

INTERNATIONAL TRAINING COURSE  
ON  
**KARST LANDSCAPE, GEOPARK, NATURAL  
HERITAGE, ENVIRONMENTAL GEOLOGY  
MAPPING AND DATA MINING**

Member of the Centre for Karst Hydrogeology, Branislav Petrović, BSc. Hydrogeologist, Research Assistant, took part in International Training Course on Karst Landscape, Geopark, Natural Heritage, Environmental Geology Mapping and Data Mining held in Nanning, China in the period from 20.9.2015. - 4.10. 2015. The course was organized by the International Research Center on Karst (IRCK) under the auspices of UNESCO and supported by *Institute of Karst Geology (IKG) of the Chinese Academy of Geological Sciences (CAGS); Department of Land and Resources of Guangxi Zhuang Autonomous Region; International Centre on Space Technologies for Natural and Cultural Heritage (HIST), UNESCO; International Knowledge Centre for Engineering Sciences and Technology (IKCEST), UNESCO - UNESCO Beijing Office; Chinese Geoparks Network*. CKH members, the second consecutive year are participating in the course organized by IRCK in China.

19 lecturers from 4 countries took part in the course and delivered 22 lectures to the participants, 14 lecturers were from China, 2 from USA, 2 from Indonesia and 1 from Denmark.



International Training Course on Karst Landscape, Geopark, Natural Heritage, Environmental Geology Mapping and Data Mining was attended by 37 trainees from 19 countries (China, Thailand, Cambodia, Philippines, Laos, Indonesia, Mongolia, Myanmar, Iran, Zimbabwe, Republic of South Africa, Australia,

USA, Mexico, Spain, Hungary, Romania, Slovenia and Serbia). Branislav Petrović, BSc Hydrogeologist, a member of the Centre for Karst Hydrogeology and a PhD student of the Department of Hydrogeology of the Faculty of Mining and Geology was representative of Serbia among the participants.



The course was organized to have lectures, to IRCK's experimental sites and one Geopark and in the end based on presentations about karst in their home countries and the topics of the course. The course was divided into 4 parts:

- Lectures in the WoMei hotel in Nanning, lectures were held in two blocks (block 1 that has lasted 4 days and, after a half-day break, block 2 that has lasted 2 days),
- Whole day break, that some participants used for a road trip to Detian Waterfall (on the border with Vietnam)
- Field trip to the Leye-Fengshan Global Geopark that has lasted 4 days, and
- 1 day Trainees' assessment.

Lectures have been presented in the following order:

*Block 1:*

1. Chinese Karst Geology and Karst Geomorphology Landscape - **Jiang Zhongcheng**
2. Geopark and Geo-heritage and sustainable geo-tourism - **Jayakumar Ramasamy**
3. World-wide Hydrogeological Mapping and Assessment Programme - **Jayakumar Ramasamy**
4. Mapping of Karst Geology Series Maps in China and Southeast Asia - **Zhang Fawang**
5. Asian Groundwater Resources and Environmental Geology Mapping - **Cheng Yanpei**
6. Chinese Karst Geology Data Base - **Shi Jian**
7. Hydrogeology and Environmental Geology Mapping in Karst Area 1:50.000 - **Zhou Lixin**
8. World Heritage Network and the South China Karst World Heritage Property - **Xiao Shizhen**
9. Protection, Management and Sustainable Development of World Heritage - **Xiao Shizhen**
10. Achievements of Chinese Geoparks' Development - **Zheng Yuanyuan**
11. Geoheritage Investigation and Evaluation - **Zhang Yuanhai**
12. Karst in the context of the World Heritage Convention - **Hans Thulstrup**
13. Ecological Civilization and Sustainable Development of World Biosphere Reserves - **Natarajan Ishwaran**
14. General and Chinese World Natural Heritage Situation - **Hong Tianhua**

## 15. Space Technology Application in Angkor Wat Monitoring in Cambodia - **Hong Tianhua**

### Block 2:

1. Big Data Management and Data Mining - **Chen Ling**
2. Searching Engine Technology in Knowledge Service - **Cao Xuejun**
3. Several Key Questions in the Shale Gas Industry Development - **Zhang Jinchuan**
4. Visualization of Geological Natural Heritages - Flying Dinosaurs - **Wang Zhangjun**
5. Introduction of Leye-Fengshan Geopark - **Erin Lynch**
6. Cave Model Visualization in 3D Karst Terrain GIS - **Stephen Michael Futrell**
7. Tourism and Karst - **Zhang Jie**

During field trip, experts from the IRCK firstly took participants to the experimental site for mitigation of deforestation processes. There, participants could see how some plant species could be used to improve agriculture of an area if it is used wisely, for example Dragon fruit - Pitaya.



Furthermore, participants have visited some of very beautiful scenic areas of the Leye-Fengshan Global Geopark, where for the first time were recognized *Tiankengs* – giant dolines/sinkholes. The park also have a lot of stone bridges, caves with enormous chambers, as well as hydrogeological active caves.



Dashiwei Tiangkengs was the first scenic area that participants visited, there they learned about process of tiangkeng development, their dimensions and locations. True tiangkengs have vertical, at least 100 m high walls, their diameter is at least 100 m. Bottom of true tiangkengs is comparatively flat and for most part is crossed by an underground river seen in daylight only at the bottom of tiangkeng. In this area limestone is at least 2500 meters thick, layers with small dip angle, and with a lot of vertical faults that have caused numerous tension cracks in the rocks. Furthermore, climate in this area is subtropical, high temperatures and abundant rainfall.

Tiankengs with Volume >10,000,000 m <sup>3</sup> 对比体积大于千万方的天坑									
No.	Name	Volume	Dimensions at Rim 坑口大小			Depth 深度(m)		Region	Country
序号	天坑名称	体积(Mm <sup>3</sup> )	长(m)	宽(m)	面积(ha)	最大Max	最小Min	地区	国家
1	Xiaozhai 小寨	119	625	535	27,4	662	511	Fengjie, Chongqing 重庆奉节	China 中国
2	Dashiwei 大石围	67,1	600	420	16,7	613	510	Leye, Guangxi 广西乐业	China 中国
3	Jiaole 交乐	67	750	400	22,0	283	140	Bama, Guangxi 广西巴马	China 中国
4	Xiaoyanwan 小岩湾	40	625	475	20,0	248	178	Xingwen, Sichuan 四川兴文	China 中国
5	Qinglong 青龙	31,7	520	200	19,4	276	195	Wulong, Chongqing 重庆武隆	China 中国
6	Crveno Jezero	30	450	400	14,0	528	431	Itmorski	克罗地亚
7	Minyé	26	350	350	7,5	510	400	New Britain	Papua New Guinea 巴布亚新几内亚
8	Mangily	25	700	500	28,0	140	100	Mangily	Madagascar 马达加斯加
9	Daocaokou 大槽口	25	920	240	14,0	220	160	Zhijin, Guizhou 贵州织金	China 中国
10	Wunung	24	500	400	16,0	160	150	New Britain	Papua New Guinea 巴布亚新几内亚
11	El Sotano	16	440	210	7,0	455	310	El Sotano	Mexico 墨西哥
14	Diaojing 吊井	12,6	290	280	8,6	170	145	Leye, Guangxi 广西乐业	China 中国
15	Kavakuna	12	380	300	8,0	480	360	New Britain	Papua New Guinea 巴布亚新几内亚
16	Daluodang 打锣洞	10,4	240	220	3,2	372	282	Wulong, Chongqing 重庆武隆	China 中国
17	Peruaçu North	10	450	200	8,5	170	130	Peruaçu North	Brazil 巴西

Participants saw two tiangkengs up close: Dashiwei (diameter 600x420 and depth 511-662 m) and Chuandong (diameter 310x270 m and depth 312 m); and several others during bus ride through Leye area.



28 tiankengs are located in the Leye area, because of this Leye was declared National park of nature and under protection of China government long before it becomes a part of Global Geopark.

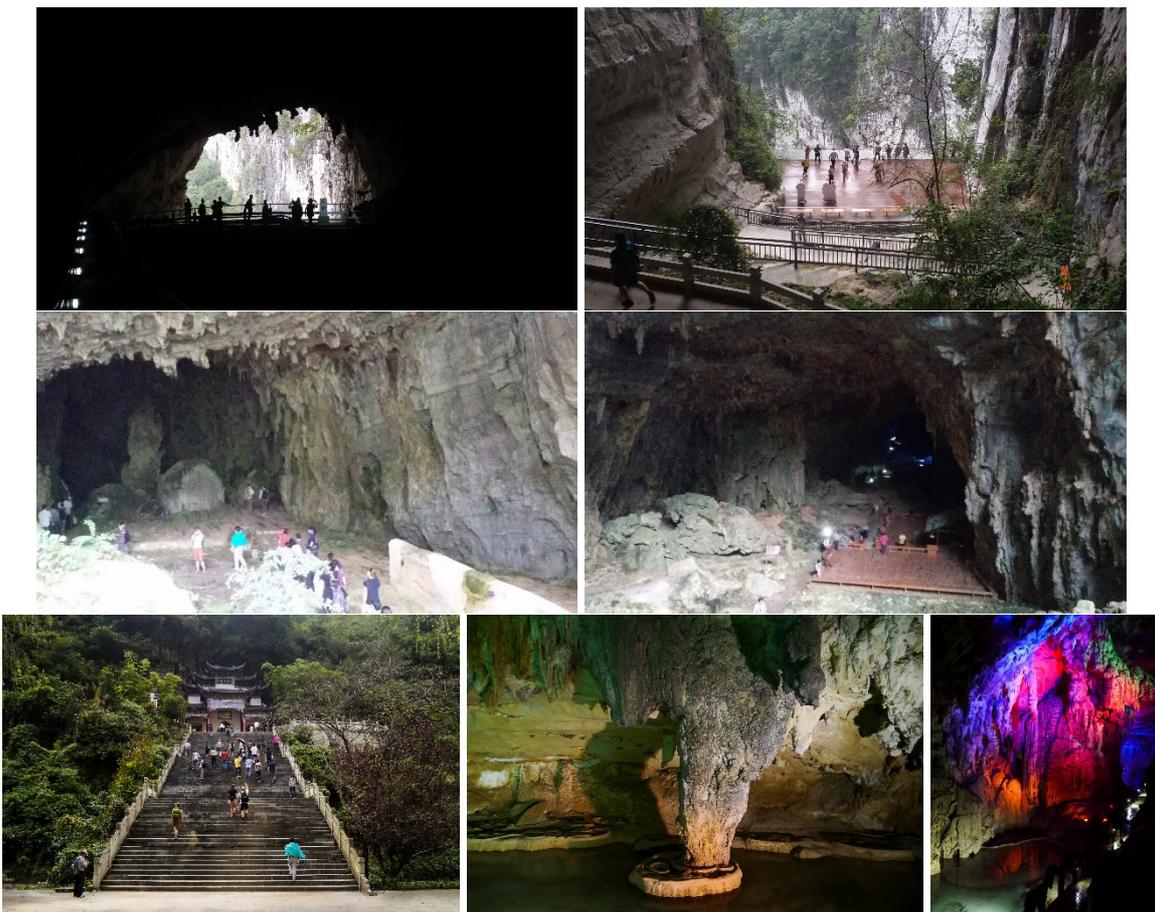
Between visits to the geomorphologic phenomena participants and organizers have visited Meijia Farmhouse Inn that is within Geopark boundaries. Thus, Meijia family needed to adapt to new conditions and sustainable use of natural resources in the park area. They provide for living with organic food production and meal preparation only with local spices, and government supports their touristic offer with some benefices.



In the end of the second day of the field trip participants and organizers have been guests of the Houmai Eco-village, where the main income now is organic food production and tourism, although their ancestors were involved in mining and timber.

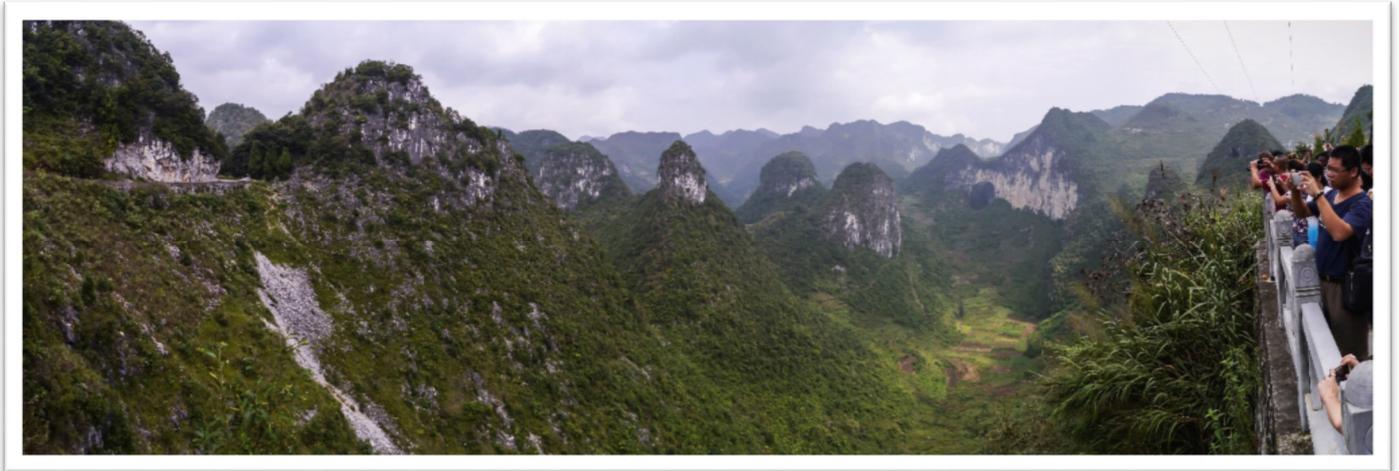


During this visit to geopark Leye area, participants could also see many other geomorphological landscape forms such as: Banyuedong cave, Chuandong cave, Luomeidong “Lotus” cave. Some of caves are only short passages for rivers under tiankengs while other are independent karst forms some still with hydrogeological function.





While traveling towards Fengshan area of the geopark, group stopped few times to see some other landscape forms such as stone bridge Mengli, enormous in its size.



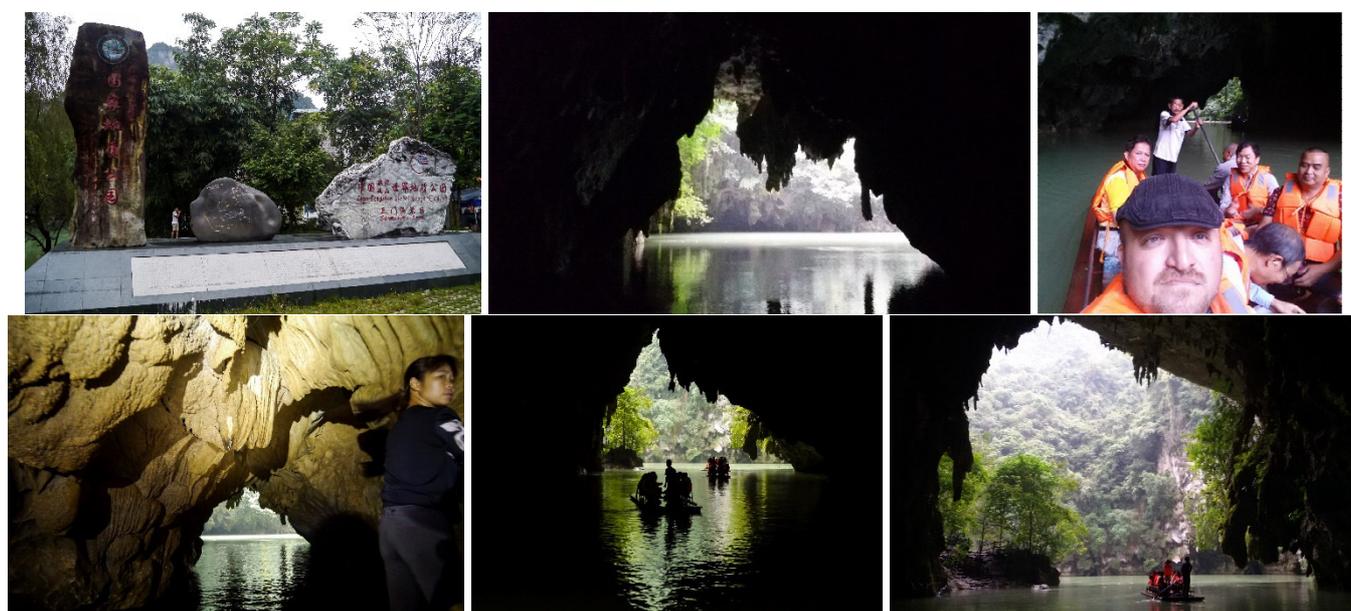
While staying in Fengshan area participants could see a specific morphology features, such as huge caves and underground passages. One of them Chuanlongyan - Fengyang pass (length 372 m and width 96~140 m, and height 35~47 m) has been used as a tunnel since ever, and now there is a geological museum, practice area for speleologists and a parking-lot.



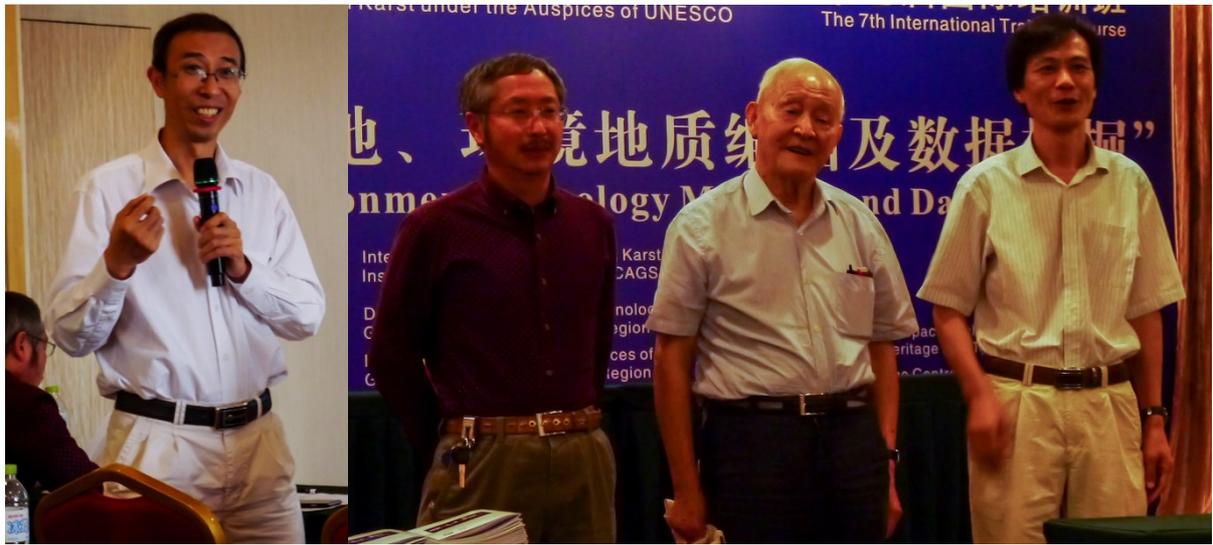
Yuan Yang dong (dong=cave) was the next on the list, there are two enormous chambers that are very rich in speleothems. One of the stalagmites is 36 meters tall.



Sanmenhai cave was the last place visited. That cave still has the hydrological function, it represents a place of resurgence of groundwater as the Poxin River. The Poxin River undergoes daily tidal fluctuations, rising by 20 centimetres at night. Owing to this tide cave got the name *Sanmenhai = three doors on the sea*.



On the last day all participants were obliged to prepare a 15 minutes presentation on karst geology, according to the topic of the training course and the karst development in their own country. Trainees' presentations were evaluated by the three-member committee assembled by the course lecturers: dr Jianhua Cao, prof. Xu Yongxin, dr Yuan Daoxian academician, and prof. Zhang Cheng.

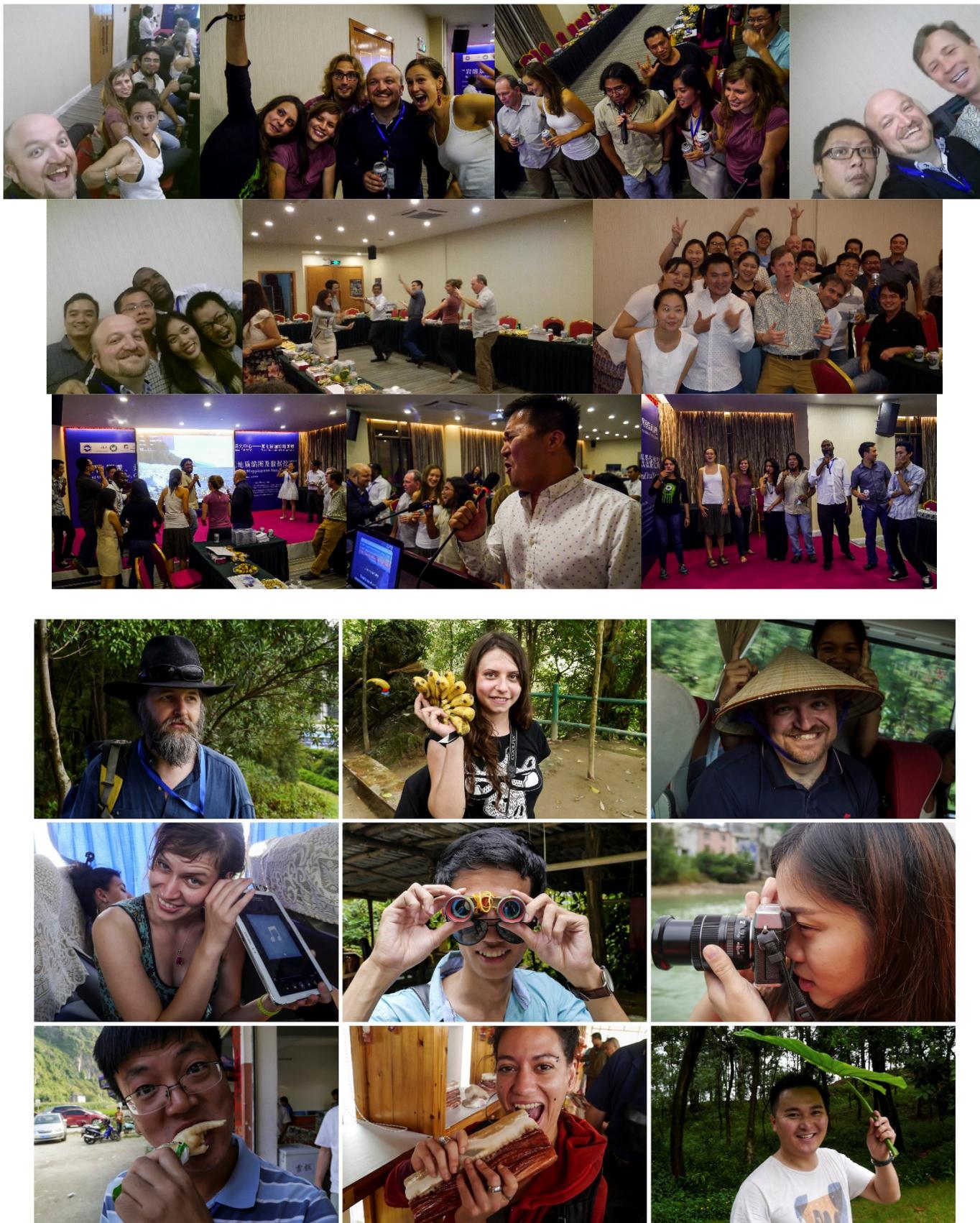




The closing ceremony was held in the afternoon. All attendants who completed the course received a Certificate of Attendance, and the most successful participants received Certificate of Excellence, among them was Branislav Petrović, a member of the Centre for Karst Hydrogeology



After the closing ceremony there was a small party with inevitable karaoke.



*Centre for Karst Hydrogeology member express big gratefulness to the International Research Center on Karst on invitation for attending the course, hospitality, acquired new knowledge and beautiful field trips. Special thanks is also extended to academician Dr Yuan Daoxian, Dr Liu Tongliang director of IRCK, Dr Cao Jinhua executive director of IRCK, as well as assistants in the IRCK Luo Qukan, Bai Bing, Yang Lichao.*