoples of the area**, and in collaboration with researchers at Silpakorn University in Bangkok, **teeth and digit bones** found in the coffin caves on this trip **may be DNA tested** in follow-up laboratory studies (see “Conservation considerations,” below). DNA profiles will be compared to those of samples from the area’s hill tribesmen to help determine the identity of the coffin occupants.

Personnel

- The expedition is organized by **Richard Borowsky**, who heads the Cave Biology Research Group at New York University and is the author of more than forty scientific papers on DNA testing, molecular evolution, and cave fishes. His laboratory has active programs of research on Thai, Brazilian and Mexican cave fishes and numerous international collaborations. He has led nine previous caving expeditions in Thailand and Mexico and carried the flag of The Explorers Club on four of these.
- **Gerry Campbell** will organize and oversee the technical and safety aspects of vertical caving. Campbell is the vertical instructor at the *Vancouver Island Caving Club* (British Columbia), an experienced EMT, and a member of the *BC Cave Rescue Team*. He has a good working knowledge of the Thai language and has accompanied Prof. Borowsky on three previous Thailand expeditions.
- **Alex Baechler** is also from Vancouver Island and is experienced in vertical caving. He is a seasoned outdoorsman with good sense in the field, and was on the previous CBRG expedition to Thailand in March of 2000.
- **Kevin O’Brien** is an experienced caver, cave- and wreck-diver. He is co-publisher of Immersed Magazine and has a technical and practical knowledge of air supply safety.
- **Dave Sutton** is a USN pilot instructor and a diver with extensive experience in the technical and practical aspects of safe air supply. He is experienced in EMT and his extensive field experience includes two seasons in the Antarctic as a survival instructor. He is the designer/builder of the air scrubber units we will use on the trip.
- **The Cosslett Team – Mark Cosslett** is a Canadian explorer who is independently organizing an expedition team with the main goal of pushing the CO₂ barrier for exploration of the deeper pit caves of the area. Cosslett’s team previously explored Tham Pha Puek (White Cliff) to over

300 meters, making it the deepest known cave in Thailand, before being stopped by the CO₂ barrier. The Cosslett team and ours will coordinate activities and cooperate in explorations of the area. Cosslett has worked with Discovery Channel at Eco-Challenges in BC, Australia, Morocco and Argentina. The Cosslett team's plan is online at <http://www.intoadventure.com/Current.htm>.

In Summary:

The expedition has four elements of interest tied together by the novel use of a technology allowing us to visit places formerly inaccessible. These are:

- the scientific study of cave fish evolution
- a search for undiscovered human artifacts
- a push of new cave passage
- the development of a safe method to explore tropical CO₂ caves

Liaisons and Collaborations in Thailand:

- **Rasmi Shooncongdej** is a Professor of Archaeology at Silpakorn University in Bangkok, and the recognized Thai authority on the coffin caves of the Mae Hong Son region. Human artifacts found will be reported to the Thai authorities through her office.
- **Chavalit Vidthayanon**, at the Thai Department of Fisheries, is the recognized authority on the freshwater fishes of Thailand and currently collaborates with Dr. Borowsky on a study of the cave and surface balitorids.
- **Dean Smart** is Cave Management consultant for the Thai Forestry Department and has worked with the CBRG on cave biology projects in Mae Hong Son and throughout Thailand before.

Conservation considerations:

All data collected on fishes will be taken by visual observation, supplemented by video or photographic record. No specimens will be taken for study without release by the appropriate Thai authorities. Any human artifacts discovered will be left *in situ* and reported to the Thai authorities for proper disposition.

Prioritized CBRG Agenda for Thailand, April 2001:

Level 1 –

- Tham Ban Louk Kow Larm – we will sample *S. oedipus* population in this CO₂ pit cave to determine color and UV fluorescence polymorphism. (One day.)
- We will penetrate CO₂ filled passage at the resurgence of Tham Huet, west of Soppong town to look for the presence of *S. oedipus*. If this species occurs here, we will eventually determine whether this population clusters (DNA sequences and coloration) with the geographically close Tham Huet or Tham Ban Nong Pha Cham populations, or with the down-river Tham Nam Lang population at similar altitude. (One day.)
- Tham Nam Lang – the goals here are to sample and characterize the populations of *S. oedipus* near the cave's resurgence, and three km upstream, below Sala Khan Thai. In addition, we will obtain photographs and video of the Sala, which is one of the most spectacularly decorated chambers in any cave. (Two days.)

Level 2 –

- Tham Huet – the goal here is to reenter this cave and study the *S. oedipus* population, at leisure. In the past, all our visits to this cave have been brief, because its passages have high levels of CO₂. A longer stay will allow us to estimate the population size and degree of coloration polymorphism. (One day.)
- Tham Susa – the goals are to study and photograph the *Cryptotora* population in this cave and to look for human artifacts, both beyond the CO₂ barrier. (Two days.)

Level 3 –

- Tham Mae Lana – the goals here are to extend previous visual surveys of the *S. oedipus* and *Cryptotora* populations in its internal tributaries, to obtain better estimates of population sizes for conservation purposes, and to get good video footage of these fishes in their native habitat.