

CHINA CAVES PROJECT

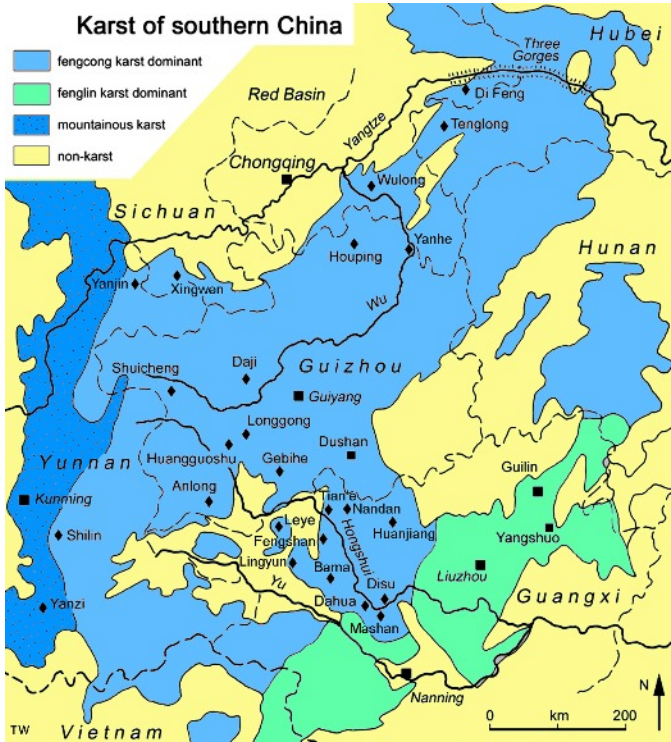
Details of the discoveries made by the expeditions, their achievements in Geomorphology, Biology, Archaeology, Expedition Medicine, Conservation, Construction and Development from the paper reproduced in part in our last journal journal. Written by GED CAMPION and TONY HARRISON

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The Project's discoveries

Carbonate rocks in China have an outcrop area of about 910,000km², and including areas covered by insoluble rocks they extend beneath more than 3.4 million km² (about one third of the country's land area). Given these statistics it is not surprising that both the number and the size of caves in China are staggering. Most are within the almost continuous karst outcrop of 0.5 million km² underlying Guizhou and Guangxi and their neighbouring provinces. According to current statistics there are 657 and 564 caves respectively in the provinces of Guizhou and Guangxi alone, and of these 13 have more than 10km of surveyed passages and 7 are more than 400m deep (Zhang, 2010). Most large caves with more than 5km of mapped passage have been explored by international teams since 1985, a significant proportion of these by cavers of the China Caves Project. The following accounts of the main explorations of the Project are listed (in alphabetical order) by Province, and within those, by County or region. Details are sparse for some areas for which expedition reports are yet to be written.



Chongqing Municipality

Prior to 1997 this major administrative region formed part of China's Sichuan Province. The China Caves Project has mounted expeditions to the region in 1994, 1996 (supported by a short reconnaissance visit during 1995), 1997, 1999 and 2002 with another trip now planned. The Hong Meigui Cave Exploration Society has also been highly active in Chongqing.

Province County/District/etc	Expedition date	Approx. number of caves located and explored	Approximate number of caves surveyed	Approximate total length of cave surveys	Main caves explored (with surveyed plan length/vertical range)	Notes	References
Chongqing							
Ba County (Ba Xian)	1994	4	2	1.4km	Lungci Dong; Wu Lu Keng Dong		Senior, 1995
	1994	18	6	7.8km	Xiaozhai Tiankeng (5.2km); Shrang Fong Dong (1km)		Senior, 1995
	1995				Reconnaissance trip		
	1996	6	6	11km	"Green Eyed Monster Cave" (c. 220m deep)		Lovett and Garman, 1996
	Dec 1997	?	?	?	Di Feng ("The Great Crack")	Too wet to make significant progress	
Fengjie County (Xin Long)	Oct 1999	?	?	>10km	Di Feng ("The Great Crack" and "Great Doline")		
	June 2002	?	?	?	Di Feng ("The Great Crack")	Very wet conditions	
Fuling District	1994	4	3	2km	Fu Lin Dong; Hei Long Dong		Senior, 1995
Hon Chi Ba region	1996	4	-		"Cold Wind Cave"		Lovett and Garman, 1996
Nanchuan District	Dec 1997	?	?	?	Caves on Yingfo Mountain		
Tongjin County	1994	2	2	0.7km	Rufu Dong		Senior, 1995
Wulong County (Jiang Kou)	1994	13	10	5km	Furong Dong; Xin Lou Kou Dong; Qikeng Dong; Dong Ba Dong		Senior, 1995
	1996	8	8	10km	Dong Ba Dong (to -400m); Dan Wan Dong; Da Dong; Mi Dong (to -200m); Chin Da Dong		Lovett and Garman, 1996
	June 2002	?	?	?	Qikeng Dong (to -550m)		
	Aug-Sept 2002				Qikeng Dong (to -707m)		
	Sept-Dec 2002	?	?	?	Qikeng Dong (to -920m); Dongba Dong (to -655m); Da Keng (to -100m)		Drake, 2005
	Sept-Oct 2003	c. 8	c. 8	?> 3.5km	Dong Ba Dong; Yan Feng Tuo Dong (2.5km); Da Keng (to about -560m)		Drake, 2005

Ba (Xian) County

Three members of the 1994 expedition team briefly visited this county to examine a series of cave features reported by the local government. One of these, Wu Lu Keng Dong, was quickly surveyed to a sump after 300m, but on the whole the area appeared to hold little of interest to cavers (Senior, 1995).

Fengjie County

At the town of Xin Long (also transliterated as Xing Long) the landscape reflects a geological structure dominated by asymmetrical folds and by continuous lowering of the base level dictated by the Chang Jiang (river). The rivers in the area have therefore incised spectacular gorges, and about 15 caves in the Tian Jing Gorge, many of which were also surveyed, were studied by the 1994 team.

A highlight of the expedition was the descent and exploration of the nearby Xiaozhai Tiankeng, believed to be the largest tiankeng in the world (Senior, 1995).

The subsequent 1996 expedition to the area was inhibited by very heavy rainfall and lack of gear, and new exploration was necessarily fairly modest. Nevertheless a number of caves were pushed further than their 1994 limits, including the Tau Yuan He Dong resurgence which was explored for a further kilometre to a sump, and the *Green Eyed Monster Shaft*, bottomed after 3 pitches, two of around 100m each (Lovett and Garman, 1996).

The main focus of effort in Fengjie over the years has been on *The Great Crack/Great Doline* system, a hydrological feature of world-class importance near Xin Long. "*The Great Doline*" is about 660m deep with, at its foot, a river flowing from an upstream cave and now diverted into a hydro-electric scheme. The upstream cave leads to a sink, Di Feng, beyond which is *The Great Crack*, a massive gorge.

The 1996 expedition had limited success in *The Great Crack*, flushed out by bad weather, and in 1997 water levels were also such that little progress was made. In 1999, however, despite tough conditions, *The Great Crack* was fully explored and 10km of surveys completed, including explorations upstream from *The Great Doline* and downstream from the surface end of *The Great Crack*.

A team was back in 2002 to attack Di Feng, the underground connection between *The Great Crack* and *The Great Doline*, but wet weather again prevented progress. An expedition is now in hand to complete the exploration of this area (following which a report of all the explorations around Xin Long over the years should be published).

Fuling District

The cone karst hills of the Huangcao Shan near Fuling, a major city of 1.6 million people on the Chang Jiang, were visited in 1994. Four caves were briefly explored and noted for further study (Senior, 1995).

Hong Chi Ba Region

This area was visited briefly by 5 members of the 1996 expedition who concentrated on two valleys cut in the 2000m-high karst plateau that covers the region. The caving potential of the area was assessed, including two shafts both descended for over 100m with promising depths below left unexplored (Lovett and Garman, 1996).

Nanchuan District

The 1997 expedition moved to Nanchuan for a few days after its time in Fengjie County for an exploration over a few days of the caves on the high limestone of Jingfo Mountain.

Tongjin County

The 1994 Ba Xian team spent only a day or so in this county, just west of Chongqing city, to explore a recently discovered cave. Disappointingly it was found to be only 260m long with little of interest (Senior, 1995).

Wulong County

The landscape around Jiang Kou is dominated by two major rivers, Wu Jiang and Furong Jiang. Jiang Kou village is on the east bank of Furong Jiang, and the major cave in the area is Furong Dong, part of which has been made into a show cave.

The 1994 team explored this beyond the show cave section for 550m to blockages, and also explored several shafts and caves near Tian Xing village, notably Qiken Dong and Dongba Dong, later found to be entrances to the massive Tianxing Dongxutong (Tianxing Cave System).

In 1994, perhaps the most interesting of the shafts explored in the Tian Xing area was Xin Lou Koyu Dong, 215m deep with an unbroken 143m pitch. A very brief reconnaissance was also carried out of caves nearer to Wulong city on the banks of the Wu Jiang; 5 caves were discovered, two of which (unnamed) are major resurgences with potential for further exploration (Senior, 1995; Lovett and Garman, 1996).

In June 2002, exasperated after thwarted attempts on Di Feng (*The Great Crack*) in Fengjie County, Brian Judd and some colleagues turned their attentions to the potential of the Tian Xing area, and a small team descended Qikeng Dong to a depth of -550m. Realizing that this cave had the potential to be the deepest in China, a small team returned in August of that year and pushed the cave to -707m, returning again in late 2002 to reach a final depth of -920m (Drake, 2005).

Since these visits, the Hong Meigui Cave Exploration Society has devoted a tremendous amount of attention to Tianxing Dongxutong, of which Qikeng Dong is a part, achieving a depth of -1020m in 2007 and connecting 7 separate entrances to the system (Lynch and Collis, 2003; Drake, 2005; Wade, 2007).

Guangxi Province

Province County/Prefecture	Expedition date	Approx. number of caves located and explored	Approximate number of caves surveyed	Approximate total length of cave surveys	Main caves explored (with surveyed plan length/vertical range)	Notes	References
Guangxi							
Bama County	1987/1988	c. 20	12	17km (of which 16km was in the Pan Yang cave system)	Hou Dong (3.5km); Qian Dong 1 and 2 (3.1km); Beimo Dong–Ren Xiang Dong (3.3km); Qiao Ban Dong–Limo Dong (3.4km)		Fogg and Fogg, 1988; Gill <i>et al.</i> , 1990
	1989	c. 15	c. 11	c. 19km	Da Yang Dong (1.2km); Xiao Shui Dong; Feng Dong (3.8km with 250m shaft).		Waltham and Willis, 1993
	Oct 1998					Recce by A Eavis and K Senior	
	Oct–Nov 2005	11	4	c. 3km	Hao Dong; Da Shan Dong; Lao Hu Dong; Long Wali Shaft		Campion, 2006; Bensley <i>et al.</i> , 2007
Duan County	1985	–	–	–	–	Mostly surface examination of hydrological sites	Waltham, 1986
	1987/1988	?	?	22 dives, with 5 to depths >7.5m	Da Xing resurgence; Bao An; Nong Nao		Fogg and Fogg, 1988; Parker and Newman, 1990
Fengshan County	1989	4	4	c. 15km	Gantuan Dong (4km); Ma Wang Dong (9.4km)	Explored from a base in Yueli village in Bama County	Waltham and Willis, 1993
	Mar 2004	15	4	10.7km	Jiang Jia Tao (250m deep); Jiang Zhou Dong (to 7.5km)		Bensley <i>et al.</i> , 2005
	Oct–Nov 2004	> 50	7	29.7km	Jiang Zhou Dong (to 29km); Green River Sink or Lu He Dong (3.1km); Mayo Li Dong (1.6km); Si Fang (1.5km)		Bensley <i>et al.</i> , 2005
	Oct–Nov 2005	c. 15	9	c.17km	Jiang Zhou Dong (to 38.5km); Zhong Ting Shaft; Da Dong, Long Shi Shaft; Maquai Dong; Long Luo Tiankeng		Campion, 2006; Bensley, 2008; Bensley <i>et al.</i> , 2007
	Oct 2010			c. 5km	Jiang Zhou Dong (to about 39km); Long Shi Dong (2.4km)		Harrison, 2011; Bensley and Harrison, 2012
	Spring 2012	2	–	–	Ma Wang Dong; Ban Dong	Prime objective: to assist National Geographic and ITV Anglia make a film	
	Mar 2013	5	5	c. 4km	Long Shi Dong (to 3.7km); Lu He Dong (to 4.4km); Jiang Zhou Dong (to 39.8km)	Objective: to seek links between Ma Wang Dong and the Jiang Zhou system	
Guilin Prefecture	1985	c. 20	14	26.6km	Guan Yan (3.8km); Xiaoheli Yan (2.8km); Chuan Yan (3.8km); Maliu Kang (2.6km); Hanzhu Yan (c. 2.5km); Shibangiao Dong (2.7km)		Waltham, 1986
Huanjiang County	Oct–Nov 2009	> 25	23	5.1km	Niao Yao Dong; Hu Tiane Dong; Ma Shan Dong; Dong Tan Dong; Gan Mei Shaft (321m deep); Shen Long Gong Dong	Most caves explored were vertical shafts	Bensley <i>et al.</i> , 2012
Leye County	2000	c. 15	7	9km	Dashiwei Tiankeng (1.1km); Fong Yen (1.0km, 407m deep); Xionajia Dong (east cave 1.6km, west cave 1.3km); Nupin Dong 1 (1.2km)		Campion, 2001
	2001	?	–	–	Bai Dong; Dacao Cave		Campion, 2003a
	Mar–Apr 2002	> 80	> 15	30km	Dashiwei Tiankeng (to 4.8km); Si Kow and Ai Dong (5km); Fong Yen, Tiankeng Dong, Labai Dong (all over 300m deep); Feng Dong, Da Ping Dong, Xin Dong (all over 100m deep); Fu Gui Dong (2.5km); Jia Guan San Dong, Lao Ying Dong (both over 200m deep)	Many horizontal caves and shafts explored, near the Dashiwei Tiankeng and its resurgence, and in 8 nearby areas. Outlying karst of Ma Dong also explored	Alker, 2003; Campion, 2003a; Campion, 2004a; Campion, 2004b
	Sep–Oct 2010	17	11	> 2km	Dashiwei Tiankeng; Ye Zhu Tuo; Di Shui Dong; Zhi Zhu Dong	Most caves explored were vertical shafts	Harrison, 2011; Bensley and Harrison, 2012
Lingyun County	2000	c. 15	12	8km	Shadong (2.9km); Penjiawen (1.7km); Xiashui Dong (0.7km)	Heavy rainfall hampered exploration	Campion, 2001a; Campion, 2001b
Mashan County	1988	4	3	15km	Jin Lun (7km); Gang Lei (7km); Nei Gang Dong		Fogg and Fogg, 1988; Fogg, 1990
Tian'e County	Feb–Mar 2004	22	11	8.5km	Ba Dong (2.0km); Cemetery Cave (1.3km); San Gui Shui Tiankeng (1.5m)	Exploration of a mix of vertical and horizontal caves	Bensley <i>et al.</i> , 2005

Bama County

The Bama karst, between the You and Hongshui rivers, comprises massive Devonian to Permian limestones in five broad domes separated by tight synclines of Triassic shales and sandstones. One of these domes, northwest of Bama town, drains from north to south to the Beimo resurgence. A second dome to the west (largely in neighbouring Fengshan County) drains from south to north to the San Men Hai resurgence where a short surface river across the shale outcrop carries the water just north of Yueli village before sinking into Da Yang Dong within the main Beimo catchment.

Bama, at that time one of the most remote parts of Guangxi Province, was a focus for a team from the 1987–1988 expedition that also visited two other counties in the province. In Bama the caves of the Beimo drainage system (also known as the Pan Yang system, from the river that flows south from Beimo into the massive Hongshui River) were the centre of attention, with 16km of passages surveyed in 8 caves, including Hou Dong, Qian Dong 1 and 2, and the extraordinary Beimo Dong (linked to Ren Xiang Dong) with its 200m high passages. The mapping and survey

work (both above and below ground) carried out by the team, which at the time had little or nothing in terms of Chinese topographical maps, provided an excellent framework for later visits by China Caves parties in 1989 and 2005 (Fogg and Fogg, 1988; Gill, *et al.*, 1990).

The China Caves Project team that returned to Bama in early 1989 was based in Yueli village, well north of the county town of Bama. Many of their explorations were in Fengshan County, and these are recorded in the appropriate section below. In Bama County the team concentrated on a series of caves along a fault zone in the limestone dome draining to Beimo. These were the Da Yang Dong river cave, the short Chushui resurgence cave, Xiao Shui Dong, which drains to the Weipo doline, and Dasuo Dong on the far side of the doline. Farther south, the expedition explored Feng Dong with a 250m-deep shaft dropping into 3.8km of passage linking to Chuifeng (Waltham and Willis, 1993).

Bama County was next visited by the Project in October 1998 in a short reconnaissance trip by Andy Eavis and Kevin Senior, and then again by the 2005 Guangxi expedition, which stopped in Bama town for just 4 days prior to moving for a longer visit to

neighbouring Fengshan County. Two of the caves explored during this stay were in or very close to Fengshan County, residing in the same limestone block as the Jiang Zhou Cave System, and so are covered in the Fengshan section below. The remaining time in Bama focused largely on the relatively small karst area to the west of Bama town where Bama's tiankengs (Hao Long and Jiaole) are situated. Both tiankengs were visited, as was the river entering Lao Hu Dong, which is believed to link to the river system under the tiankengs. This cave was surveyed for 4km to a sump (Campion, 2006; Bensley *et al.*, 2007).

Duan County

The karst catchment region of the Tisu River in Duan County (with an area of approximately 1000km²) was the scene of a short reconnaissance by 3 members of the 1985 China Caves expedition (Waltham, 1986). They examined a number of potential diving sites in the numerous flooded conduits draining the massive Tisu hydrological system to the Chiu Shui resurgence that were subsequently followed up by the 1987–1988 expedition in early 1988. This team, equipped with 2 compressors, 25 cylinders and 5km of diving line, visited a total of 15 sites and made 22 dives in 9 sinks or resurgences characterized by massive depth and extremely low visibilities (less than 4 metres being typical). Their finds included the Da Xing resurgence, dived to minus 76 metres, and many dives into potential passages between Bao An and Nong Nao, which are 9km apart (Fogg and Fogg, 1988; Parker and Newman, 1990).

Fengshan County

Fengshan County is extremely rich in karst, dominated by massive limestone of Devonian to Carboniferous age spreading from Fengshan town in the north into Bama County in the south. A cave-bearing sector in the east – the Qiaoyin and Xialijing drainage area – is separated from the Ma Wang and Jiang Zhou sectors in the west by a tight syncline, cored by Triassic sandstones and shales, with its axis trending directly north–south.

The 1989 expedition, based in Yueli village in northwestern Bama, spent much of its time across the county border exploring four caves in Fengshan west of the Triassic shales: Gantuan Dong, Ma Wang Dong, San Men Hai, and Chuan Dong (Waltham and Willis, 1993). Gantuan Dong, an ancient phreatic trunk route, stretched for almost 4km in a single large passage. The San Men Hai resurgence now provides an excellent show cave experience in boats or bamboo rafts, but above it lies the massive and intimidating Ma Wang Dong, the related relict series. This was explored for 9.4km to a small, remote, draughting exit in the south, Hei Dong. The team sensibly returned through the cave, rather than attempt an unknown, overland journey back to base. (The late 2004 expedition retraced much of this exciting through trip, attacking the system from both ends).

In 2004 the China Caves Project returned to Fengshan almost by chance. The February–March expedition was based in Tian'e County, north of Fengshan but, towards the end of the stay, the leader noticed characteristic cave symbols drawn on a Chinese map, in an area about 25km south of Fengshan

town. Two cavers went to investigate and literally walked into one of the entrances to the Jiang Zhou system with its vast passages seemingly going on for ever. About 7.5km of these were surveyed during the final few days of the expedition, with many leads left untouched.

When the Project returned in October 2004, Jiang Zhou was at the top of the agenda. A further 14km of mainly large relict passage were discovered and four entrances to the system located in 20 days of caving. Sporadic shafts gave access to the river system below but progress at that level was invariably blocked by mud sumps and collapses.

With so much still unexplored the Project was back in Fengshan within a year, in October 2005. Again the Jiang Zhou system, then thought to be the third longest in China (after Shuanghe Dong and Teng Long Dong), received much attention, especially the far reaches of Hijack Passage, the most remote part of the system, several hours from the closest entrance. By the end of the trip the system's surveyed length was 38.5km, making it the second longest in China at the time (Bensley *et al.*, 2005).

Effort on these 3 expeditions to Fengshan was not, however, limited to the Jiang Zhou system. In a few days in March 2004 the team explored about 15 other caves in the county, most of them close to Fengshan town, including Jiang Jia Tao (to the north of the town) with a 180m shaft and a total depth of 250m. Later in the same year the returning expedition also examined caves near Fengshan town including the series of sinks and resurgences of the Qiaoyin–Pan Yang river system, which runs from east of the town towards Jiang Zhou in the south, and a group of caves (including Dong Li Dong, Mayo Li Dong and Green River Sink) that lie between Ma Wang Dong and Jiang Zhou and which might eventually be key to connecting these systems. The late-2004 team also re-explored Ma Wang Dong including its southern entrance, Hei Dong. Similarly the 2005 expedition to Fengshan, although focusing on the Jiang Zhou system, gave some attention to other areas of the county. This included exploration (from Bama town as they are just in Bama County) of Hao Dong and Da Shan Dong, two well decorated caves which are very close to the southern sections of Jiang Zhou Dong; unfortunately no links were found between the three caves. Long Shi Shaft, first explored in 2004, was again visited and more passage surveyed. This important cave might eventually be part of a future connection between the Ma Wang Dong and Jiang Zhou Dong systems.

Maguai Dong, in the west of the county, was similarly extended, and Yu Long Dong (east of Paoli village), which has been almost completely desecrated by the "mining" of speleothems for sale by locals, was surveyed. A further "tiankeng" was discovered and descended: Long Luo near Pingle village. More correctly termed a "youthful tiankeng" or very large doline (as it fails to meet the formal tiankeng size definition), this shaft disappointingly closed down at its foot (Bensley *et al.*, 2007; Campion, 2005, 2006, 2008). The short visit to Fengshan by the 2010 expedition also focused on Long Shi, pushing its passages to a length of about 2.4km. A short period was also spent in the Jiang Zhou system, but very little was added to its previously explored horizontal length (Harrison, 2011; Bensley and Harrison, 2012).

Two years later, in 2012, China Caves Project members were back in Fengshan with other cavers and scientists helping the National Geographic organisation and ITV Anglia (a UK commercial TV franchise) to make a film about the development of the spectacular karst features of Fengshan and Leye. The China Caves team focused on Ma Wang Dong, and made efforts to explore the downstream section of the river which had not been visited previously; however, only 300m of river cave was conquered due to lack of time and logistical difficulties. A four-day underground camp was also set up in Ban Dong (midway between the entrances of Ma Wang Dong and Hei Dong) where a high-level cave was accessed by abseil but found to close down after 50m.

The Chinese-dominated March 2013 expedition to the county aimed to close the gaps between the 38km Jiang Zhou cave system and Ma Wang Dong (now about 12km long following recent diving and other extensions), that will eventually create a system of more than 60km. In a period of only a week the team made considerable progress, extending Long Shi Dong by over 1km southwards to a point very close to Terragoata Doline in the Jiang Zhou system, and also northwards towards Lu He Dong, which itself was extended still farther north and east towards Hei Dong, the southern entrance of Ma Wang Dong.

Guilin Prefecture

The first China Caves Project expedition in 1985 spent much of its time in the Guilin Prefecture. To the east and south of Guilin town is a sequence of north/south-aligned carbonates dating from the Middle Devonian to Lower Carboniferous, now much deformed and worn into remarkable fenglin and fengcong landscapes. As described in the “**Genesis of the Project**” section in our last journal, the expedition concentrated on three areas in the prefecture: around Haiyang in the east, the extensive Guanyan Cave system between Caoping and Nanxu, and the Xingping area in the south; the most important finds of the expedition there are outlined above (Waltham, 1986).

Huanjiang County

China Caves visited this county, some 200km from the Karst Institute in Guilin, just once, in 2009. The aim was to explore lower and middle Carboniferous limestones in and surrounding the Mulun Karst National Nature Reserve in the northwest of the county, adjacent to Libo County in Guizhou Province. Eight specific areas in or close to the reserve were explored, along with two other karst areas, the Wenja area to the east of the reserve and Nuan Hecun in the south of the county (close to Huanjiang town, the expedition's base).

Some 23 caves were surveyed, most of them vertical shafts. The Mulun, Xia Rong and Wenya areas were particularly productive. Wenya yielded its tiankeng (130m deep) and the superbly decorated Niao Yao Dong, Xia Rong the isolated Hou Gan Dong shaft with a large chamber at its foot, and Mulun the shaft of Xia Tan No.2 with a 132m, slightly off-vertical, pitch. The expedition highlight, however, was the descent over two days of Gan Mei Shaft, some 320m deep, in the far northwest of the county and approached by a long journey from Huanjiang into Guizhou and then back to the village of Gengba, close to the provincial border (Bensley *et al.*, 2012).

Leye County

Leye was first visited by the China Caves Project in October 2000, when some members of the Guangxi 2000 Expedition moved on there from Lingyun, a short distance to the south. The prime aim was to explore the Dashiwei Tiankeng and its underground river. The team was extraordinarily successful, exploring about 1.5km of the cave (and mapping 1.1km of this) in very wet conditions before being unable to proceed further due to the volume of water. The exploration involved numerous river crossings tackled by a mixture of swimming and Tyrolean traverses. The expedition also explored several other karst features in the region, including the descent of Fong Yen, an open shaft that proved to be 407m deep, and Xionajia Dong East and West caves that together were 3km long. The Nupin Dong river cave was also explored to just short of Hong Meigui Chamber (entered the following year). Other features examined in the limited remaining time available were the Luoja, Dacao, Shujia and Baidong tiankengs. A skylight just east of Dashiwei, Macqi Dong, was discovered and this was thought to lead to the Baidong underground river (Campion, 2001b).

A small China Caves team was back in Leye in 2001, and made notable discoveries in tiankengs adjacent to Dashiwei, including Bai Dong where the 260m pitch of Maoqi Dong was descended, and Dacao Cave with its world-class chamber was surveyed (Campion, 2003a).

Dashiwei Tiankeng itself had to wait until 2002 when the Project put together a strong team of 21 overseas cavers under the leadership of Andy Eavis to undertake a comprehensive review of this 500km² area of limestone and to attempt to follow the Dashiwei underground river to its resurgence. The expedition was extremely successful, and blessed by low water levels for much of the 2 months in the field. Down the Dashiwei Tiankeng river, the 2000 limit was soon reached and the water followed to its disappearance under a chamber wall. High-level passages beyond here led eventually to a shaft into the *Turbine Room* where the water was met again in an impassable waterfall. The survey indicated that 4776m of cave passage with a vertical range of 557m had been explored.

Attention then switched to the resurgence area, 20km to the north, where a number of truncated river caves and shafts were examined (including Si Kow and Ai Dong, together about 5km long), all ended in sumps and impassable risings. Eight areas around Dashiwei were then selected for examination; Yun Lai, Labia, Hua Ping, Homei, La Lai, Da Ping, Lao Shah and Pin Za. The latter two proved slightly disappointing, but the other 6 areas produced a vast array of mainly vertical shafts, most between 100m and 400m deep, unfortunately with little or no subsequent horizontal development.

The list of descents is too long even to summarize here, but notable among them were Labia Dong, with a depth of 400m, Tiankeng Dong near Hua Ping with a 172m free-hang, and Feng Dong near Da Ping, about 230m deep. Towards the end of the expedition a small team of 6 cavers made a 3-day exploration of a stand-alone limestone inlier well to the northeast of the Leye massif, called Ma Drong. Six caves were surveyed here (and more located), including Fu Gui Dong, a big sink cave 2.5km long (Alker, 2003; Campion, 2003a, 2004a, 2004b).

Leye County was again briefly visited by the China Caves Project in 2010, on the 10th anniversary of the Project's first visit to the area. Celebrations were the order of the day for much of the time but some caving was managed in between banquets and concerts. The small team focused on an area just to the south of the famous Dashiwei Tiankeng, which had not been visited by the earlier China Caves Project or other western expeditions to Leye. In total 13 caves were explored. The bulk of these were vertical shafts, some exceeding 100m in depth, but regrettably most had little horizontal development at the bottom. The most exciting find was Ye Zhu Tuo, a multi-shaft series of rifts that was not bottomed in the time available and which becomes a key target for a future team in the area (Harrison, 2001; Bensley and Harrison, 2012).

Lingyun County

Lingyun was visited by the Guangxi 2000 expedition for a period of four weeks or so in October of that year (some of the team moving on to Leye County, slightly farther north, about half way through the expedition).

Much of the time in Lingyun was spent trying to locate sections of the underground course of the elusive Shiyui River, which runs to the north of Lingyun town. Two caves in particular, Xiashui Dong and Sha Dong, yielded considerable lengths of passage. Some time was also spent south of Lingyun town, where large dolines dominate the landscape. Despite their successes – the expedition's surveyed plan length in Lingyun totalled about 8km and deep shafts had to be negotiated in many of the caves – the team felt that their explorations had been hindered by the fact that the erosion of Permian shales surrounding the karst area has caused considerable silting and blockages in many of the caves (Campion, 2001a, 2001b).

Guizhou Province

Province County/region/etc	Expedition date	Approx. number of caves located and explored	Approximate number of caves surveyed	Approximate total length of cave surveys	Main caves explored (with surveyed plan length/vertical range)	Notes	References
Guizhou							
Anlong County	1988	?	2	probably 22.6km	Ban Dong-Xinu-Chu Yan Dong (17.6km); Dragon Cave (c. 5km)		Lewis, 1988; Dunton and Laverty, 1993
	Mar–Apr 1989	?	3	c. 3.7km	Ran Jia Wan Dong-Chang Sha Dong (2.2km); Guo Jia Dong (173m deep)		Dunton, 1990; Dunton and Laverty, 1993
Anshun Prefecture	1985	5	4	c. 3.8km	Gan Dong (1.1km); Xian Ren Dong (1.1km)		Waltham, 1986
Guiyang Prefecture	1985	relatively few	1	-	Longtan Dong (275m deep)	Shafts explored	Waltham, 1986
Shuicheng County	1985	4	4	2.7km	San Cha He Dong (1.1km)		Waltham, 1986
	1987–1988	> 20	c. 14	probably c. 25km	Saguo Dong (3.4km); Wujia Dong (1.5km, 450m deep); Mu Cheng He Dong		Fogg and Fogg, 1988
Yanhe County	Oct–Nov 2008	57	23	26.4km	Chuan Dong (4.6km); Gan Dong (6.3km); Long Qiao Dong (3.3km)		Bensley <i>et al.</i> , 2010
Hubei							
Lichuan County	Oct 2006	c. 25 (including several sections of TLD)	23	18.5km	Teng Long Dong (TLD) system (7.5km); Gan Dong (3.0km)		Bensley <i>et al.</i> , 2008; Campion, 2011
Jianshi County	Oct 2006	4	4	2.3km	Xie Pan Dong (1km)		Bensley <i>et al.</i> , 2008
Jiangxi							
Wannian County	Nov 2006	c. 8	4	4.4km	Shen Nong Gong Dong (4.2km); Bian Fu Dong		Bensley <i>et al.</i> , 2008
Sichuan							
Xingwen County	1992	> 15	13	> 26km	Zhucaojing (8.8km); Tiencuan Dong (8.1km); Xia Dong (2.2km); Yanzi Luo Shui Dong (1.8km); Heping Dong (1.8km)		Waltham <i>et al.</i> , 1993; Waltham and Willis, 1993
Tibet							
Central Tibet	1992	"relatively few"	1?	"a few hundred metres" (longest cave: 50m)	Small caves found at 3 locations (Nam Co, Nilong and Perochi)	All caves found at greater than 4500m altitude	Waltham, 1993; Waltham and Willis, 1993
Yunnan							
Luxi County	Spring 1991	"limited"	at least 2	?	Alu Dong; Maoyin Dong		Waltham and Willis, 1993
Mengzi County	Spring 1991	c. 10	at least 5	> 6km	Nan Dong/Taoyuan Dong (2.5km); Shi Dong (3.3km); Zuomeidi Dong (208m deep)	Expedition involved cave diving	Waltham and Willis, 1993
Yanjin County	Nov 2013	6	3	c. 4km	Huangshan Dong (2km)		

Mashan County

Mashan County, lying on the right bank of the massive Hongshui River just south of Duan County, was visited by the 1987–1988 expedition. Areas explored south and southeast of the Mashan county town are fengcong karst with a maximum vertical range of 300m, and the expedition concentrated on two extensive caves – Jin Lun Dong and the Gang Zei River Cave. The former is a fascinating multi-entrance system some 7km long, with interconnecting passages on several levels and an immense chamber of 14,000m² in area. Gang Zei proved to be of a similar length, but of a very different character, with six entrances and much of the surveying carried out in boats (Fogg and Fogg, 1988; Fogg, 1990).

Tian'e County

Tian'e was visited in February and March 2004 by a small expedition of just 5 UK cavers, who spent 10 days based in Tian'e town (Bensley *et al.*, 2005). The county is dominated by the Hong Shui River, which cuts down through Triassic shales at Tian'e town, on the edge of a long chain of Devonian-to-Carboniferous limestone extending from a few kilometres north of the town into Fengshan County to the south. About 22 caves were explored (11 were surveyed), but only a few were able to deliver significant length or depth, with sumps or sediment infill commonly preventing progress. Two specific finds, however, are worthy of note. The first was Ba Dong, a relatively short cave about 2km in length, with a magnificent, decorated chamber over 200m in diameter (containing a huge 38m-high boss), which took several days to survey. The second was a new "tiankeng", the San Gui Shui Tiankeng near the village of Lao Pung, 226m deep. (When a formal list of all China's tiankengs was published later (Zhu and Chen, 2005), San Gui Shui's volume of 0.46Mm³ just failed to qualify and so strictly it is now termed a "large karst doline").

Anlong County

Anlong is about 220km from the provincial capital of Guiyang, with the Doshan area of the county comprising a sloping plateau of Triassic limestone with impressive collapse dolines and vadose shafts, including the An He closed depression with a number of cave entrances. Subterranean water courses in the area resurge at Si Fang in the east. The 1988 and 1989 teams focused initially on the Ban Dong–Xinu–Chu Yan Dong system, accessed from the An He Doline, which proved to be 17.6km long. Other caves surveyed include (in 1988) Dragon Cave, and (in 1989) Guo Jia Dong, with a 100m shaft leading to a large sloping chamber with no obvious way on, and Ran Jia Wan Dong – Chang Sha Dong, another relict system some 2.2km long (Dunton and Lavery, 1993; Lewis, 1988; Dunton, 1990).

Anshun Prefecture

Anshun Prefecture, which lies to the southwest of Guiyang, the provincial capital, contains outcrops of massive limestone of Triassic age. The area was visited by the 1985 reconnaissance expedition; details of their findings are listed in the “**Genesis of the Project**” section published last edition and are not replicated here (Waltham, 1986).

Guiyang Prefecture

As well as visiting Anshun and Shuicheng, the 1985 reconnaissance expedition spent a short time in the Longtan plateau region of Guiyang Prefecture. The main caving achievement in this area was the descent of Longtan Shaft, an unbroken vadose drop of 275m (Waltham, 1986).

Shuicheng County

This county lies on the Guizhou plateau to the west of the provincial capital Guiyang and is dominated by outcrops of Carboniferous age limestone hundreds of metres in thickness.

The area was first visited by the reconnaissance expedition of 1985, whose explorations are summarized in the “**Genesis of the Project**” section (Waltham, 1986); they are thus not repeated here. In 1987–1988 a China Caves Project expedition team of 9 British cavers returned to Shuicheng with the objective of trying to follow the underground course of the Fala He (River) between a sink near Fala village and its resurgence near Pan Long village 8km to the south. Saguo Dong and Mu Cheng He Dong, two of the links in the system, were discovered and surveyed, but fast-flowing unexplored sections of the massive river remained to be explored. Team members also tackled Wujia Dong, a short distance towards the west and part of the same drainage system, which was surveyed for one and a half kilometres, reaching a depth of 450m at an impassable syphon (Fogg and Fogg, 1988).

Yanhe County

The Project's expedition in 2008 was initially planned to be in Bijie County, in the west of Guizhou Province. However, at the last minute, Guilin's Karst Institute suggested changing the venue to Yanhe, a county in the far northeast of the same province. Not previously visited by a Western expedition, this proved to be an interesting choice, although the expedition's activities were commonly hampered by particularly persistent rainfall. The team explored about 50 caves spread throughout the county, which

borders the massive Wu Jiang (river) to the north and is endowed with several bands of Triassic and Ordovician limestone running the length of the county from southwest to northeast. The main discoveries of the team were two extensive, largely horizontal cave systems: Chuan Dong, on the banks of the Wu Jiang, and Gan Dong, in thick Ordovician limestone near the middle of the county. Lack of time prevented the full exploration of these caves, although more than 10km of passages were surveyed in them. Several species of cave fauna were examined in numerous caves in the county, including at least one species of beetle that is new to science (Bensley *et al.*, 2010).

Lichuan County

The China Caves Project was not the first overseas caving organisation to visit Lichuan. In 1987–1988 a large and strong Sino-Belgian expedition had explored the massive Teng Long Dong system, part of which is now an important show cave. In the early 2000s the system was regarded as the second longest in China with 33.5km of surveyed cave. However, in reality the Belgian team had explored a series of truncated active and relict sections of the underground river, not all of which had been connected to other parts. When the China Caves Project was invited to re-explore the area in 2006, the objectives were to link sections of this massive system if possible, and to expand knowledge of the area to support its possible designation as a geo-park. In the event, the 2006 cavers resurveyed and discovered about 7.4km of passage in Teng Long Dong, and made several more connections. The caving commonly involved often spectacular traverses along the vertical sides of the raging underground river, but the system remains one of largely unconnected sections with many sumps and impassable lengths of river between them.

Equally important was the team's exploration of nearby caves, mainly to the east of Teng Long Dong. These included Gan Dong, an essentially horizontal relict system explored for over 3km, and numerous caves around the Xiaoxi River, about 20km to the east of Lichuan town, the expedition's base. About 24 “new” caves were explored and more than 18km of passage surveyed (Bensley *et al.*, 2008; Campion, 2011).

Jianshi County

During the 2006 expedition to Lichuan County, the Guilin Karst Institute and local officials asked a small team of 3 British cavers to carry out a short reconnoitre within the neighbouring Jianshi County. Four caves were briefly explored during the course of four days, and the potential of the area for future exploration was assessed (Bensley *et al.*, 2008).

Jiangxi Province

Wannian County

At the end of the 2006 expedition to Lichuan County, six of the expedition's cavers travelled eastwards to Wannian County in the neighbouring Jiangxi Province to meet some old caving friends from Nanning, and to explore the Shennong Gong cave system. Part of this cave had already been opened as a popular show cave and, in a visit of only a week, the team were able to survey an additional 2km or so of passages beyond the show cave section and also explore two other entrances to the system (Bensley *et al.*, 2008).

Sichuan Province

Xingwen County

In 1992 the China Caves Project visited Xingwen County in Sichuan. The karst scenery here is dominated by a dramatic limestone scarp, riddled with caves (Zhu *et al.*, 1995). Many caves were explored and surveyed including Zhucaojing, a vast system comprising the remains of two relict trunk passages, now linked by a later streamway. Nine kilometres of cave were surveyed here, but lack of time and bad weather meant that many open leads remained. Tiencuan Dong, part of which had already been opened as a show cave, was also surveyed by the team, with a final mapped length of 8.1km.

Among many finds, Xia Dong was of particular geomorphological interest, because it comprises classic parallel rifts connected by dissolutionally enlarged phreatic tubes. Of equal interest was the exploration of the Xiaoyanwan Tiankeng (which holds one of the entrances to Tiencuan Dong). The team also examined nearby factories that produce sulphur by processing pyrite contained in Permian rocks that overlie the limestone; proposals were made to reduce pollution emanating from the factory waste heaps (Waltham and Willis, 1993; Waltham *et al.*, 1993).

Tibet

In 1992 a small team of 6 Project members made a brief survey of the limestone of the Tibetan Plateau but with only limited success in terms of finding karst features. Limestone in Tibet occurs just as thin bands or fault slices, most of it complexly deformed, and karst features are minimal because of the low rainfall, low temperatures and reduced chemical activity. Small caves were found at three locations in central Tibet, all at altitudes of over 4500m. These were at Nam Co, a lake to the north of Lhasa (where caves of up to 20m are found along joint weaknesses), at the village of Nilong, west of Lhasa (where Chagong Chimu with a 15m high entrance – but only 50m long – was examined), and farther south near the village of Perochi, where again small fissure caves exist. The most exciting cave prospects in Tibet probably lie in the far west of the region, around Rutog and Shiquanhe, but the area has not yet been visited by western cavers (Waltham, 1993; Waltham and Willis, 1993).

Yunnan Province

Luxi County

Yunnan Province has been visited by the Project only twice. In 1991 the karst features of Luxi County were examined briefly, including Alu Dong, in which a sump was dived beyond an extensive tourist cave (which includes a boat ride), and Maoyin Dong, with an impressive, impenetrable 80m water-filled shaft and river passage (Waltham and Willis, 1993).

Menzi County

In 1991 the main area explored was the Mengzi karst, just north of the Vietnamese border, where massive Triassic limestones form large plateaus around three broad basins. Nan Dong and its related show cave of Taoyuan Dong were visited on many occasions, resulting in a survey totalling 2.5km. Unfortunately for the team's diving members, the sump at the northern end of the

system had zero visibility; bad air also restricted exploration elsewhere in the system. The main plateau sink of Shi Dong was also explored through sumps into previously unentered open passage, followed for 3.3km to a second sump. A number of shafts were explored on the same plateau, one to a depth of 208m; unfortunately all proved to be choked (Waltham and Willis, 1993).

Yanjin County

Yunnan was visited again in late 2013 by a very small team that went to Yanjin County in the far northeast of the province. The expedition was only in the field for 10 days and so underground exploration was necessarily limited, but several caves were found and explored, including Huangshan Dong (Eel Cave), a through cave initially explored at both the sink and resurgence ends, which were subsequently linked and the cave surveyed.

The achievements of the Project

Geomorphology

Perhaps the most important geomorphological research to which the China Caves Project has contributed has been the identification and characterization of tiankengs. Tiankengs are giant collapse dolines, generally round or oval in plan, with diameters of 100 to 1000m and very steep (vertical or overhanging) walls greater than 100m deep (Zhu and Waltham, 2005; Waltham, 2005a). These were first identified in China by Professor Zhu of the Guilin Karst Institute, who has studied them intensively over many years. Forty nine tiankengs have now been found in the southern provinces of Guangxi, Guizhou and Chongqing, and many more similar features that are between 50 and 100m wide have also been located (Zhu and Chen, 2005). These latter features are also widely known as tiankengs, but are better referred to as "*large collapse dolines*". The most important tiankeng discoveries have been since 1994 when, while searching for a new exploration site for the China Caves Project, scientists from the Guilin Institute found Xiaozhai Tiankeng near the Yangtze Gorges, the largest tiankeng yet discovered in China. Dashiwei Tiankeng in Leye County (China's second largest tiankeng) and its surrounding group of 25 tiankengs were also discovered ahead of a China Caves Project expedition in 2001 (Zhu, Huang, Zhu and Chen, 2003). Descents of these and similar features elsewhere in Guizhou, Guangxi and Chongqing by Project cavers, and in some cases the exploration of their underground rivers, has enabled Professor Zhu and other geomorphologists to determine their probable mode of formation, identify their development environment, and speculate on their likely age (Zhu, Zhu and Chen, 2003).

China Caves Project members have also contributed more specifically to geomorphological queries arising from visits to China's tiankengs and other features of its karst scenery (Eavis, 2005). An example of these is the study of the collapse processes at the tiankengs of Xingwen, explored by the Project's expedition there in 1992 (Waltham, 2005b). Another is the use of water chemistry on samples from the Xingwen caves in Sichuan to determine the influence of sulphuric acid (from nearby pyrite deposits) on limestone dissolution and cave development (Bottrell, 1993). The development of caves in Fengshan County, Guangxi, has also received the attention of the Project, particularly after the discovery of the massive Jiang Zhou Cave

System in 2004–2005. Geological studies involving the analysis of water and rock samples (involving, in part, x-ray micro-analytical techniques) suggest that the large size of the horizontal cave passages in this system is a function of the favourable climatic conditions in Cenozoic times on relatively pure calcitic limestone, and not related to any influences from dolomitic limestone, gypsum, anhydrite or aragonite, as had previously been surmised (Campion, 2008; Dale and Harrison, 2008).

An interesting analysis carried out as a result of a China Caves Project expedition, which has contributed to scientific studies with a wider geographical range than China alone, was the 1992/3 examination of speleothems from Xingwen as recorders of palaeomagnetic secular variation over the last 10,000 years (Openshaw *et al.*, 1993). Palaeomagnetic studies of speleothems in the caves of Duan County, Guangxi were also carried out by the 1988 expedition, but samples were found to be only very weakly magnetised, proving it difficult to establish polarity magnetozones for use in geomagnetic dating (Noel, 1990).

Finally it is noted that nearly all China Caves Project members arriving in the country from overseas have been privileged to see fine examples of both fenglin (“tower karst”) and fengcong (“cone karst”) scenery. It is therefore fitting that the most authoritative paper on the definitions and modes of formation of these karst features has been written by one of the founders of the Project (Waltham, 2008).

Conservation

Conservation of karst landscape and of caves has always been high on the agenda of China Caves Project expeditions, and can be a real challenge in a country like China that is undergoing rapid economic development and infrastructure expansion. The issue is compounded in some regions by the fact that the “mining” of speleothems for hotel, restaurant and domestic decoration in parts of China, Japan and other parts of East Asia has been one of few reliable sources of income for local peasants (Price, 2006). Examples of this activity have commonly been seen by expedition members, such as the discovery, at the foot of a 170m vertical shaft (Long Shi) in Fengshan County (Guangxi), of a pile of cut stalactites wrapped in cling film and ready for transportation out of the region.

The solution is to persuade local authorities that preservation of caves and karst environments in their original state can lead to more reliable, long-term sources of income as show caves or related attractions for the growing domestic tourism industry (Zhu, 2001).

China has a vast array of show caves and the number is expanding all the time. The Project has worked for many years with the Guilin Karst Institute and other authorities to ensure that these are developed in a responsible and sustainable manner.

Since about 2000, China Caves Project expeditions have had an additional objective of providing data (in the form of cave surveys, geomorphological reports, etc.) to enable national and local authorities in the karst areas visited to obtain more formal protection of their environments by designation as international, national or provincial nature reserves, heritage sites or geo-parks. The most important and impressive achievement in terms of

conservation of karst areas was the June 2007 designation by UNESCO of South China Karst as a World Heritage site.

South China’s karst scenery spans half a million km², mainly in Guangxi, Guizhou and Yunnan provinces. The formal UNESCO designation is what is called a *coherent serial property* with 7 *components* in 3 *clusters*, these being in Libo County (Guizhou), Shilin Yi County (Yunnan) and Wulong County (Chongqing). Each “component” is a magnificent example of a specific type of karst scenery, including the Naigu Stone Forest in Shilin Yi, Xiaoqijong and Dongduo in Libo, and Furong Cave in Chongqing. Explorations by the China Caves Project between 1985 and 2005 played a not inconsiderable part in this important UNESCO designation. During 2013 the designation was being expanded to cover more regions, and China Caves Project discoveries are again an important background data source.

The geo-park concept – originally developed in Europe and given international recognition in 2004 when UNESCO launched its “**Global Geo-Park Network**” initiative – was quickly embraced by China, and several Project expeditions since 2004 have been geared specifically towards objectives of national or international geo-park designation for given karst areas. The most successful outcomes were the designations, in Guangxi Province, of a large area of Leye County as a national geopark in 2004, followed in 2005 by the same designation for part of Fengshan County, and subsequently the designation by UNESCO in October 2010 of a combined area of the two counties as a global geo-park encompassing 930km² of magnificent karst scenery including the Dashiwei Tiankeng and the Jiang Zhou cave system. Not only does this provide an incentive for the development of responsible tourism, which at the same time will raise local standards of living, but it puts in place an administrative framework within which the region’s outstanding karst scenery will be protected. Project expeditions to Lichuan County (Hubei) in 2006 and to Huanjiang County (Guangxi) in 2009 had similar objectives of obtaining or expanding geo-park or national park designations.

Biology

Since its inception in 1985, the China Caves Project has regarded cave biology as an important area of study. Indeed, the summary report of the Project’s early expedition to Guizhou and Guangxi in 1987–1988 has a section describing many cave-dwelling invertebrates observed, including centipedes, spiders and beetles (Fogg and Fogg, 1988). This was followed up by an extensive scientific paper on the troglomorphic and troglophilic species observed by the expedition in Guangxi caves, including a quantitative assessment of the effect of flooding, humidity and human impact on the number of various cave dwelling species (Fowler, 1990).

Surface species including mammals, birds, and reptiles have also featured prominently on various expeditions. Of particular interest was the discovery, by the 2002 Hidden River Expedition to Leye County, of two red-and-white giant flying squirrels (*Petaurista alborufus*) deep in the impressive shaft of Fong Yen Dong, the lower one being about 200m below the surface. These mammals, which glide from tree to tree in the tropical forests of eastern Asia, must have approached too close to the edge of the shaft and parachuted inescapably into the depths. They are an endangered species, on the IUCN Red List of Threatened Species, and as

such were duly rescued by team members, after a difficult time when trying to get the furious animals into tackle sacks for the long prussik out of the cave (Campion, 2003c). Reptiles have also featured frequently in China Caves Project explorations, examples being the discoveries of a 3m-long python (*Python molurus bivittatus*) several kilometres underground in Fengshan County and of a couple of nasty-looking rat snakes (*Elaphe moellendorffi*) down a 130m shaft in Huanjiang County, occasions that provided tense moments for some expedition members. The discovery of linsangs, porcupines and catfish in Tian'e and Fengshan counties in 2004 were also interesting expedition highlights, and numerous similar examples can be found scattered throughout virtually all expedition reports.

The Project's biological studies took a leap forward in 2000 with the recruitment to the Project of a biologist from the School of Zoology in the University of Tasmania, who specializes in the biodiversity and ecology of subterranean ecosystems. Nearly all of the reports of expeditions since 2000 include detailed appendices covering the troglomorphic biological studies of the expedition. Typical of the expeditions' discoveries are two new species of trechine beetle, one found in Bianfu Dong, Jiangxi Province, in 2006 (Ueno and Clarke, 2007), the other described from Gan Dong, Guizhou Province in 2008 (Tian and Clarke, 2012).

Archaeology

Caves in all parts of the world have attracted people for many thousands of years, providing permanent or temporary refuge and sites for burial or ritual. This is particularly evident in the caves of southern China, and the 1988 expedition to Guangxi Province studied archaeological remains in many caves in Duan and Bama counties. Striking features noted included an abundance of dry stone walling, the designs suggesting a defensive purpose (Roberts, 1990). Palaeomagnetic studies were carried out by the same expedition on archaeological fired sediments in some caves in Duan, and these gave indications of the period of use of the hearth areas and so of the occupational timescale of the caves (Noel, 1990).

Proposals for more systematic studies of the archaeology of caves during expeditions have been published (Roberts, 1986) but this has been a relatively neglected area of study on many China Caves Project expeditions. The 2005 expedition to Fengshan, however, also noted defensive walls in one of the entrances to the Jiang Zhou cave system, believed to date from the period of communist/nationalist conflict during the late 1920s (Bensley *et al.*, 2007, pp73–74). Numerous China Caves Project expeditions have found evidence of mineral extraction (including guano, saltpetre and coal) in China's caves, and several journals record details of such finds (see for example: Bensley *et al.*, 2008, pp70–72). However, a systematic analysis of mining in caves explored by the China Caves Project expedition teams has yet to be tackled.

Construction and Development

Prior to the establishment of the China Caves Project, cave studies in China were almost wholly devoted to economic requirements, particularly related to the harnessing of cave water for domestic and industrial supplies, irrigation and generating

hydroelectric power. One of the early – and still continuing – anticipated outcomes of Project's expeditions was an increase in knowledge of the hydrology of the karst areas explored, and over the years the Project can be said to have made a very acceptable contribution to this topic.

A typical example is the Project's expedition to the Mengzi karst of southern Yunnan in 1991, where exploration and survey of the caves helped to provide data to support the work of civil engineers in sinking wells (Waltham and Willis, 1993). Another typical example is the study of Guizhou's geomorphology by Zhang, Yang and He of Guizhou Normal University, and its implications for engineering in karst terrains, which built in part upon the observations of the 1985 China Caves Project expedition to the province (Zhang *et al.*, 1992).

During the past 20 years or so, China has enjoyed an unprecedented period of economic development. This has been supported by rapid expansion of its basic services and transport infrastructure, and the need to understand the geomorphology of karst areas to assist construction projects related to these activities continues to be important. Consequently the China Caves Project expedition teams have continued to recognize a primary or secondary objective of collecting and providing such information. A recent example, in this case of assisting local mining activities, took place on the Yanhe 2008 expedition, when the team was asked to examine highly contaminated water emerging from the partially mined (coal) Lao Yin Qin cave in the south of the county (Bensley *et al.*, 2010). Many similar examples can be found within the expedition reports and related papers.

Expedition medicine

Very few of the China Caves Project expeditions have included a qualified medical practitioner as a team member. The 1988 expedition to Guangxi was a notable exception, allowing a brief study of the incidence of histoplasmosis, a health risk commonly faced by cavers in tropical regions (Frankland, 1990).

It is perhaps relevant here to comment more generally on medical issues affecting China Caves Project expeditions. It seems that expeditions during which the presence of a doctor would have been beneficial usually did not have one on the team, but some of the expeditions without a medical presence did have some team members who suffered from various ailments and injuries! In these cases the Chinese medical service has usually stepped up to the mark.

One of the present authors recalls incurring, in 2005, a leg wound from a fall underground that became severely infected, and which was subsequently treated by daily injections of antibiotics at a local cottage hospital in western Guangxi. This treatment was completely effective, the only downside being that medical treatment in China is not free; at the end of the course the patient was presented with a bill for a total sum equivalent to just one pound sterling!

It is perhaps significant that the most serious mishap to occur on a China Caves Project expedition was on the surface, not in a cave. This was in Huanjiang in 2009 when a car containing four Chinese and British cavers overturned *en route* to a cave, with significant injuries to all the occupants. All made full recoveries.

The complete article in *Cave and Karst Science*, Volume 41, Number 2, August 2014 contains a wealth of photographs, far more than we can reproduce here. These are amongst the photos taken on these expeditions by YRC members.



The classic 120m-deep entrance shaft of Xin Dong in Leye County, Guangxi, which was descended during the spring 2002 expedition.
(Photo: Bruce Bensley)



The celebrated Dashiwei Tiangkeng in Leye County, Guangxi, photographed during the 2001 expedition to the region.
(Photo: Ged Campion)

Pools and speleothems in Hei Dong (Dark Cave), in the Datuo Tiangkeng area of Leye County, Guangxi, in 2010.
(Photo: John Whalley)





A group of team members at Dashiwei Tiankeng during the expedition to Leye County in Guangxi Province in spring 2002. (Photo: John Whalley)



Above the river in Teng Long Dong, Lichuan County, Hubei Province, in 2006. (Photo: John Whalley)

Below left Part of Chuan Dong (Through Cave) in Guizhou's Yanhe County, explored and surveyed in 2008. (Photo: John Whalley)

Below - A member of the 2006 Lichuan Expedition crosses the underground river in Teng Long Dong, Hubei Province. (Photo: Dave Williams.)

