CONE KARST, CAVES, CAVE FAUNA & KARST MANAGEMENT IN SOUTHERN CHINA

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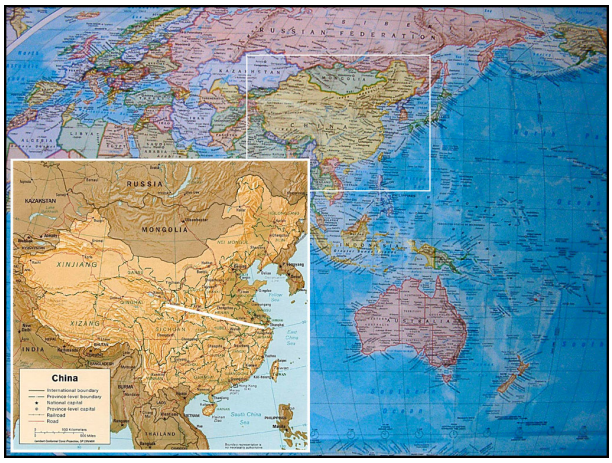

Figure 1: *Map of Asia, Europe and the western Pacific, showing position of China in relation to Australia and New Zealand. Inset map shows the approximate position of the boundary line between the northen Palaeoarctic and southern Oriental biogeographic regions in China. (Source: Australian Geographic wall map; Clarke & Latella, 2001.)*

Introduction

Based on the Microsoft PowerPoint Presentation to the ACKMA Conference at *Wombeyan Caves*, this paper provides some background information on carbonate rock areas and karst in China (Figure 3), reporting observations and experiences from three karst areas in southern China, during October 2000. As shown in Figure 2, these areas were located in two provinces: Guangxi and Zhejiang. Two of the visited areas were in Guangxi Province: in the northeast (Guilin and Yangshuo counties) and the far northwest (Lingyun and Leye) county regions of Guangxi, and the third area was south of Hangzhou, in the central-southern (Tonglu County) region of Zhejiang Province.

I was in China by invitation for two reasons: firstly, as a cave biologist and team member of "Guangxi 2000", the 11th China-Britain expedition to explore and document caves and karst in China, (a continuation of the on-going "China Caves Project").

Secondly, I was there attending the International Show Caves Association (ISCA) symposium for Year 2000, with three other Australian participants: Brian and Sue Clark, plus Nick White. Following the ISCA Symposium held at Tonglu, we Australians were the sole participants in a post-symposium field trip to Guilin and Yangshuo in Guangxi Province.

Carbonate rock distribution, karst classification and karst development

China is well endowed with karst. As the third largest country in the world, the territory of China (Figure 1) covers around 9.5million km²; over a third of this area (3.46million km²) is composed of soluble rocks (Figure 3), an area approximately equal to almost half the size of Australia or Brazil (Clarke & Latella, 2001). Most of these soluble carbonate rock areas in China have confirmed karst with caves reported from almost every province. Widespread in many parts of China, karst occurs in almost the full range of climatic zones within the Palaearctic and Oriental biogeographic regions (Clarke & Latella, 2001); the boundary between these regions is shown in Figure 1. Chen, et. al., (2001) record karst in tropical, sub-tropical, temperate mountain and arid regions of China, but in a more detailed analysis, Yuan (1990) describes five karst environment systems in China classified according to mean annual rainfall and temperature: humid tropical jungle karst; humid sub-tropical stony karst; humid temperate karst; arid and semi-arid karst; arctic and alpine karst.

Figure 2: *Map of China and its provinces showing location of Guangxi and Zhejiang (circled).*

There is only a scattering of karst across the provinces in central and northeastern provinces of China. The more extensive areas of known karst are located in southern and southwest China within the Oriental biogeographical region (Figure 1) and karst is prominent in the provinces of Guangxi, Guizhou and Yunnan, plus Guangdong and Sichuan (Clarke & Latella, 2001).

A comparison of Figures 2 and 3, shows that carbonate rock areas extends westwards from the five mentioned provinces - across the inclined Yunnan-Guizhou plateau - into Tibet, Qinghai and Xinjiang, but the karst potential in these far western areas is unknown. The karst is variable in appearance and geomorphic form.

Tower karst with isolated pockets of cone karst is prevalent in the lowlands of southern China (Figures 4 and 5), then as you go further west and north, there is a predominance of cone karst in mountainous regions (Figures 6 and 7) extending back to the stony karst in eroded plateau regions where there are pockets of pinnacle karst such as the Shilin Stone Forest, east of Kunming (Figures 8 and 9).

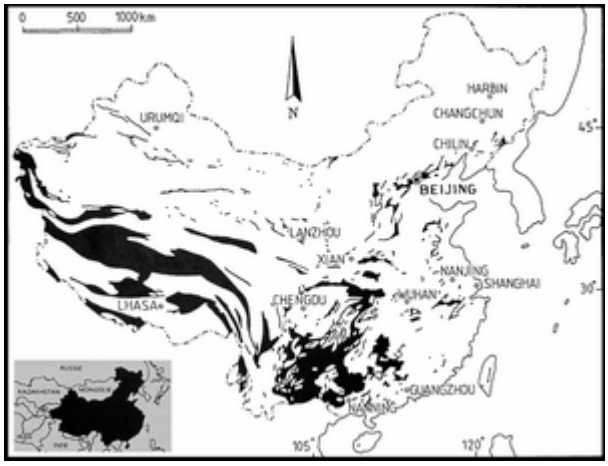

Figure 3: *Distribution of carbonate rock areas in China. (Reproduced with permission from Chen Zhiping et. al.; map originally titled: "Les zones karstiques de Chine".)*

Some further background (or how did I come to be in China?): the exploration and documentation of karst in China (with excerpts from my travel diary)

Britain was one of the first "foreign" countries to become involved in the exploration of caves and karst in China, closely followed within a month or two by a New Zealand expedition.

The English-based China Caves Project commenced in 1985 when Andy Eavis and Tony Waltham lead the first Anglo-Chinese project: a British team exploring tower karst near Guilin in Guangxi Province and a Chinese team (supported by the Guizhou Normal University from Guiyang) exploring plateau karst in Guizhou Province.

The on-going British exploration projects in south China have been mainly hosted by the Institute of Karst Geology in Guilin (part of Guangxi Normal University), who provide "*Letters of Invitation*" and logistical support.

Figure 4: *Tower karst obelisk and cone karst hills reflected in fish farming ponds south of Yangshuo*.

Figure 5: *Three-wheeled "Biscuit-Tin" taxi on countryside road near rice paddies with cone karst backdrop, south of Yangshuo*.

The motivations behind this interest in having foreigners assist in exploration of karst areas of southern China stem from a scientific and economic interest, principally related to hydrology and civil engineering projects (Waltham, 1986) and latterly from increasing demands for more show caves and/or development of karst tourism projects. This is exemplified by the development of *Crown Cave* as a show cave; situated beside the *Li Jiang* (Li River) south of Guilin (Figure 10); the cave was initially explored and surveyed as the *Guanyan Dong* system by the first British team in 1985. Similarly, during our Guangxi 2000 expedition, team members explored the 550metre deep *Dashiwei* tiankeng (a massive cliff-walled doline) in Leye County (Figure 25). Rated as the second largest and deepest doline in the world, *Dashiwei* is being promoted for world heritage listing and developed as a major tourist feature, due to be open for inspection on 1 May 2002. The exploration of caves in China has followed the general principle that cavers are fundamental for land managers to foster an understanding and knowledge of the karst and its potential for development. In addition to the British teams, groups from France, Italy, Japan, New Zealand, Slovenia and USA have been involved in expeditions or consultancies to explore karst regions in China. Separate studies have been undertaken by biologists from Argentina, France, Italy, Japan and USA - studying specific groups of cave animals.

Figure 6: *Cone karst peaks north of Lingyun township in NW Guangxi Province*.

Figure 7: *Small village in flat-floored depression between cone karst peaks north of Lingyun*.

The more recent expeditions to China have also indirectly fallen under the auspices of a series of UNESCO sponsored five-year plans incorporating karst research in China. A number of Chinese bodies have assisted in the management of these five year plans, including various institute sections of the Chinese Academy of Sciences and several universities: notably the Guizhou Normal University in Guiyang and the Guangxi Normal University in Guilin (which includes the Institute of Karst Geology).

Cave biology is itself one of the major objectives of the current UNESCO / IUGS IGCP sponsored 5 year project: "IGCP-448" titled: "World correlation on karst geology and its relevant ecosystem (2000-2004)" which focuses on the ecological problems of karst. During the recent expedition, my role involved a study of cave ecosystems and species; this was considered as the first intensive study of cavernicoles in southern China: with a systematic collection or recording of all aquatic and terrestrial species.

Figure 8: *View of the pinnacle karst in Shilin Stone Forest, east of Kunming in Yunnan Province.*

The recent Guangxi 2000 expedition, lead by Ged Campion, was organised by two British caving clubs: Wolverhampton Caving Group and Yorkshire Ramblers Club (YRC).

It is sometimes said that caving, or international caving, is all about networking! In mid-1999, two YRC members (Ged Campion and Bruce Bensley) visited

Figure 9: *Eroded plateau karst with grikes and fissures at Naigo, north of Lunan (20km from Shilin Stone Forest) in Yunnan Province*.

Figure 10: *Sampans and houseboats on Li Jiang, near entrance to Crown Cave, with cone karst backdrop.*

Tasmania, attended a meeting of Southern Tasmanian Caverneers in Hobart, then were taken to the *Slaughterhouse Pot*/*Growling Swallet* system in the Junee-Florentine karst by Jeff Butt and myself, where they saw a few of our cave adapted invertebrate species. I maintained contact within them and, during a visit to England in December 1999, was formally invited to join their forthcoming China expedition.

There were 16 expeditioners in the Guangxi 2000 team: 13 from England, one from Ireland, one from France and myself from Australia. We entered China via Shanghai, and then flew south to Guilin, being met by our hosts from the Institute of Karst Geology and a Nanning-based film crew. Apart from some initial activity in Guilin including a ferry boat ride down the *Li Jiang* (Li River) to introduce us to the karst of southern China (Figures 10, 11 and 12), our three week "Guangxi 2000" expedition was based in Ling-yűn Hsien (Lingyun County) in northwest Guangxi Province. This remote Lingyun County region is apparently better known as a source of green tea, than for its karst; tea plantations (Figure 13) are grown on the steep slate rock soils that lie between the outcrops of limestone. Guangxi is a quite large province: around 241,000 km^2 (10% larger than the state of Victoria, Australia) and is divided into eight regions (ti-ch'ű) with 72 counties (hsien), eight autonomous counties (tzu-chih-hsien) and six major municipalities (shih) or cities (Geelan and Twichett, 1974).

Figure 11: *Passing ferries on the Li Jiang; during peak tourist season, up to 300 ferries traverse this section of river each day to view the karst terrain*.

Figure 12: *Tourist ferries passing cone karst with pointed peaks beside Li Jiang (Li River) south of Guilin in Guangxi Province*.

Travelling from Guilin to Lingyun involved a long day on the road, stopping frequently to pay road tolls at regional, county or local town borders. For the first half of the day, we were securely fastened in seat belts in a government bus complete with a hostess, TV monitors, Chinese newspapers and bus lunch pack, travelling 380km southwest along major highways to Nanning (the capital of Guangxi Province). At the Nanning bus station, we transferred to small "protective" police escort vans for the remaining 355km distance: a 260km journey along varying road surfaces travelling northwest to Bose (Baise) and a further epic 95km drive north, along narrow often single lane winding roads through the cone karst hills, to Lingyun: the county town of Lingyun County. Our expedition spent just under two weeks exploring, surveying and documenting caves in the cone karst north of Lingyun township (and two days south of Lingyun), and a reconnaissance party spent a week undertaking a preliminary investigation of caves further north in Lo-yeh Hsien (Leye County).

Immediately following the expedition, the International Show Caves Association (ISCA) held its biennial symposium in China: in the town of Tonglu (in Tonglu County), 70-80km southwest of Hangzhou city in Zhejiang Province in the central east region of southern China. (Hangzhou itself is about 170km southwest of Shanghai.) Tonglu is located about 15km east of *Yaolin Cave*, a well known and popularly visited show cave. Variously referred to as "Yaolin Wonderland" or "Yaolin Fairyland Scenic Area", the cave is promoted as one of the show piece tourist sites in this part of China (Clarke, 2000). The symposium was hosted by the Institute of Geography at the Chinese Academy of Sciences in Beijing and supported by local tourism operators and the board of management for *Yaolin* (*Cave*) *Wonderland*, plus a range of local municipal, regional, county, provincial and national Chinese bodies.

All foreign delegates to the ISCA symposium at Tonglu were considered to be important international dignitaries; we were constantly escorted (and guarded) by local police or uniformed officials and accompanied by interpreters: language students from the University of Zhejiang, in Hangzhou.

The main theme for ISCA symposium, related to the "Protection and Restoration of Show Caves", and along with visits to local tourist attractions and show caves, there were many presentations on similar and unrelated karst management themes (Clarke, 2000).

Figure 13: *Tea plantations on the steep shale soil slopes near Lingyun. (Source: Tourism promotion display, Lingyun Hotel, NW Guangxi.)*

Following the ISCA symposium, the four Australian delegates went south to Guilin in Guangxi Province where we were hosted by the Institute of Karst Geology, and accommodated in the "foreign visitors" quarters.

Venturing further south again to Yangshuo, via another Chinese ferry boat cruise on the Li River, we experienced life in a rural village setting amidst tower karst and cone karst peaks with their pavilions and pagodas.

Yangshuo is an older style traditional village now thriving on the tourist trade and catering for westerners, but maintaining its markets and eating places for villagers amidst street side gift shops, coffee shops and western style restaurants.

Sight-seeing attractions include options for cycling, three-wheeled taxi car ("Biscuit Tin") rides in the countryside (Figure 5) and a number of non-commercial adventure caving options to flooded cave systems, where for example in *Buddha Water Cave*, you were invited to wade in and catch your own blind cave fish!

Figure 14: *Buddhist temple in entrance chamber of* Shuiyuandong *(Water Source Cave) near Lingyun county town.*

Figure 15: *Calligraphy on cave walls of in entrance chamber of* Shuiyuandong *(Water Source Cave) near Lingyun county town; includes poetic verse and political propaganda*.

Some historical aspects in regard to cave use, culture and karst studies in China

Although most karst areas have been utilised for hundreds of years for agricultural purposes, there is scattered evidence of other cultural use including the presence of pavilions or pagodas on the pointed tops of karst pinnacles or cone karst peaks. Caves in China have also been used as ceremonial and habitation sites from times before the birth of Christ and many caves are still used today for similar purposes including burial site tombs or graves, Buddhist worshipping temples (Figure 14), ritual sites (with incense burning) and sometimes as shelter sites for hermits or shamans. Many caves are adorned with calligraphy (see Figure 15), where poets have written verse, some of which have been over-written by political propaganda. Some established or regularly frequented caves near villages have ornate statues or figurines in their entrances, plus decorative or carved stonework including bridges and stairs, excavated in the limestone. In more remote areas, some entrance chambers have old fire hearths, remains of pots and cooking containers, plus raised bedding structures all behind fortress-like rock walls, where local villagers or farming families probably lived, protected from wild animals or perhaps hiding from their enemies in the time of feuding warlords.

Figure 16: *Statue of Xu Xiake (1587-1641) on a limestone pedestal outside the Institute of Karst Geology in Guilin, NE Guangxi Province.*

Figure 17: *Tower karst obelisk near cone karst hills at town of Yangshuo in NE Guangxi Province.*

The evidence for prehistoric man in China is widespread and many cave habitation sites are known. In earlier books on karst in China, there are references to the skulls, teeth and limb bones in fossil deposits of the "Chinese ape-man" or Peking Man (*Sinanthropus pekinensis*), discovered in the "ape-man cave" at Dragon Bone Hill at Choukoutein in Peking. Dating of these deposits indicates that mankind occupied these caves around 400,000-500,000 years ago (CAGS, 1976).

Mid-Pleistocene mammalian fossils, together with the teeth and artefacts of early humans have also been unearthed from cave excavation sites at Dadong in Pan Xian County, Guizhou (Si, 1993). Late Pleistocene deposits of "Upper Cave Man" (*Neoanthropus*) have been discovered in other Chinese caves (CAGS, 1976). Ru, et. al., (1991) record the dating of deposits in *Baoji Cave* near Guilin, where early human occupation occurred around 30,000 years BP and similarly in *Zhenpi Cave*, human fossils have been dated at 10,000 years BP. More recent cave studies have yielded further human fossil deposits including the skulls of Nanjing Man (*Homo erectus*) at Tangshan Hill, in Nanjing – found together with mammalian remains of animals from northern China - suggesting a cold climate period of occupation in the Nanjing caves (Zu, 1993).

Figure 18: *Edge of concrete road above* Shadong*; the road winds through cone karst hills in the peak cluster depression type karst, typical of elevated areas in NW Guangxi Province*.

Figure 19: *Mist and cloud hanging amidst cone karst peaks south of Lingyun in NW Guangxi*.

The historical use of caves for human activity is quite evident in many areas. For example, during the ISCA symposium, delegates were shown a deposit of charcoal embedded under flowstone inside the entrance of *Yaolin Cave*; in south-central Zhejiang Province. Proven to be the remains of an early hearth site, this deposit in *Yaolin Cave* has been dated to 2,900 years BP, providing evidence of a substantial occupation history by early mankind. Further south in the Guilin area - in northeast Guangxi - there is the evidence of early tombs and engravings in cave entrance walls.

Figure 20: *Chinese scroll paintings in roadside shop at Yangshuo, featuring images of karst landscape*.

These date back to more recent times in the Qin (Chin) Dynasty (221-206 BC) and subsequent Han Dynasty (206 BC – 22 AD), along with the carved stone statues and inscriptions from later periods around 618-907 AD during the Tang Dynasty (Ru, et al, 1991).

Living in carbonate rock areas for several thousand years, the Chinese have been utilising karst resources since before the time of Christ. Around 214 BC, during the Qin Dynasty, the 30 metre long Ling Canal was dug in the Hsinan area of the Guilin region in Kwangsi (Guangxi) Province, as part of a water conservancy project and around 200 AD during the Eastern Han Dynasty, there is a record of people in Shansi (Shanxi) Province using spring water to irrigate farmland (CAGS, 1976).

Figure 21*: Reverse side of the new 1999 issue of 20 RMB (20 yuan) Chinese bank note featuring tower karst and cone karst beside the Li Jiang, south of Guilin in NE Guangxi.*

Caves in China were documented in relatively ancient times. In northern China, caves and their hydrology were described in "*The Mountain Scriptures*" – a book written over 2200 years ago (Waltham, 1986). Around 900 years ago, (Northern Sung Dynasty), Shen Ko discussed the origin of stalactites in a book titled: "*Study Notes of Dreaming Stream Garden*" (CAGS, 1976). In southern China, the "father" of cave and karst studies is Xu Xiake (1587-1641), described as "an outstanding geographer and self-taught scientific observer" - a travelling geographer and naturalist who lived during the Ming Dynasty (Ru, et. al., 1991). Over a 30 year period, Xu Xiake travelled to remote parts of south-eastern, southern and southwest China, observing and recording many aspects of natural science. During the last four years of his active life (1636-1640), Xu devoted himself totally to karst studies, producing the first systematic description of karst in China. He reported 357 cave entrances - visiting 306 of them, recording their structure, cross-section shapes, profiles, dimensions and size, plus solutional and erosional features (Zhang, 1993). Xu Xiake also described speleothems such as straw stalactites, helictites, shields and cave pearls (Ru, et. al., 1991) and his notes record cave animals including bats, snakes and insects (Clarke & Latella, 2001). He was probably one of the first to document damage in caves, reporting that villagers had destroyed 70% of the speleothems in *Meitiandong Cave* in Jiangsi Province to produce lime and on another occasion in Yunnan Province, Xu states that the smoke from cave guides'

pine torches had made white speleothems become as black as coal; he also records theft of stalactites from caves (Zhang, 1993). Collated posthumously, his journals were published in 16 volumes as *Hsu Hsia-ko's Travels* (CAGS, 1976), known today as "*Xu Xiake's Travels*" (Ru, et. al., 1991). A sculpture of Xu Xiake stands outside the Karst Institute in Guilin (Figure 16).

Figure 22: *Ray of sunlight, entering a karst window, shines across tourist pathway in* Shuiyuandong*, near Lingyun township*.

Figure 23: *The 200m deep* Yanliu Dong *collapse doline, south of Lingyun County town; arrow points to position of main road built on top of a 15m high vertical retainer wall where road traverses steep cone karst hillside above the collapse feature*.

A brief overview of karst geology and karst landforms in southern China

The age of carbonate rocks in China extends from the Pre-Cambrian to the Quaternary (Chen, et. al., 2001) reaching a total thickness of between 3000 to 10,000 metres (Bridgemon & Lindsley, 1991). This might seemingly give potential for some very deep caves, but most of the recorded karst is confined to a series of limestones and dolomites of mid-Devonian to Lower Carboniferous age, where the total relief is limited to around 3000 metres (Ru, et. al., 1991).

Although it is variously reported that around one third of China is covered in soluble rocks, the literature on carbonate rock outcrop and actual karst area in China provides some confusing or seemingly conflicting statements. In one of the earlier publications on karst in China, the outcrop of carbonate rocks is recorded as covering a 1,200,000km^2 area (CAGS, 1976). In a subsequent publication, Ru Jinwen, et. al., (1991), record the total surface exposure of carbonate rock in China at around 900,000km^2 through all climatic zones, with Guangxi Province at the centre of a 540,000km^2 belt of some of the finest subtropical tower karst in the world. Chen Xiaoping et al., (1998) state that the outcrop of carbonates is in excess of 1,250,000km^2 with the most intensive area situated in three adjoining provinces: Guangxi, Guizhou and Yunnan (Figure 2) where karst represents 28.9% (320,000km^2) of the total land area of those provinces. Chen Zhiping et al., (2001) record the total outcrop of karst in China at around 700,000km^2. The soluble rocks of southern China have been rapidly dissolved and sculpted by vast amounts of precipitation, high temperatures and quick circulation of water and hence the karst has developed more intensely in the tropical and sub-tropical climatic zones (CAGS, 1976) giving rise to a range of karst forms: large scale surface features, huge caves and many subterranean river systems formed over a long period of time.

Joints, fissures and fractures - the structural features resulting from tectonic activity and crustal movement - have provided avenues for water movement, while fracture zones, folds, upheavals and subsidence act as boundaries controlling water movement and the development of separated or isolated hydrological systems. There is evidence for periods of multiple karstification with defined stages of karst development recorded in six provinces during the Cretaceous-Early Tertiary, Tertiary-Early Quaternary and present late Quaternary (Holocene) development (CAGS, 1976).

Palaeokarst is evident in many karst areas: in caves and side walls of collapse dolines; thick veins of calcite surround some of the palaeokarst deposits. It is probable that sulphuric acid – emanating from the sulphides associated with the palaeokarst – is a contributing factor in the solution of soluble rocks in southern China and formation of the large scale karst features. Massive calcite deposits also appear in and around zones of altered (metamorphosed) limestones or in association with fault zones due to the subsequent movement of hydrothermal fluids, possibly also associated with tectonic activity. Several parts of southern and south-central China have been subjected to Pleistocene

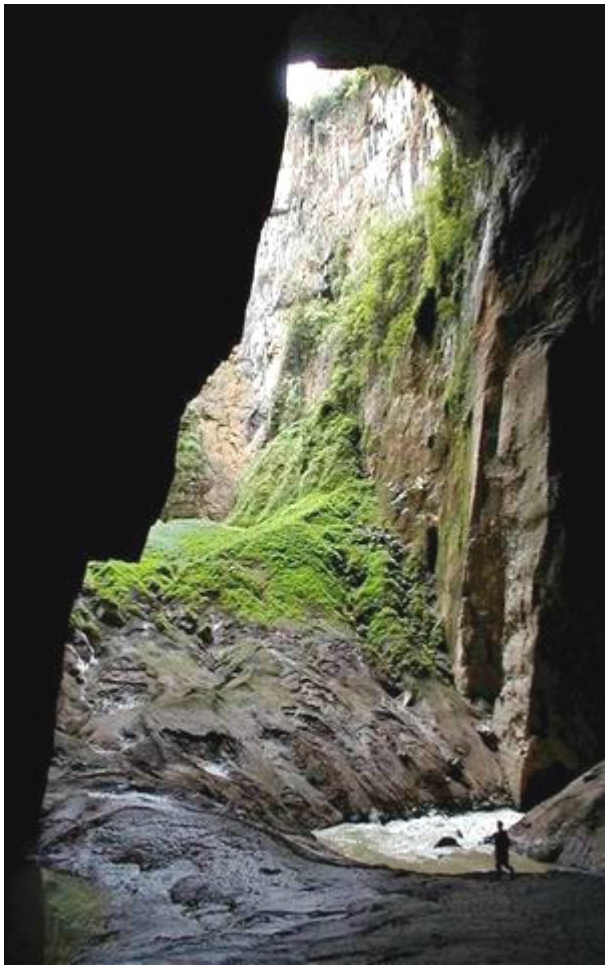

Figure 24: *Caver on mudbank, 20metres above the turbulent stream in cave entrance at base of* Yanliu Dong *collapse doline; cavers descending the 200m entrance pitch (see Figure 29) land on grassy scrub knoll on top of the steep mudbanks, 35-40m above where caver is standing.*

Figure 25: *View into top half of the massive 550m deep* Dashiwei *tiankeng in the mountainous cone karst region in Leye County of NW Guangxi*.

glaciations and the writer has seen massive glacial infill deposits including breccias in some high region caves; till deposits and moraines have also been recorded in lowland areas near Guilin (Ru, et al., 1991).

The karst landforms of China have been categorised into varying types according to the role of water flow and geological structure and can be classified as: corrosion, corrosion-erosion and corrosion-structure types (CAGS, 1976). The corrosion type mainly occurs in southern China, where six type forms are recognised as: renowned stone forest-karren, hill-depression, peak cluster-depression, peak cluster-valley, peak forest-valley type and isolated peak-rolling land type. Prominent among the large scale surface features in southern China are numerous peak cluster or peak forest valley types typified around Guilin and Yangshuo, where the peaks appear as residual elements - rising above the otherwise flat or gently undulating landscape. In the flat lowland areas, there are the numerous near vertical-sided "obelisks" known as tower karst (Figures 4 and 17) or the multi-peaked (mountain-like) hills often with pointed tops, referred to as cone karst (Figures 6, 7, 18 and 19). Cone karst is more prevalent in elevated areas as the peak cluster depression type, as seen during our expedition. Some of these residual karst peaks are typically portrayed in traditional Chinese paintings or scrolls, in the design motif of some old "*Willow Pattern*" plates, on modern day postcards, cigarette packets and more recently on the 20 RMB (20 yuan) Chinese banknote (see Figures 20 and 21).

Figure 26: *The 45m high stream swallet entrance to* Shadong*, north of Lingyun, with caver descending to base of entrance rubble*.

In the elevated peak cluster region around Lingyun, there are numerous flat-floored depressions or collapse dolines. Some of these flat or gently undulating depressions are partially flooded in the wet season, and then intensively farmed with ground cover crops in the dry season. There are many impressive collapse dolines and karst windows that connect to caves (Figure 22) or major subterranean stream systems; underground waters in some collapse features such as *Yanliu Dong*, have been harnessed for hydro-electric power (Figures 23, 24 and 29).

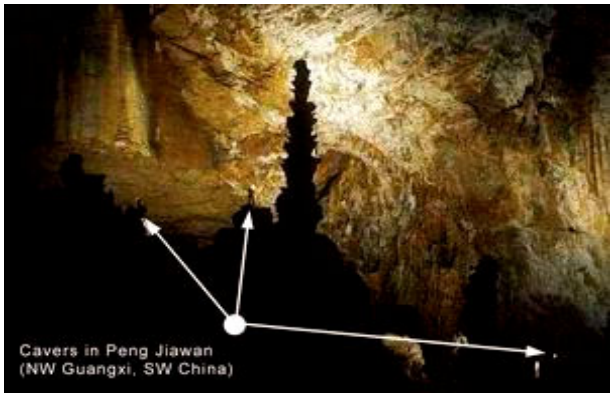

Figure 27: *Cavers photographing the massive end chamber in* Peng Jiawan*. (Photo by Bruce Bensley.)*

Another related karst collapse feature, coming into increasing prominence in China, is the "tiankeng" - also located in mountainous cone karst regions. Tiankengs are massive collapse dolines with extensive vertical cliff wall sections, such as the over half kilometre deep *Dashiwei* tiankeng explored by our Guangxi 2000 team (Figure 25). Abounding in bird life, many of the tiankengs have quite unique and undisturbed plant assemblages with rainforest species composed of 30m tall trees, vine-plants and ancient treeferns.

Due to their vertical separation from the surrounding land surfaces and natural protection from desiccating winds, the isolated pockets of humid forests in the base of these tiankengs probably represent refuges for relic vegetation communities. Some tiankengs – including *Dashiwei* – have extensive cave systems connecting to underground rivers.

Figure 28: *Efflux entrance to* Chengbi Hedong*, south of Lingyun township. (Photo by Mike Pitt.)*

In addition to the deep and often massive tiankengs, most of the other known caves form parts of large hydrological systems. Many have impressive entrances, such as *Shadong* (Figure 26), large passages, chambers and massive speleothem formations, e.g., *Peng Jiawan* (Figure 27). Some of these huge caves are fossil systems (increasingly being developed as show caves) and/or systems associated with active and often turbulent underground rivers with year-round effluxes (Figure 28).

From a speleologist's point of view, these large fossil cave entrances, massive collapse features, swallets or large effluxes are very enticing for exploration and photography. When expeditioners descended the 200m entrance pitch into the *Yanliu Dong* collapse doline (Figure 29), they located a man-made horizontal tunnel (*Yanliu Suidao*) constructed to channel overflow waters to a hydro power station. Some of the larger more sheltered cave entrances were habitation sites for early humans.

Figure 29: *Caver abseiling 200m entrance pitch, during first descent of* Yanliu Dong*; on the RHS* inside the cave, *cavers discovered an excavated tunnel, constructed to channel floodwaters to a hydro pwer station. (Photo by Mike Pitt.).*

Figure 30: Distribution of troglobitic Trechini beetles from caves in southern China:14 genera: 38 species. (Family Carabidae: Subfamily Trechinae: Tribe Trechini) [From Clarke & Latella, July 2001]

Figure 30: Caption included with map figure.

Figure 31: *Pale and depigmented blind cavefish with long sensory barbels - in collecting net in* Yanliu Suidao*; believed to be a subterranean ecotype of the catfish:* Silurus gilberti.

Figure 32: *Blind cave shrimp with translucent body in* Shadong*, north of Lingyun county town; believed to be the first record of a blind palaemonid from caves in China and second only from southeast Asia.*

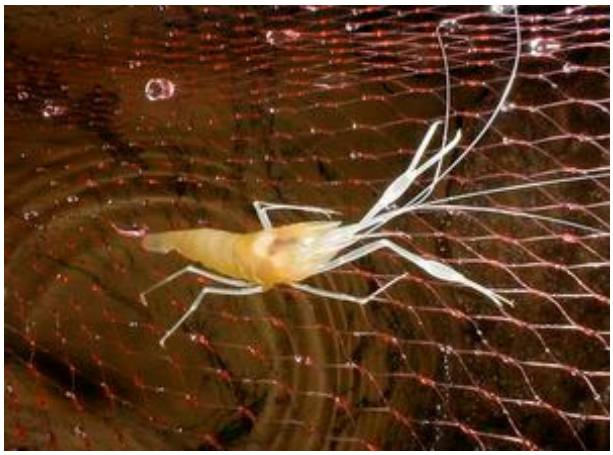

Figure 33: *Blind cave shrimp in villager's onion bag fishing net; assumed to be* Macrobrachium *sp. nov.*

Cave biology studies in China

During the 1930s to the 1950s, most of the early scientific (biological) studies of caves in China related to palaeontology and/or prehistory studies of Peking Man. The studies of Peking Man deposits and associated hearth ash sites at Choukoutein in Peking yielded a number of vertebrate fossils, including burnt bones of megafauna and contemporaneous animal species (CAGS, 1976; Weng-Chung, 1940). In more recent years, mammalian fossil deposits in caves have been used in palaeo-climatic studies. Zu Qinqi (1993) reports that an analysis of the species assemblages in bone deposits associated with fossils of Nanjing Man indicates that cold climate animals from northern Asia were living in south-eastern China, supporting the theory for Late Pleistocene occupation of caves in the Nanjing region (just west of Shanghai).

Figure 34: *Female cave cricket in* Lian Huadong *(Lotus Flower Cave) near town of Lingyun*.

Figure 35: *A 12-13cm long scutigerid centipede on cave wall in* Shendong*, north of Lingyun*.

The early studies of cave invertebrates in China involved just a few zoologists or taxonomists who were interested in specific animal species groups. Although a report of reduviid assassin bugs from caves in China was published in 1924 (Chen Zhiping et al., 2001), the first known intensive study of cave invertebrates in China occurred in 1934 when the Japanese zoologist (M. Ueno) undertook a survey of malocostracean crustaceans in Guangdong (Clarke & Latella, 2001). A few years later in 1938, Oguro published a paper relating to a new subterranean aquatic amphipod in China. Another 20 years later, Loksa (a Hungarian zoologist) published a list of new millipede species, describing six species from caves in China, including three blind species (Bridgemon & Lindsley, 1991). In 1977, Boris Sket (from Slovenia) led the first known western expedition to study the general biology of caves in southern China (Chen Zhiping et al., 2001). The next

major study of cave fauna occurred in January 1988, during the third Anglo-Chinese expedition to southern China (Fowler, 1990).

Subsequent expeditions by universities and zoological institutes within China have resulted in faunal surveys of specific caves in Guangxi, Guizhou and Yunnan and several studies of specific animal groups.

Although sporadic studies of individual species groups have continued, e.g., beetles, cavefish, copepods, millipedes and springtails, many of the new discoveries of cavernicoles are the direct results of expeditions, particularly foreign expeditions.

The majority of these expeditions have been based in southern China in the provinces of Guangdong, Guangxi, Guizhou and Yunnan where much of the intensive karst occurs, so it is probably no surprise that most of the known cave dwelling species occur in these four provinces.

However, in 1993 during the course of the 11th International Congress of Speleology in Beijing, 13 invertebrate taxa were recorded during a small expedition to Liaoning Province in northeast China, when four show caves were sampled (Hubbard and Wang, 1997).

Amongst the most described cave species there are 52 carabid beetles, 23 cavefish, 14 collembola, 12 copepods, 6 millipedes and 5 amphipods (Clarke & Latella, 2001). Most of the cave dwelling carabid beetles are trechines (Family Carabidae: Sub-family Trechinae: Tribe Trechini); almost 40 of these are either troglobitic or highly troglobitic (Taglianti, 2001) and found only in southern China (Figure 30).

The carabid beetles have been principally described by two taxonomists: Thierry Deuve from France and Shun-Ishi Ueno (son of M. Ueno) from Japan; some species have only been described from a single specimen. There are a total of 121 described troglobites in China (Clarke & Latella, 2001).

With its numerous subterranean hydrological systems, China is known to have a diverse aquatic fauna including a rich troglobitic ichthyofauna: cave adapted fish species (Clarke, 2001). Since the first cavefish species was discovered in Yunnan Province in 1976 (Chu & Chen 1978), there have been a spate of fish discoveries in caves of southern China.

At the 1993 UIS Congress in Beijing, there were reports of 12 known cavefish in China; in October 2000 there were 19 recorded species and now (July 2001) there are 23 known species of cavefish (Clarke & Latella, 2001).

All but one of these cave adapted fish species are found in three adjoining provinces: Guangxi, Guizhou and Yunnan. During our expedition, we saw a number of cave fish including some blind pink to orange translucent catfish with their long antennae-like barbels (Figure 31) that could swim out of their small pools and use their fins to "walk" across water washed flowstone in the riffle zone between pools.

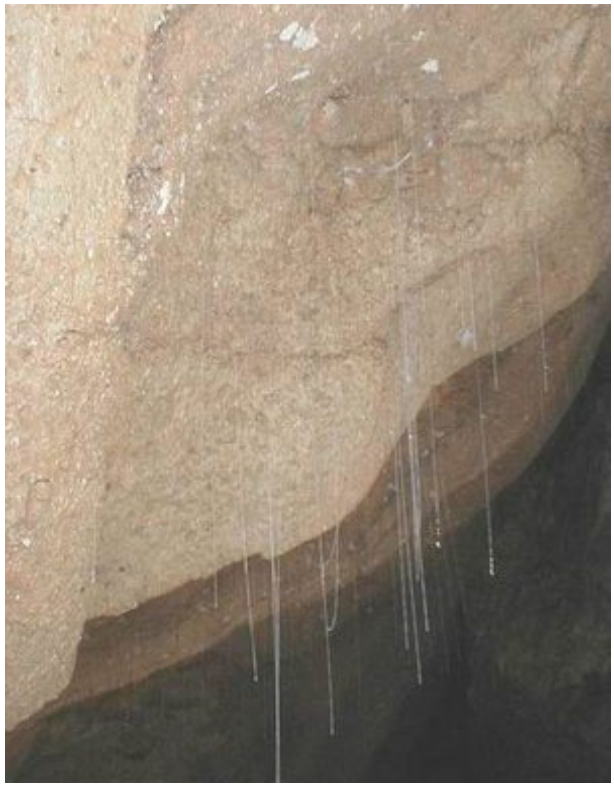

Figure 36: *Long (40-50cm) silken snare threads of non-luminous larvae of fungus gnats (Keroplatidae), above rubble slope 50m inside entrance to* Peng Jiawan*, north of Lingyun.*

Figure 37: *Large leaf-nosed bats (Hipposoderidae) roosting on the fossiliferous bedding plane ceiling of a low-roofed stream passage in* Shendong.

Figure 38: *Carved speleothems and stalagmites for sale in display cabinets at Guilin International airport; prices range from $750 to $1,000 (AUS).*

Figure 39: *Coloured lighting in* Naling Dong *show cave, near Lingyun County town*.

Some outcomes from the "Guangxi 2000" cave fauna study

Apart from the many cavefish, a number of epigean fish species were seen in the caves around Lingyun in NW Guangxi; interestingly, these surface species seem to co-exist with the true cavefish well into the dark zone of stream caves.

Considering the number of fish seen in these caves, there were a surprisingly large number of other aquatic organisms, including insect larvae, water boatmen, small aquatic snails, flatworms and numerous crustaceans such as crabs and shrimps: small atyids (Family Atyidae) and the larger relatively rare palaemonids (Family Palaemonidae).

One of the many highlights of this expedition and the Guangxi 2000 cave fauna study was the discovery of some large blind shrimps (Figures 32 and 33); initially determined as new species of a new Family (Clarke, 2001), these are now considered to be new species of *Macrobrachium* (F. Palaemonidae).

These represent the first record of blind palaemonids in China and possibly only the second record for Southeast Asia.

Figure 40: *Cavers posing for photograph with village children after exiting* Long Taowan*, a vertical cave north of Lingyun*.

Millipedes, cave crickets (Figure 34), cave beetles and spiders are the most abundant terrestrial species in the Lingyun caves. Amongst other finds there were white moths at minus 100m, eyeless spiders, tiny red mites, 4cm long white millipedes and 12-13cm long scutigerid centipedes (Figure 35). It was also surprising to see "non-glowing" glow-worms: the non-luminous larvae of fungus gnats with their 40-50cm long snare threads (Figure 36) near cave entrances (Clarke, 2001).

In the few caves with bat guano mounds, there were numerous guanophiles: springtails, mites, small stapyhlinid beetles, occasional carabids, thousands of millipedes and several centipede species. Apart from the few bats (Figure 37), the only other terrestrial vertebrates were frogs, including one with milky white eyes at minus 350m, nearly 1km underground. Many of the caves were sections of underground stream systems that we could now explore in the dry season walking along dry streambeds, or wading in shallow fast-flowing streamways, but sometimes having to negotiate steep sand banks or slippery mud banks.

Some giant whip scorpions were located 700-800m underground on streamside mud banks in *Chengbi Hedong* (Figure 28), the subterranean course of *Chengbi He* (River). In cave streamways and on stream banks there were vast amounts of flood debris along with the litter or rubbish that invariably finds its way into these caves; many terrestrial species had colonised sections of the flood debris.

Compared to the stream cave systems in the cool temperate areas of Australia, especially Tasmania, the caves in China have a very high nutrient input which probably accounts for the apparent abundance in species numbers and high biodiversity in their ecosystems.

Figure 41: *Village women carrying bundles of firewood branches on top of their already fully laden back baskets containing harvested produce*.

It's not difficult to find new cave species in China. During the course of our expedition there were a number of significant fauna discoveries, ranging from first cave records for particular species types in southern China to several new genera and a suspected possible new family group (Clarke, 2001). Although a number of species are yet to be determined to family or genera, a preliminary analysis of the cave fauna study reveals the following:

1: First known cave records for this part of southern China:

- Atyidae: Small freshwater shrimps –*Neocaridina palmata bosensis*;
- Decapoda: Various brown and yellow crabs (Unknown family);
- Gastropoda (Land snails): *Tropidauchenia* cf. *fuchsi*, *Helicorbis* sp. and *Hippeutis* sp.;
- Keroplatidae: Non-luminous larvae of fungus gnagnats (Figure 36), formerly classified as specof Family Mycetophilidae;
- Entomobryidae: Springtails – *Seira* sensu lato;
- Formicidae: Pigmented and depigmented ants;
- Fulgoridae (?): Hemipteran planthoppers;
- Dermaptera: Earwigs (unknown family);
- Blaberidae: Cockroaches, including possible *Calolampra* sp.;
- Dytiscidae or Noteridae (?): Water-diving beetles (Hydradephaga); Salticidae: Ant-mimic spider – *Myrmarachne* sp.;
- Thomisidae; Cosmopolitan spider, possibly *Thomisus spectabilis*;
- Uropygida: Whip scorpions (unknown family);
- Siluridae: Siluriform catfish from epigean waters: *Silurus gilberti*;
- Cyprinidae: Fish from epigean waters – *Parasinilabeo assimilis*;
- Hipposideridae: Leaf-nosed Bat - *Hipposideros amiger* (Figure 37).

2: New troglobitic species from caves in Lingyun County (not included above):

- Springtail (Collembola): *Coecobrya* sp. (F. Entomobryidae);
- Centipedes (Chilopoda): 2 genera – 2 unidentified species (Figure 35);
- Millipede (Diplopoda): 2 genera – 3 unidentified species;
- Beetles (Coleoptera): 2 genera – 2-3 trechine carabid species, including new species of either *Cathaiaphaenops* or *Guizhaphaenops* (Carabidae);
- Spiders (Araneae): 2 genera – 2-3 unidentified species;
- Blind shrimp (Decapoda): new genus from possible new Family or *Macrobrachium* sp. nov. (Palaemonidae) (Figure 32 and 33);
- Cavefish: 2 genera – 2 new species: probable subterranean ecotypes of *Pterocryptes* sp. (Siluridae) and *Silurus gilberti* (Siluridae) (Figure 31) with varying numbers of paired barbels.

Cave uses & abuses

Apart from the problem of pollution in the Chinese "throw-away" society, China's cave fauna is constantly under threat by large-scale development projects (Chen et al, 1998), including cave tourism, dam building (for irrigation or power), hydroelectric power schemes and road construction.

Figure 42: *Women quarry workers carrying hand shovel buckets of limestone to a mobile crusher at Quarry Number 2 near Lingyun County town*.

Figure 43: *Laden to the hilt: three-wheeled bike cart on Qixing Road outside Institute of Karst Geology in Guilin - with fabric bags and carboard sheeting*.

Figure 44: *Kitten on a leash, tied to stool at back of a restaurant in Daxu, south of Guilin in NE Guangxi.*

Combined with the effects of stream pollution, the aquatic fauna is particularly threatened due to increasing demands of tourism and industrial development. The threat to aquatic species is also magnified due to the pressures of traditional farming/harvesting practices where villagers see the caves as a food resource for shrimps and fish. Some of these blind cavefish species are also known as "oil fish" – because they are rich in natural body oils and can be cooked without adding oil to the wok or pan; hence these species are much sought

as delicacies for culinary purposes. There is a real concern that many rare and endemic species in China will soon become extinct due to the culinary demands and traditional foraging habits of Chinese villagers, particularly in southern China.

The outdoors environment in China is littered with plastic bags and other refuse and the problem of cave pollution has been previously mentioned. Unfortunately, cave and karst conservation issues have not yet become accepted policy or practice in most parts of China. Their environmental policy, if any, leaves much to be desired – the throwaway mentality of discarding unwanted plastic wrappers, containers, cigarette butts and empty packets, plus general refuse and food scraps.

However, the unexpected return of a camera case, left on the back seat of a rickshaw taxi and discarded in the street by the taxi driver (Clarke, 2000) made me re-consider some of my derogatory attitudes about their throwaway society. It could only happen in China!

Nonetheless, I believe the Chinese need to develop some change in regard to their environmental policies, their exploitation of natural resources and the pollution of waterways and city air, where smog from oil or coal burning fires is always present. Unperturbed by cave pollution, authorities from most levels of government: local municipal, county, or provincial level seem more interested in the development of karst resources, locating sites for underground power stations or finding caves suitable for development as tourist caves.

The demand for new show caves appears to be insatiable! The Chinese love their caves and some of the longer established show caves have very large tourist visitation numbers (Clarke, 2000). One unfortunate part of this… the caves are not maintained and many speleothems formations are "dulling" as they succumb to the pressures of tourism, showing effects of desiccation and being masked by coatings of lint, dust and lampenflora.

Many show caves in China could be better managed by engaging maintenance staff to vacuum clean walkways and speleothems, reducing illumination time and light wattage, plus curbing visitor numbers, but that might put even greater pressure on the undeveloped wild caves.

There is also a considerable trade in the sale of speleothems, evidenced by the roadside stalls selling cave formations outside *Reed Flute Cave* and other major show caves. The duty free shop at Guilin international airport has glass display cabinets with large speleothems selling for prices around $750AUS to $1,000AUS dollars (Figure 38).

You might also wonder whether the display of massive speleothems in museums – including the museum at the Institute of Karst Geology in Guilin – might also encourage the wanton destruction of natural cave speleothems or their removal from caves in a bid to sell them to institutions.

Show caves in southern China: examples in the Zhejiang and Guangxi provinces

There are an estimated 1500 show caves in the world and at time of the ISCA symposium (in October 2000), there were reportedly over 260 recorded show caves in China (around 17% of the world total). Amongst the many so-called features of Chinese show caves is the almost "over-the-top" use of coloured lighting to highlight speleothems (Figure 39); this was a feature of all the tourist caves visited by delegates to the recent 4th ISCA symposium. Coloured lights are perceived as a means to enhance the natural appearance of dull or uninteresting speleothems as well as producing a certain evocative and emotional, but comfortable state for visitors. The rationale for different colours is supposedly quite simple: green colour lights are used to encourage feelings of peace and relaxation; red light gives a feeling of delight and healthiness; blue light promotes wisdom and spirituality and mauve or purple lighting supposedly moves you into higher levels of consciousness.

There is a considerable degree of competitive marketing between the provinces in China and between different show caves. *Reed Flute Cave*, about 10km from Guilin in north-eastern Guangxi Province is rated as having the largest volume of cave visitors, employing numerous linguists and translators to guide the many thousands of overseas tourists each year. Numerous tour parties of 20-30 visitors per guide travel through the cave simultaneously in different directions. In common with most other show caves in China, the guides in *Reed Flute Cave* describe cave formations in terms of their shape and likeness to animal forms, or the faces of Chinese minority peoples and various fictitious or cultural identities including Buddha head statues.

A number of the show caves in China have added attractions with karst walks, nearby village tourist centres or garden settings with ponds – complete with goldfish. The highly impressive *Crown Cave* adjoins a theme park, gardens and "An Ji' slide track that can be used as access to or from the cave. Situated beside the *Li* (*Jiang*) river, 40km south of Guilin, *Crown Cave* can be reached via a *Li Jiang* ferry or bus; the cave tour includes an underground train ride, rowboat trip and a choice of exits: via elevator or the An Ji slide, where you sit astride a geared toboggan on rail tracks (Clarke, 2000).

Operators of other show caves consider themselves as the premier sites in China. Supposedly rated as number one cave in China, *Yaolin Cave* near Tonglu in Zhejiang Province is listed in one of the "Chinglish" language tourism brochures as one of the "*40 Topping Tourist Attractions of China*" (Clarke, 2000). Promoted as the "Yaolin Wonderland", *Yaolin Cave* is situated in a picturesque forest setting with ornate buildings and their red lantern lights, goldfish ponds, decorative wall murals, various sculptures and positioned rocks: karst solution pinnacles. About 30km from Tonglu there is a new show cave: *Chuiyan Cave*, situated beside a picturesque lake into which the cave efflux flows. Opened for commercial tourism in March 1999, cave visitors pass a model village with cultural exhibits and obligatory red lanterns, then take their guided tour in

Chuiyan Cave by longboat with cave guide controlling the oar.

After rowing across the lake, tourists enter a low roofed cave with roof pendants, boulder fills and speleothem chambers, and around a corner the rowboats are guided into a dual framed stainless steel cradle: two boats at a time and raised up a 15-20m long inclined haulage to an upper level high-roofed streamway which is supposedly 8 metres above the lower resurgence stream level.

Figure 45: *ACKMA at breakfast in Yangshuo: Nick White and Brian Clark on squat stools with Sue Clark (about to sit); a wholesome meal of rice noodles, vegetables and minced pork costing 2 yuan (50 cents AUS).*

Figure 46: *Snake wine on offer at a restaurant on board a Li Jiang ferry; considered to promote virility, this is often consumed with banquet meals*.

After rowing to the final chamber, tourists are invited to change into period costumes to be photographed with a cave lit backdrop and for those who want to explore further, there are guided adventure caving options with light, gumboots, helmet and overalls supplied (Clarke, 2000).

Some first impressions of China: cave exploration and culinary practices

Invariably as cave expeditioners exploring karst systems in remote parts of northwest China, we are usually the first foreigners that most locals have ever seen and most certainly the first "westerners": these strange "white-skinned" people. At both of our expedition bases in the towns of Lingyun and Leye and out in the more remote and less developed mountain villages, we are continually followed by children and often stared at like freaks of nature. The children like to practice their few school learnt phrases of English. An interesting observation for us is the fact that many of the men in the towns or villages are wearing suits: often well worn suits and instead of shoes, they wear plastic flip flop sandals and are sometimes barefooted! Villagers follow us to caves (with their suits on) and some attempt (and succeed) to follow us into vertical caves - often climbing down in the dark either with bare feet or plastic flip-flops: going hand over hand on the ropes we are abseiling or prussiking! The villagers usually carry a torch, sometimes in their teeth; more often or not, they will only have one or two torches amongst a group of four or five cave visitors, but they rarely carry spare batteries. In the instances when we did get into a cave without being followed, there were always villagers there to greet us when we emerged - particularly children - offering to carry our heavy packs or wanting to have their photos taken (Figure 40).

The culture of these rural villagers in the mountainous cone karst terrain was quite amazing, especially where limestone rock is seen as a commodity with value, but the caves are also given a value. In these small mountain villagers, locals use hand-operated quarrying "machinery" to produce a powdered limestone product for local buildings, but maintain a protective attitude towards caves and conservation of their content. For example, 20km north of Lingyun on route to Leye, between the villages of Nongying and Nongfeng, there is a small tiankeng (cliff-walled doline) with a very large cave (*Peng Jiawan*) at its base, truly worthy of being developed as a show cave.

About ten years previous, locals from both villages became increasingly disturbed that outsiders were visiting "their" cave and stealing speleothems and bats. Following a massive influx of visitors over several days (including a party of over 300 visitors on one day), villagers blasted the cliff face above the entrance to block entry to the cave, leaving a small hole for air flow that allowed bats to fly in and out. A dated inscription was painted on rocks near the sealed entrance. (Interestingly, there are numerous caves in southern China that no longer have any bats, possibly because they have been plundered as a food source.) Knowing we were here as a team of foreign cave scientists to evaluate the area, local villagers agreed to open the cave. For a small fee: 50 yuan (about $12.50 AUS), about twenty villagers were engaged to blast the rock debris into small moveable pieces, so we could enter the cave to survey the site, collect fauna and photograph its features. The villagers followed us in, watched us

caving, and then planned to seal the entrance again, after we departed!

Compared to our western culture, the lifestyles in NW Guangxi were markedly different, particularly in the small towns and rural villages where much of the physical manual work is done by women, who often carry heavy loads (Figures 41 and 42). There seems to be a constant flurry of activity everywhere: in the fields, in villages and on the roads, particularly in the rural towns and cities where there was an almost constant flow of congested traffic. Apart from pedestrians and livestock, the streets were jammed with a mix of various wheeled vehicles: cars, vans, buses, trucks and Chinese tractors; horse or bullock towed carts and vans; pedal or hand-operated barrows, bikes and three-wheelers, all often loaded to the hilt and overflowing with passengers or cargo (Figure 43).

One of the most obvious differences is the food: variety of foodstuffs, presentation and preparation. It has been said that the people of southern China (especially in Guangxi and Guangdong) will eat anything that moves, so after a while we became less shocked at what we saw on offer as food. The style of food preparation is often quite startling. Sides of meat are butchered into their various cuts in the open marketplace and together with offal, these slabs of meat (often more fat than meat) sit in the open on concrete benches or tables where flies crawl all over it. Smaller animals such as ducks, geese, chicken, fish and occasionally dog or cat are freshly slaughtered at point of sale in the marketplace, mountain village or roadside restaurant and prepared on the spot, often for immediate cooking.

During the Guangxi 2000 expedition, we often had a real problem being served with cuts of lean meat; it was normally very fatty and the occasional lean meat we had was often very tough and chewy. From our observations, most animals were poorly fed and/or not primarily bred or raised as meat producers and in many parts of rural China, dogs and pigs roam the village streets living off food scraps that are thrown onto streets. Aside from this, livestock is often freshly slaughtered and the carcasses of beef or pork are rarely hung (and relaxed) as we do in our western abattoirs or in the back of our enclosed butchers shops. The few times we did get beef as meat, it was usually water buffalo beef and only very occasionally, we ate cattle meat. Some of the best cuts of lean meat seemed to be reserved for their "barbecues", where cubes of meat are skewered on sticks (as we would term a kebab) and cooked over coals.

On the whole, we had expected better quality food because our expedition was based in a government run hotel, though it was probably only a half star hotel by western standards. The squat hole that was our toilet also served as the shower and hand basin drain, but you only got hot water between the hours of 4pm and 6pm when the coal-fired burners were turned on for cooking the hotel evening meals. (Near the end of our stay, we discovered that our hotel did have more luxurious rooms with double beds, a bath and sit-down toilets, suggesting perhaps that there is a class distinction between the rich and the poor in China.

No doubt, we were given the second rate quarters, because caving was considered to be a dirty working class activity only done by labourers!)
In terms of meat, there were some quite unusual servings of protein: gristly pieces of chicken or chicken feet, the occasional serving of insect larvae (giant wasp or dragonfly larvae), snails, snake, and dog meat to name a few, plus pieces of crumbed or battered pork rib bones - everything eaten with chopsticks of course. When we were first served with dog meat, we were told it was "field animal" from a farm; it was indeed dog meat and it was the most lean and tender meat we had eaten in China!

Dog meat is sometimes served as an alternative to chicken (or cat meat) at restaurants or roadside banqueting houses where you can select your desired food choice from the caged animals or aquariums on the pavement outside the eating place or inside the restaurant itself. The choices are many: various furry creatures such as rats, cats, squirrels and hares, plus various birds (usually chicken, geese or pheasants) or reptiles (mainly snakes) and a variety of aquatic animals: fish, turtles, water snakes and crustaceans (crabs, yabbies and prawns). Some restaurants have more animals out the back, where they are fattened up with kitchen scraps prior to going on display out front. At the back of one such restaurant in Daxu, south of Guilin, we saw owl chicks, kittens and pups beside the kitchen, presumably all being fattened up for human consumption. With these choices of live meat on offer, diners can select food options to the desired body weight after the proprietor puts them on hand held scales.

Interestingly, some restaurants have their cats or dogs tied up out front or back of the restaurants (Figure 44) where they are sometimes cruelly cuddled or mishandled as "pets" by restaurant staff, before being dispatched to the cook pot when the next customer requests cat or dog meat as part of a meal. Cats and dogs are also reportedly kept on a leash so they don't catch the rats. In some villages close to rural farmland you see dogs being kept as barking watchdogs, but also kept as pets - in either case, until they reach a certain age when suitable for going into the cook pot.

Although you can purchase a simple breakfast bowl of noodles and green condiments from roadside eating places (Figure 45), almost every meal in China seems to be banquet style for breakfast, lunch and dinner. As you sit on your low stool or chair, various dishes are placed in the centre of the table or on a revolving glass plate... and every meal starts with a cup of green tea. In our hotel, we had a banquet meal at breakfast time with different dishes every morning, starting with the usual green China tea then a glass of warm sweet (reconstituted) milk and tasteless doughy breads or dim sums and other less recognisable food stuffs including what looked liked Dahlia bulbs. One particular item of breakfast cuisine that was missing was coffee… it was very scarce in this part of China. A lot of their popular meat dishes, such as pork ribs and chicken are served as bone pieces; this meat is simply just hacked or splintered into pieces and cooked in the wok - bone and all. I managed to break a tooth eating what I thought was a crumbed piece of pork that was actually all bone. There is sometimes very little difference between lunch time

and evening meal banquet items, except in the evening there is often more variety of alcoholic drinks in addition to the green tea. At lunch you get “pijoh” (beer) – rarely chilled – but in the evening, it might be chilled and you also have various spirit drinks they called wines, such as “white wine” (we would call it saké or rice spirit), rat wine or snake wine (Figure 46).

And another aside... we were being continually invited to Chinese meal banquets and taken to meet “important” people. We seemed to be treated a bit like royalty and were always invited to sample different and varied foodstuffs… quite a few of which are unpalatable to our western tastes. There were lots of banquets or eating functions and numerous toasts to make with visiting officials, local government people and provincial dignitaries who have traveled to our remote area to meet us – sometimes just from Bose (95km away), but often from Nanning (350km) and all the way from Guilin (750km). To make a toast, you would raise your glass of beer or white wine with a “gambeh” – until we learnt that gambeh meant “bottoms-up”, or sculling the drink in one go! At one of these functions, we were treated to a barbecue, by the *Chengbi River* that runs through this pretty mountain village of Lingyun. Dozens of barbecue stalls sit beside each other, with their little coal or charcoal burners under racks with skewers of lean meat: beef, snake, fish, frogs, "sparrows", pigs' penis (very tough), some sort of animal tongue and a very chewy chive-like bitter tasting green vegetable (Figure 47).

Everyday that we went caving, we were given a packed hotel lunch in a flimsy plastic bag: usually a boiled duck or chicken egg, some doughy sweetbread, a stick of processed ham, an apple or nashi pear, plus a bottle of water. In the cone karst limestone hills of NW Guangxi, most days were around 32-35 degrees; it was a dry heat, so you needed a good supply of bottled water just to walk to and from the caves. Fortunately the caves were generally cooler… around 19-20 degrees, but you still needed plenty of drinking water to explore caves and look for cave critters!

And finally… an anecdote about cave fauna and culinary practices in China

On several occasions during the expedition, I was on my own… searching for cave beasties while cavers were exploring, surveying or photographing in other sections of the cave. One such cave was *Shadong* (Sand Cave), about 15km north of Lingyun: with a huge entrance (Figure 26) above an inlet streamway leading to a multi-level system with upper level fossil passages and chambers above the active river passage. On one occasion in *Shadong*, I had an interesting experience, while leaning over one of the deep rimstone pools in upper level passages where back flooding occurs. I was nearly 1.5km into the cave, looking for crustaceans and other aquatic species with my collecting net and vials and heard someone whistling as they approached my position. Assuming it was another caver returning from their survey mapping or photography, I was surprised to see a local villager in T-Shirt, shorts and plastic flip-flop sandals, carrying a torch and small onion bag fishing net; it soon became apparent that we were competing for the same commodity: cave shrimps. (Incidentally, I tried to buy some flip-flop sandals in China and discovered they don't produce footwear over size 8 or 9.) I wanted to catch these cave shrimps to get them identified and further our scientific knowledge of this karst area, intending to preserve them in ethanol in collecting vials; the villager was catching the shrimps to eat, keeping them alive in a plastic bag of cave water. The villagers probably consider the cave crustaceans a delicacy. However, these were not just any sort of crustacean I was after; these were large decapod shrimps – in fact, quite rare blind palaemonids – possibly one of the first records from caves in China… and as it turned out, one of the first records of blind palaemonids from caves in Southeast Asia! The long and the short of it all, aided with my Petzl zoom headpiece, the chain-smoking villager was more deft as a fisherman with his onion bag net (Figure 33) than I was as a biologist with my professional net; he caught four shrimps ranging in size from about 6-9cm long and I only caught one, but mine escaped! However, he was impressed with my other catch: a 7-8cm long scutigerid centipede, which was crawling along the edge of the rimstone pool where he caught the shrimps!

Figure 47: *Chinese barbecue offerings: skewered meats include from L to R front row: chicken legs, bird, rat, pig’s penis, fish and prawns*.

And now the interesting bit… how to persuade him to part with his tasty morsels! The villager could speak no English and I could speak no Chinese, but I had my trusty Chinese dictionary with me, albeit Cantonese. I had already learnt by now that this was a predominantly Mandarin speaking region of China. The shrimp fisherman was from a Yao minority group village where they speak in Zhuang “tongue”, but fortunately for me, although spoken language and minority group tongues or dialects are different, the Chinese characters (or calligraphy) for words is the same all over China. So with a magnifying glass and torch to read the small print dictionary characters, my digital camera as a toy to show images of himself as a cave fisherman and exchanging Aussie tobacco “rollies” with his Chinese cigarettes, we eventually came up with the solution. We agreed to divide the catch, though it seemed to me that he was actually talking about cutting the specimens in half - down the middle - because some of the shrimps were larger than others! He then led me off to another part of the cave that we (cavers) had not seen before, to a deep pool below a cascade in the roaring underground river, but it was too turbulent and murky for any beasties.

Two hours later… we emerged from the cave and after a bit of haggling, gesticulating and arm waving, I managed to talk him into selling me all his catch. I had no coins with me… only two Chinese currency notes: a 5 yuan note and a 10 yuan note. Showing him each note in turn, I asked him how much he wanted and he put up two fingers, so I gave him both notes. I was pretty happy: four specimens of a blind cave shrimp never recorded before in China in exchange for 15 yuan (about $3.75 AUS), plus an apple and some processed ham from my hotel lunch kit. I felt a bit guilty about this, depriving him of his catch, but he seemed OK about it and before I could think twice he lumbered my heavy pack of caving gear on to his back and marched off at a very brisk pace. I found it difficult to keep up with him. He carried my pack along the dry streambed from the *Shadong* swallet entrance, then on to the 2 km long track uphill through terraced gardens and paddy fields back to the main (cement-paved) road (Figure 18) beside a village, where we cavers gathered and waited for our small bus for the half hour journey back to Lingyun Township.

Amidst the usual throng of curious on-looking villagers at our bus stop, I located the expedition interpreter who informed me that the mountain villagers in this remote area have an income of around 120-130 yuan ($30-32 AUS) a year. Even with the aid of the interpreter, there was some doubt about my financial arrangement in acquiring the shrimps. When the villager put up his two fingers, he may have been only asking for 2 jiao, something like 20 cents in Chinese monetary terms (equivalent to 5 cents AUS) or perhaps he was being ambitious and asking for 2yuan (about 50 ents AUS). Either way, I had just given him the equivalent of six weeks wages!

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