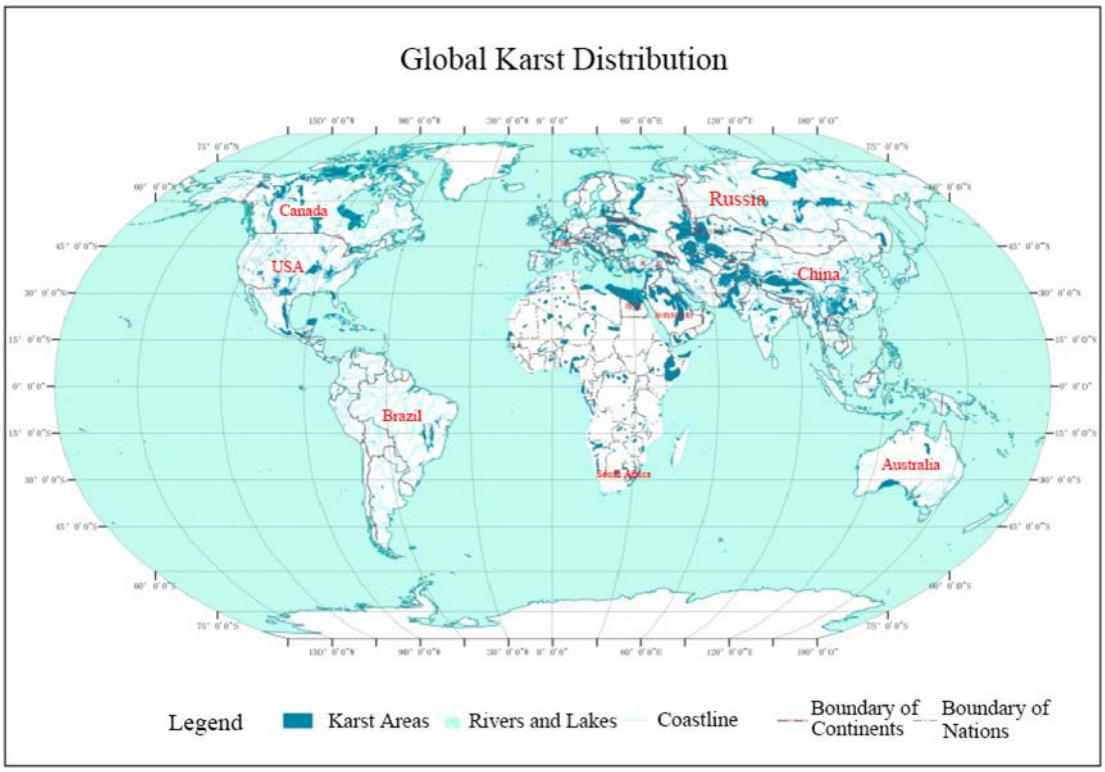
United Nations Educational, Scientific and Cultural Organization

联合国教科文组织国际岩溶研究中心
国际合作及培训成果汇编

International Cooperation and Training Achievements of International Research Center on Karst, under the Auspices of UNESCO



中国地质科学院岩溶地质研究所

联合国教科文组织国际岩溶研究中心

2016 年 4 月

导言

联合国教科文组织国际岩溶研究中心（中心）于 2008 年 12 月 15 日在中国桂林成立，是教科文组织赞助设立的第一个地学二类研究中心，也是在国际地学计划（IGCP）框架下成立的第一个二类研究中心。中心于 2013 年 11 月顺利通过由教科文组织聘请组成的专家评估组队岩溶中心的第一个 6 年工作进行评估。

中心自成立以来，广泛开展国际合作、初步建成信息共享平台，致力于在全球范围内更好地理解岩溶系统，以保持脆弱岩溶环境的良性生态循环，促进岩溶地区的社会和经济可持续发展。中心通过科学研究、出版活动和国际合作，促进岩溶动力学的发展，增进国际交流与往来，搭建一个有关岩溶动力学、岩溶资源可持续利用和生态环境保护的科学信息交流平台，并进一步提供咨询服务、技术信息、教育及培训，为制定和实施新的岩溶石漠化治理和生态恢复综合方案奠定基础。

中心的国际合作主要包括：举办国际教育培训班、与全球范围内合作单位签署合作协议、及共同开展国际合作项目。

Preface

International Research Center on Karst (IRCK), under the Auspices of UNESCO was established on December 15th, 2008 in Guilin, China. It is the first category II center concerning geosciences under the auspices of UNESCO and in the framework of the International Geoscience Programme (IGCP), and IRCK had successfully passed the first six-year review by the Experts Panel of UNESCO in November 2013.

Since the inception, IRCK extensively conducting international exchange and initially putting in place an information sharing platform. IRCK devotes itself to know the karst system further all over the world, to maintain a positive ecological cycle of the fragile karst environment, to accelerate the social and economic development in karst areas. IRCK, with the scientific research, publishing and international cooperation, promoted the achievements of karst dynamic, enhanced the international exchange, established a scientific information sharing platform on karst dynamics, karst resources sustainable utilization and ecological environment protection, and provided requiring service, technical information, education and training further, to lay the foundation of conduction and implementation of comprehensive scheme on karst rocky desertification management and ecology restoration.

The international cooperation of IRCK mainly includes the international training courses, signing cooperative agreements with cooperating organization globally and implementing the international cooperation project together.

目录 Contents

国际培训 International Training Courses

中心自 2009 年开始，每年举办一期国际培训班，目前已经成功举办了七届国际岩溶培训班。一共吸引了来自 33 个国家的 147 名学员参与，并且有幸邀请到来自 16 个国家（不含中国）的 35 位外籍一流专家前来授课。国际培训班是促成各类国际合作的最佳平台，通过培训班，一方面搭建技术传播平台，一方面促成双多边合作。此外，培训班还积极响应国家“一带一路”和平共建倡议，为沿线国家岩溶地质研究提供重要的技术支撑，目前，已惠及 18 个“一带一路”沿线国家。

Since 2009, IRCK has began to organize international training courses annually. So far, 7 international training courses have been held successfully. 147 trainees from 33 countries joined our training courses, and 35 professional foreign scientists and technicians from 16 countries (except China) were invited to give lectures. This training course is the best platform to promote international cooperation. For one hand, it served as a platform for science and technology on karst sharing, for the other hand, it helped to build a bridge for bilateral or multilateral international cooperation. Besides, the training courses also respond actively to the initiation of One Belt One Road by Chairman Xi Jinping. It served as a great support to karst geology study of One Belt One Road countries. So far, about 18 countries along this area have participated in the international training courses of IRCK.

2009-2015年国际培训班主题信息列表
List of Themes and Other Related Information about the International Training Courses from 2009 to 2015

期次 Sequence	主题 Themes	开班时间 Year/Duration	相关支撑/协助机构 Sponsors/Co-organizers	参与学员(人) Number of Trainees	学员涉及国别（国） Trainees Nationalities
第一期 First	岩溶水文地质与生态 Karst Hydrogeology and Karst Ecosystem	2009年/30天 2009 / 30 Days	商务部 Ministry of Commerce, China	17	8
第二期 Second	岩溶水文地质与碳循环 Karst Hydrogeology and Karst Carbon Cycle Monitoring	2010年/12天 2010 / 12 Days	国土资源部 Ministry of Land and Resources, China	17	11
第三期 Third	岩溶水文地质调查技术方法 Karst Hydrogeological Investigation Technology and Methodology	2011年/12天 2011 / 12 Days	国土资源部 Ministry of Land and Resources, China (MLR)	17	9
第四期 Forth	岩溶与水文地球化学 Karst and Hydrogeochemistry	2012年/12天 2012 / 12 Days	国土资源部/西南大学 MLR / Southwest University	20	11
第五期 Fifth	流域岩溶水文地质调查、动态监测与应用 Karst Hydrogeological Survey, Dynamic Monitoring and Application in River Basins	2013年/12天 2013 / 12 Days	国土资源部 Ministry of Land and Resources, China	21	18
第六期 Sixth	岩溶生态系统与地质微生物 Karst Ecosystem and Geomicrobiology	2014年/14天 2014 / 14 Days	国土资源部/中国地质大学（武汉） MLR / China University of Geosciences (Wuhan)	17	14
第七期 Seventh	岩溶景观、地质公园、自然遗产地、环境地质编图与数据挖掘 Karst Landscape, Geopark, Natural Heritage, Environmental Geology Mapping and Data Mining	2015年/14天 2015 / 14 Days	国土资源部/中国-东盟矿业合作论坛 MLR/ China-ASEAN Mining Cooperation Forum	38	20
合计 Summation		106天(Days)		147	33

2009 年岩溶水文地质与生态国际培训班

培训主题：岩溶水文地质与生态

Theme: Karst Hydrogeology and Karst Ecosystem

培训时间：2009 年 11 月 8 日至 12 月 5 日

Duration: 8 November to 5 December, 2009

培训地点：广西桂林、云南昆明

Avenue: Guilin, Guangxi & Kunming, Yunnan

由商务部主办，国际岩溶研究中心与岩溶所联合承办的岩溶水文地质与生态国际培训班于 2009 年 11 月 8 日至 12 月 5 日在广西桂林召开。

The Training Course on Karst Hydrogeology and Karst Ecosystem sponsored by the Ministry of Commerce of China and organized jointly by IRCK/IKG, was held from Nov. 8 to Dec. 5, 2009 in Guilin, China.

25 名国内外岩溶地质领域的著名专家学者应邀加入培训班讲师团，为学员们授课讲学。其中，国内专家 14 名，外籍专家 11 名，他们分别来自美国、奥地利、澳大利亚、加拿大、克罗地亚、德国、波兰、塞尔维亚和斯洛文尼亚共 9 个国家。招收学员共 17 人，他们分别来自埃塞俄比亚、印度、印度尼西亚、肯尼亚、秘鲁、罗马尼亚、乌干达和越南共 8 个国家，多为本国水文地质及岩溶环境领域的科研人员和政府相关部门的官员。培训包括课堂讲学、野外实践、综合分析和学员评估共四个部分。授课内容覆盖面广，基本涵盖了岩溶动力学、岩溶水文地质学和岩溶生态系统三个方面的内容。

Twenty-five renowned experts and specialists in the field of karst and geology research were invited to give lectures. Among them, there are eleven overseas lecturers from nine countries (i.e.

America, Austria, Australia, Canada, Croatia, Germany, Poland, Serbia and Slovenia) and fourteen Chinese lecturers. Seventeen trainees from the following eight countries: Ethiopian, India, Indonesia, Kenya, Peru, Romania, Uganda and Viet Nam are themselves hydrogeological and karst environmental researchers and officials of related governmental organizations in their own countries. There are four main parts of the course: lectures, field practice, field excursion and final evaluation test of the trainees. The lectures delivered at the training course cover a wide range of topics including karst dynamics, karst hydrogeology and karst ecosystem.

课堂教学 Indoor lectures

11 名外籍教员分别是：安德烈·迪克（波兰），克里斯·格洛夫斯、弗雷德里克·西韦尔斯、连严青（美国），德瑞克·福特（加拿大），艾瑞里·汉密尔顿史密斯（澳大利亚），娜塔莎·拉夫巴（斯洛文尼亚），奥格尼恩·博纳奇（克罗地亚），彼塔·米兰诺维奇（塞尔维亚），拉尔夫·贝尼什科（奥地利）和威赫穆·斯图克梅尔（德国）。14 名国内教员分别是：袁道先、蒋忠诚、王世杰、曹建华、郭芳、何师意、姜光辉、雷明堂、李强、刘再华、祁士华、王明章、汪进良和谢运球。

There are eleven lecturers from overseas： Andrzej Tyc (Poland), Chris Groves, Fredrick D.Siewers and Yanqing Lian (USA), Derek Ford (Canada), Elery Hamilton-Smith (Australia), Natasa Ravbar (Slovenia), Ognjen Bonacci (Croatia), Petar Milanovic (Serbia), Ralf Benischke (Austria) and Wilhelm Struckmeier (Germany). The fourteen Chinese lecturers are Yuan Daoxian,

Jiang Zhongcheng, Wang Shijie, Cao Jianhua, Guo Fang, He Shiyi, Jiang Guanghui, Lei Mingtang, Li Qiang, Liu Zaihua, Qi Shihua, Wang Mingzhang, Wang Jinliang, Xie Yunqiu.

野外实践 Field excursion

学员评估

Trainees' assessment

颁发结业证书

Awarding certificates

通过近一个月的学习，学员们不仅对国际和我国在岩溶水文地质和生态方面的研究成果和进展及研究方法等有了较全面的了解，还从不同侧面接触了中国的文化和习俗。大部分学员表示通过学习取得了很大的收获。此次培训为各国间进一步的合作与往来奠定了基础。

After nearly one-month's study and stay in Guilin, the trainees not only have had a deep understanding of the research development and approaches of the karst hydrogeology and karst ecosystem of China, but enjoyed the traditional Chinese customs and culture so that makes them much more understand China and Chinese people and paves the way for future cooperation of each other.

培训班闭幕式合影

Group photo at the closing ceremony

2010 年岩溶水文地质与岩溶碳循环监测国际培训班

培训主题：岩溶水文地质与岩溶碳循环监测

Theme: Karst Hydrogeology and Karst Carbon Cycle Monitoring

培训时间：2010 年 11 月 29 日-12 月 10 日

Duration: 29 November to 10 December, 2010

培训地点：广西桂林

Avenue: Guilin, Guangxi

由联合国教科文组织国际岩溶研究中心、中国地质科学院岩溶地质研究所联合主办的“岩溶水文地质与岩溶碳循环监测”国际培训班于2010年11月29日~12月10日在桂林举办。17 名来自亚洲、非洲、欧洲、南美洲和大洋洲 11 个国家的学员进行了为期两周的培训。

The International Training Course on Karst Hydrogeology and Karst Carbon Cycle Monitoring, which was organized by IRCK/IKG, was held in Guilin, China from November 29 to December 10,, 2010. 17 course participants from 11 countries of Africa, South America, Oceanic, Europe and Asia enjoyed this 12-day training in Guilin, China.

袁道先院士讲授岩溶动力系统并介绍中国岩溶

Prof. Yuan Daoxian was giving a lecture on karst dynamic system and introducing karst in China

Wolfgang Drebrodt 教授回答学员提问

Prof. Wolfgang Drebrodt was answering questions raised by trainees

此次培训围绕中国岩溶水文地质概况、中国岩溶地下水资源评价与管理及岩溶碳循环监测评价技术和方法等三个主题，针对地下水相关的环境问题、岩溶含水层保护、岩溶塌陷、碳汇、碳储等学术热点，进行了专业讲座和野外调研活动。一方面使学员了解了中国的岩溶水文地质现状及世界范围的岩溶科学进展，另一方面通过学员报告及评估活动，加深了对不同气候、地质背景下的岩溶特征的认识；不仅在学术层面，更在不同国家的文化层面上增进了多方的了解与沟通。

This training course was based on the following three main aspects, karst hydrogeology of China, assessment and management of karst groundwater resources in China and technology and methodology of karst carbon cycle monitoring. Lectures and field investigations focused on relevant research hotspots such as groundwater-related environmental problems, karst aquifer

protection, carbon sink, karst collapse and carbon capture and storage. During this period, the course participant improved their understanding of the research status of karst hydrogeology in China as well as the karst scientific advances on a global scale. Also, the trainees' presentation and assessment provided a good chance for all the people involved to deepen their knowledge of karst in various climatic and geological settings so that multilateral communication and understanding have been enhanced not only in the academic level, but social and cultural levels.

野外实践 Field excursion

教员与学员在本次培训期间进行了广泛的交流；交流并获悉了国际岩溶研究领域新认识，如巴西岩溶和第纳尔岩溶；学员对岩溶碳汇研究及其评估测量方法产生了浓厚兴趣；通过教员的授课，传播并普及了岩溶动力学理论、其功能及主要研究成果；巩固了已有合作；通过面向广大发展中国家的岩溶专业课堂教学及野外实地考察，普及了岩溶知识，交流了合作项目的申请办法。

During this training course, lecturers and trainees had an intensive communication among course participants. Ideas and new trends of international karst research were exchanged, and the karst in Brazil and Dinaric karst were learned. Trainees had strong interest in the research of karst carbon sink and its investigation approaches. Knowledge on karst dynamics, its functions and main achievements were widely spread by the well prepared lectures. The existing cooperation was strengthened. Through the lectures and field practice, the trainees from developing countries acquired karst science and prepared the international cooperation proposals.

参观中国岩溶地质馆

Visit to the Karst Museum of China

颁发结业证书

Awarding certificates

讲师名单

序号	姓名	职务/职称	单位	教授课程
1	Augusto Auler	所长/研究员	巴西岩溶所	巴西洞穴岩溶概述之潜在环境研究；学员评估
2	曹建华	国际岩溶研究中心常务副主任/研究员	国际岩溶研究中心/岩溶所	中国岩溶碳汇项目进展；学员评估
3	姜光辉	副研究员	国际岩溶研究中心/岩溶所	中国西南岩溶区的干旱与洪涝问题
4	蒋忠诚	国际岩溶研究中心学术委员会委员/研究员	国际岩溶研究中心/岩溶所	尧山考察；学员评估
5	雷明堂	岩溶所地质灾害防治中心主任/研究员	国际岩溶研究中心/岩溶所	岩溶塌陷地质灾害监测
6	李国敏	研究员	中国科学院地质与地球物理研究所	岩溶水文模型
7	刘再华	国际岩溶研究中心学术委员会委员/研究员	中国科学院地球化学所	岩溶作用与碳汇
8	Mitja Prelovšek	博士后研究助理	斯洛文尼亚岩溶所	斯洛文尼亚岩溶及第纳尔岩溶水文地质特征
9	Rick Fowler	研究员	美国西肯塔基大学霍夫曼环境研究所	岩溶水质分析与微生物DNA测试技术；学员评估
10	Thierry Bussard	博士/水文地质学家	瑞士纳莎泰尔大学水文地质与地热研究中心	岩溶区地下水保护基本方法及其脆弱性评价；学员评估
11	王维平	教授	济南大学资源与环境学院	含水层回灌技术
12	Wolfgang Dreybrodt	国际岩溶研究中心学术委员会委员/教授	德国不莱梅大学	碳酸盐岩的溶解与沉积；石笋的生长与形态
13	Xu Yongxin	国际岩溶研究中心学术委员会委员/教授	南非西开普大学自然科学系	学员评估
14	姚玉鹏	处长/研究员	国家自然科学基金委员会地球科学部地质学科处	国家自然科学基金委员会地质科学项目与国际合作
15	袁道先	国际岩溶研究中心学术委员会主任/研究员，院士	国际岩溶研究中心/岩溶所	岩溶动力学概论；岩溶水文地质学概述；学员评估
16	章程	国际岩溶研究中心秘书长/研究员	国际岩溶研究中心/岩溶所	岩溶IGCP与联合国教科文组织国际岩溶研究中心；中国西南岩溶水环境问题；学员评估
17	郑洪波	副院长/教授	南京大学气候与全球变化研究院	硅酸盐的风化作用与碳循环

List of the lecturers

No.	Name	Position/Title	Affiliation	Lecture
1	Augusto Sarreiro Auler	Director/Research Fellow	Institute of Karst, Brazil	An overview of caves and karst in Brazil with emphasis on "karst" in low solubility rocks; Trainee assessment
2	Cao Jianhua	IRCK Executive Deputy Director/ Research Fellow	IRCK/IKG	Introduction of the projects on karst process and carbon sink; Trainee assessment
3	Jiang Guanghui	Associate Professor	IRCK/IKG	Problems of flood and drought in karst area in southwest China
4	Jiang Zhongcheng	IRCK Academic Committee Member/Research Fellow	IRCK/IKG	Field work on Yao Mountain; Trainee assessment
5	Lei Mingtang	Chief of Geological Hazards Research Division, IKG/ Research Fellow	IRCK/IKG	Monitoring and forecasting of karst collapse (sinkhole) geohazard
6	Li Guomin	Research Fellow	Institute of Geology and Geophysics, Chinese Academy of Sciences	Numerical modeling for groundwater flow in karst aquifer
7	Liu Zaihua	IRCK Academic Committee Member/Research Fellow	Institute of Geochemistry, Chinese Academy of Sciences	A new direction in searching for the atmospheric CO_2 sink; Atmospheric CO_2 sink: silicate weathering or carbonate weathering?
8	Mitja Prelovšek	Postdoctoral Research Assistant	Karst Research Institute at ZRC SAZU, Slovenia	Hydrogeological characteristics of Classical and Dinaric karst
9	Rick Fowler	Research Fellow	Hoffman Environmental Research Institute, Western Kentucky University, USA	DNA analysis of bacteroides to quantify fecal contamination and identify its source; Trainee assessment
10	Thierry Bussard	Hydrogeologist	Center of Hydrogeology and Geothermy (CHYN), University of Neuchâtel. Switzerland	Groudwater protection: general approach and vulnerability assessment in karst areas; Trainee assessment
11	Wang Weiping	Professor	School of Resources and Environment, University of Jinan	Introduction to managed aquifer recharge
12	Wolfgang Dreybrodt	IRCK Academic Committee Member/Professor	University of Bremen, Germany	Dissolution and precipitation kinetics of limestone; Stalagmites, chemical kinetics of calcite deposition, and climate
13	Xu Yongxin	IRCK Academic Committee Member/ Professor	Faculty of Natural Sciences, University of the Western Cape, South Africa	Trainee assessment
14	Yao Yupeng	Director / Research Fellow	Earth Sciences Department, National Natural Science Foundation of China	An introduction of the earth science programs in NSFC and inte rnational collaborations
15	Yuan Daoxian	IRCK Academic Committee Director/Research Fellow, Academician	IRCK/IKG	Origin, structure and function of the Karst Dynamic system; Karst Hydrogeology; Trainee assessment
16	Zhang Cheng	IRCK Secretary-General/ Research Fellow	IRCK/IKG	IGCP299, 379 & 448, 513, 20 years of world karst studies; Water environmental problems in southwest China karst region; Trainee assessment
17	Zheng Hongbo	Deputy Director/Research Fellow	Institute for Climate and Global Change Research, Nanjing University	Silicate rock weathering and carbon cycle; Carbon capture and storage (CCS)

闭幕式合影 Group photo at the closing ceremony

2011 年岩溶水文地质调查技术方法国际培训班

培训主题：岩溶水文地质调查技术方法

Theme: Karst Hydrogeological Investigation and Methodology

培训时间：2011 年 11 月 21 日-12 月 2 日

Duration: 21 November to 2 December, 2011

培训地点：广西桂林

Avenue: Guilin, Guangxi

“岩溶水文地质调查技术方法”国际培训班于 2011 年 11 月 21 日-12 月 2 日在桂林举办，有来自加拿大、美国、中国、瑞士、印尼等 5 个国家的 16 名教员，来自越南、巴西、尼日利亚、印度、印尼、泰国、罗马尼亚、埃塞尔比亚和中国共 9 个国家的 17 位学员进行了为期两周的专业培训。

The International Training Course on Karst Hydrogeological Investigation Technology and Methodology was held from November 21 to December 2, 2011, in Guilin, China.17 geo-environmental trainees from 9 developing countries (Brazil, Ethiopia, India, Indonesia, Nigeria, Romania, Thailand, Vietnam and China) took part in this training.16 lecturers from 5 countries (America, Canada, China, Indonesia, Switzerland) participated in this training courses.

袁道先院士与 Derek Ford 教授进行授课讨论

Academician Yuan Daoxian and Prof. Derek Ford giving lectures and discussing

此次培训以基础性和实用性并重、系统授课与前沿研究讲座相结合为原则，围绕岩溶水文地质调查技术方法主题，从岩溶动力学理论与实践、岩溶地下水监测与地球物理探测和示踪技术、水文地质填图、地下水资源开发利用与管理、岩溶作用与碳循环等方面，进行了专业培训、系列讲座和野外调研活动。一方面使学员们了解到岩溶水文地质基本调查技术方法及世界范围的岩溶科学进展，另一方面通过学员报告及评估活动，加深了对更多不同气候、地质背景下岩溶特征的认识；不仅在学术层面，更在社会及文化层面上增进了国内外多方的了解与沟通。

With the principle of combining basic research and practical application, and integrating systematical lectures and reports on karst frontier research, the IRCK provided this two-week professional training course with focus on the theory of karst dynamic system, karst groundwater

monitoring, geophysical methods and tracing techniques, hydrogeological mapping, underground water resources exploitation and management, karst processes and carbon cycle. During this training course, most of the participants have had a better understanding of the current research situation of karst hydrogeological investigation technology and methodology in China as well as the karst scientific advances on a global scale. On the other hand, the section of trainees' presentations and assessments provided a good chance to deepen and broaden the karst knowledge in various climatic and geological settings, so that multilateral communication and understanding have been enhanced not only in the academic level, but social and cultural levels.

考察丫吉岩溶试验场

Field trip in Yiji Experimental Site

考察寨底岩溶水文地质基地

Field trip in Zhaidi Karst Hydrogeological Base

通过培训授课展示了我国岩溶的地域优势与现状、水文地质与岩溶研究领域取得的丰硕成果，更交流并获悉了国际岩溶研究领域新趋势；

IRCK served as a platform for Chinese karst researchers to present their achievements in karst hydrogeology research. On the other hand, brilliant ideas and new trends of international karst research were exchanged among different countries.

通过国际大师级岩溶学者 Derek Ford 教授和袁道先院士的悉心授课和对岩溶学经典理论深入浅出的解析，以及在讲座和野外教学实践岩溶水文、地质环境工作方法，传播并普及了岩溶动力学及相关岩溶科学理论，及主要研究成果；

The karst dynamics theory and major problems on karst environment and resources, the functions of karst dynamic system and main research results were widely spread by the well-prepared lectures of the invited top karst scientists, such as Prof. Derek Ford and Prof. Yuan Daoxian, and field practice concerning karst hydrogeological, geophysical methods and application.

巩固了已有的合作，增进了合作潜力。Eko Haryono 博士是印尼噶迦玛达大学地理学院地理与环境科学系主任，2009 和 2010 年连续参加了两次中心培训，并促成中心与该校地理学院于 2010 年 3 月签署了有关热带岩溶研究及管理领域的双边合作备忘录，今年他又来到桂林与中心科研人员合作开展石笋测年研究，并积极参与中心活动，受聘为培训班讲师为学员介绍了印度尼西亚岩溶管理政策；

This training activity strengthened the existing cooperation. Dr. Eko Haryono, Head of Geography and Environmental Science, Faculty of Geography, Gadjah Mada University in Indonesia participated in the IRCK training courses successively in 2009 and 2010. Under his assistance, the MOU between IRCK and Faculty of Geography, Gadjah Mada University towards a partnership

on tropical karst studies and management was signed in March, 2010. In late 2011, he came to Guilin again, together with Dr. Asmono M. Sc. From the Center for Research and Development, Indonesia Meteorological Climatological and Geophysical Agency, to cooperate with IRCK researchers on stalagmite dating study. Besides, he actively participated in the IRCK training course and served as a lecturer to give a presentation on karst management policy in Indonesia.

多数学员对岩溶水文地质调查技术方法产生了浓厚的兴趣。来自罗马尼亚环境林业部生物多样性研究处的高级顾问 Samad John Smaranda 博士更提出希望联系罗马尼亚相关科研单位与国际岩溶研究中心开展岩溶洞穴方面和合作研究及联合考察。来自埃塞俄比亚地调局的水文地质研究员 Demis Alamirew 先生来函表示希望与中心合作开展中非岩溶区水文地质项目合作；通过面向广大发展中国家的岩溶专业课堂讲学及研究基地展示、野外工作方法演示，传播了岩溶环境保护知识，深化并拓展了双边及多边国际合作与交流。

Most of the course participants expressed their interest in karst research and would like to conduct relevant collaborative projects with IRCK. Dr. Samad John Smaranda, Senior Councilor of the Biodiversity Directorate, Ministry of Environment and Forests of Romania, proposed to contact relevant research institutions in Romania to make cooperative links with IRCK in the field of karst cave research and joint caving. Mr. Demis Alamirew, Senior Hydrogeologist of the Groundwater Resource Assessment Department, Geological Survey of Ethiopia, presented his intention to have a collaboration project with African climatic and geological set particularly in Ethiopia. The IRCK welcome these proposals and prepared to have extensive discussions with them.

闭幕式合影

Group photo on the closing ceremony

教员名单

序号	姓名	性别	职务/职称	单位	教授课程
1	袁道先	男	国际岩溶研究中心学术委员会主任/研究员，院士	国际岩溶研究中心/岩溶所	岩溶动力学理论与实践；学员评估
2	曹建华	男	国际岩溶研究中心常务副主任/研究员	国际岩溶研究中心/岩溶所	国际岩溶研究中心介绍，毛村野外考察
3	Derek Ford	男	国际岩溶研究中心理事会成员/学术委员会委员/教授，院士	加拿大麦克麦斯特大学	The development of patterns of meteoric water (Hypergene) cave conduit systems; The empirical linear relationships between electrical conductivity and TDS in bicarbonate and sulphate waters；学员评估
4	Eko Haryono	男	系主任/教授	印尼噶迦玛达大学地理学院地理与环境科学系	印度尼西亚岩溶管理政策
5	何师意	男	研究员	国际岩溶研究中心/岩溶所	水文地质化学监测及数据分析原理；化学示踪剂第一部分：无机盐、气体示踪剂，分别取样和实验室技术；化学示踪剂第二部分：荧光染料、分析法、实验室技术及应用；寨底野外考察
6	甘伏平	男	研究员	国际岩溶研究中心/岩溶所	岩溶地质物理野外技术及其应用；寨底野外考察
7	郭芳	女	副研究员	国际岩溶研究中心/岩溶所	岩溶地下水监测与水化学数据评估；岩溶地下水管理与保护
8	姜光辉	男	副研究员	国际岩溶研究中心/岩溶所	岩溶水文作用及其环境影响；丫吉野外考察
9	蒋勇军	男	教授	西南大学地理科学学院	人类活动对岩溶过程碳汇的影响；学员评估
10	蒋忠诚	男	国际岩溶研究中心学术委员会委员/研究员	国际岩溶研究中心/岩溶所	岩溶水资源调查与开发利用；岩溶作用与碳循环及岩溶碳汇估算；学员评估

11	刘再华	男	国际岩溶研究中心学术委员会委员/研究员	中国科学院地球化学所	中国西南岩溶系统地球化学变化及其与碳循环和环境变化研究的联系；学员评估
12	蒲俊兵	男	助理研究员	国际岩溶研究中心/岩溶所	硫锶同位素在地下水资源调查中的应用
13	Rick Fowler	男	研究员	美国西肯塔基大学WATERS实验室	Quantification and characterization of bacteriodes 16S rDNA in three karst watersheds in southwest China；学员评估
14	唐建生	男	研究员	国际岩溶研究中心/岩溶所	大比例尺岩溶水文地质填图野外工作方法
15	Thierry Bussard	男	博士/水文地质学家	瑞士纳莎泰尔大学水文地质中心	Groundwater protection: quantitative and vulnerability approaches；学员评估
16	汪进良	男	助理研究员	国际岩溶研究中心/岩溶所	毛村野外考察
17	易连兴	男	研究员	国际岩溶研究中心/岩溶所	寨底地下河系统研究基地及其水文地质条件分析；寨底野外考察

List of lecturers

No.	Name	Position/Title	Affiliation	Lecture
1	Cao Jianhua	IRCK Executive Deputy Director /Research Fellow	IRCK/IKG	IRCK introduction; Field practice in Maocun Karst Experimental Site
2	Derek Ford	IRCK Governing Board and Academic Committee Member /Emeritus Professor, Academician	School of Geography and Earth Sciences, McMaster University (Canada)	The development of patterns of meteoric water (Hypergene) cave conduit systems; The empirical linear relationships between electrical conductivity and TDS in bicarbonate and sulphate waters; Computer simulations of groundwater flow in karst terrains; Trainee assessment
3	Eko Haryono	Head of Geography and Environmental Science /Professor	Karst Research Group, Faculty of Geography, Gadjah Mada University (Indonesia)	Karst management policy in Indonesia

4	He Shiyi	Research Fellow	IRCK/IKG	Introduction to observation and processing of hydrogeochemical data; Chemical tracers I: inorganic salts, gas tracers and respective sampling and lab technology; Chemical tracers II: fluorescent tracers, analytical methods, lab technology applications; Field practice in Zhaidi Hydrogeological Monitoring Site
5	Gan Fuping	Research Fellow	IRCK/IKG	Introduction of geophysical methods and applications in karst areas; Field practice in Zhaidi Hydrogeological Monitoring Site
6	Guo Fang	Associate Researcher	IRCK/IKG	Introduction to karst groundwater monitoring and hydrochemical data evaluation; Karst groundwater management and protection
7	Jiang Guang hui	Associate Researcher	IRCK/IKG	Karst hydrology and its impact on environment; Field practice in Yaji Karst Experimental Site
8	Jiang Yongjun	Professor	Southwest University (China)	Impacts of human activities on karst process and carbon cycle; Trainee assessment
9	Jiang Zhongcheng	IRCK Academic Committee Member, IKG General Deputy Director/Research Fellow	IRCK/IKG	Karst water survey and exploitation in southwest China; Atmospheric CO_2 sink of karst processes in China; Trainee assessment
10	Liu Zaihua	IRCK Academic Committee Member/Research Fellow	Institute of Geochemistry, Chinese Academy of Sciences	Geochemical variations in the karst systems of SW China: implications for the carbon cycle and environmental change study; Trainee assessment

11	Pu Junbing	Assistant Researcher	IRCK/IKG	Sulfur and Strontium Isotope in karst groundwater
12	Rick Fowler	Research Fellow	WATERS Laboratory, Western Kentucky University (USA)	Quantification and characterization of bacteriodes 16S rDNA in three karst watersheds in southwest China; Trainee assessment
13	Tang Jiansheng	Research Fellow	IRCK/IKG	Large-scale karst hydrogeological mapping in field work
14	Thierry Bussard	Hydrogeologist	Center of Hydrogeology, University of Neuchâtel (Switzerland)	Groundwater protection: quantitative and vulnerability approaches; Trainee assessment
15	Wang Jinliang	Assistant Researcher	IRCK/IKG	Field practice in Maocun Karst Experimental Site
16	Yi Lianxing	Research Fellow	IRCK/IKG	Zhaidi underground river system research base & its hydrogeological condition analyses; Field practice in Zhaidi Hydrogeological Monitoring Site
17	Yuan Daoxian	IRCK Academic Committee Director/Research Fellow, Academician	IRCK/IKG	Origin, structure and function of the Karst Dynamic system; Trainee assessment

2012 年岩溶与水文地球化学国际培训班

培训主题：岩溶与水文地球化学

Theme: Karst and Hydrogeochemistry

培训时间：2012 年 11 月 25 日-12 月 7 日

Duration: 25 November to 7 December, 2012

培训地点：重庆

Avenue: Chongqing

由国际岩溶研究中心主办，西南大学、联合国教科文组织北京办事处和国际地学计划项目 IGCP/SIDA 598 协办，“岩溶与水文地球化学”国际培训班于 2012 年 11 月 25 日-12 月 7 日在重庆举办，来自斯洛文尼亚、巴西、美国、西班牙、中国等 5 个国家的 21 名教员，来自匈牙利、斯洛伐克、罗马尼亚、越南、巴西、埃塞俄比亚、马来西亚、泰国、印度、印尼、肯尼亚等 11 个国家的 20 名学员进行了为期两周的专业培训。

The 4th IRCK International Training Course on Karst and Hydrogeochemistry, co-sponsored by the Southwest University, the UNESCO Beijing Office and UNESCO-IUGS IGCP/SIDA 598, was held in Chongqing, China from November 25 to December 7, 2012. 21 geo-environmental researchers and managers from 11 developing countries (Hungary, Slovenia, Romania, Vietnam, Brazil, Ethiopia, Malaysia, Thailand, India, Indonesia and Kenya) participated in this training. 21 scientists working in karst science from 5 countries (Slovenia, Brazil, America, Spain and China) joined in this training course as lecturers.

此次培训班比较系统地讲授了岩溶水化学数据分析、评价与建模、碳水钙监测方法与数据解译、稳定同位素地球化学、土地利用与水化学，包括的专题有岩溶与岩溶资源及其分布，岩溶动力学概念、功能与工作方法，岩溶碳循环与地质环境工作方法等。培训班强调了岩溶知识基础性、实用性和可操作性相结合，侧重方法展示和实效评估。培训形式分为室内授课和室外实习，注重学员的实际操作和专业演练。达到了预期的课程设计目标。此次培训班一方面为国际岩溶水文地质最新知识的传播以及探讨岩溶区普遍面临的水资源与环境问题提供了一个良好的平台，另一方面也为开展多边国际合作创造了良好条件。

Systematic lectures on karst hydrochemistry data evaluation and modeling, monitoring methods of carbon, water and calcium in karst areas and the data interpretation, staple isotopic geochemistry, land use and hydrochemistry were provided in this training course. Special topics on karst, concept, functions and research methods of karst dynamics, karst resources and distribution, and karst carbon cycle and geological environment research methods were also arranged. This training course emphasized the integration of basic, practical and operational knowledge, and highlighted the karst research methodology and trainee assessment. The training had both indoor lectures and field practice, focusing on trainees’ practical and professional operation. It is believed that the desired training targets have been achieved. This training course, on the one hand serves as a good platform for the spread of international karst hydrogeological knowledge and the discussion of the water resources scarcity and environmental problems in most karst areas, on the other hand provides a good condition for multi-lateral international research cooperation.

特得依·斯拉贝教授讲授岩溶学发展

Prof. Tadej Slabe giving a lecture on karstology

巴托洛梅·安德里奥教授讲授岩溶地下水保护

Prof. Bartolome Andreo giving a lecture on Protecting groundwater in karst media

举办一年一度的国际培训班是中心能力建设的重要组成部分和有效手段。对传播岩溶水文地质知识，探索水资源和环境问题解决途径，加深相互了解和开展进一步合作具有积极作用。

To organize international training course annually is a great component and an effective means for building capacity of IRCK, playing a positive role in the spread of karst hydrogeological knowledge, the exploration of effective ways to resolve water and environmental problems, and deepening mutual understanding and further cooperation.

通过培训展示了中国、斯洛文尼亚、西班牙等国家的岩溶特色与研究现状，以及水文地质与岩溶研究领域取得的最新进展，共享了调查研究技术方法;

Through the IRCK training course, the karst features, research status and latest study advance in hydrogeology and karst in China, Slovenia and Spain are introduced, and different investigation technologies and methodologies are shared.

交流并获悉了国际岩溶研究领域新趋势，如越南学员邓泰茹玉（Dang Tran Nhu Thuy）和印度尼西亚学员阿哈麦德·赛依雅迪（Ahmad Cahyadi）分别介绍了越南下龙湾自然遗产与河江省岩溶区和爪哇岛日惹特区的Gunungsewu岩溶区石漠化和人口增加带来的污染和管理等问题，肯尼亚学员鲁凯（Sila Onesmus Nzung'a）和埃塞俄比亚学员阿坝汉姆·概布莱拉萨斯·吉卜力（Abrham Gebreslassie Gebre）则分别分析了本国水净化技术和不当废弃物处理带来的严重岩溶水污染问题等等;

This training activity contributes to the communication and exchange of international new trends in karst research. For example, Ms. Dang Tran Nhu Thuy from Vietnam introduced the Halong Bay natural heritage site and the Hagiang Karst Plateau. Mr. Ahmad Cahyadi from Indonesia introduced the Gunungsewu karst area near Yogyakarta Special Province. They also talked about issues such as karst desertification and the pollution and management problems with population increase in those places. Moreover, Mr. Sila Onesmus Nzung'a from Kenya and Mr. Abrham Gebreslassie Gebre from Ethiopia analyzed the water treatment technologies and severe karst water contamination caused by improper waste disposal in their countries respectively.

芙蓉洞考察

Furong Cave visit

参观重庆地质博物馆

Chongqing Geological Museum Visit

巩固已有的合作，增进合作潜力。国际岩溶研究中心与斯洛文尼亚科学与艺术研究院岩溶研究所拥有长期以来的友好合作关系，双方于 2010 年 2 月签订合作意向备忘录。在本届培训班举办期间，中心成功邀请了斯洛文尼亚岩溶所所长特得依·斯拉贝教授和马丁·克仁研究员加入培训讲师团为学员授课，交流岩溶科学研究经验，讲授斯洛文尼亚最新岩溶研究成果。

This training course strengthens the existing international collaboration. IRCK and the Karst Research Institute, Scientific Research Centre of the Slovenian Academy of Sciences and Arts have long-term friendly collaborative relationship. In February, 2010, both sides signed a MOU for further cooperation in future research projects, training courses and student education. The Karst Research Institute Director Prof. Tadej Slabe and Senior Researcher Dr. Martin Knez joined in this training course lecturer group and introduced the research progress of karst in Slovenia.

参观西南大学地理科学学院实验室

Visiting the laboratories of the School of Geographical Sciences of Southwest University

教员名单

序号	教员姓名	职务/职称	单位	教授课程
1	袁道先	国际岩溶研究中心学术委员会主任/研究员，院士	国际岩溶研究中心/岩溶地质研究所	国际岩溶研究中心/岩溶所介绍；岩溶碳汇研究概况；生物岩溶和岩溶生态系统
2	Bartolome Andreo	教授/主任	西班牙马拉加大学水文地质中心	岩溶地下水保护；学员评估
3	Ben Miller	副研究员	美国西肯塔基大学霍夫曼环境研究所	岩溶区地下水示踪应用技术方法与案例研究
4	曹建华	国际岩溶研究中心常务副主任/研究员	国际岩溶研究中心/岩溶地质研究所	国际岩溶研究中心/岩溶所介绍；岩溶碳汇研究概况；生物岩溶和岩溶生态系统
5	何师意	研究员	国际岩溶研究中心/岩溶地质研究所	岩溶地下水示踪技术
6	蒋勇军	教授	西南大学地理科学学院	岩溶泉昼夜生物化学过程及对二氧化碳通量的影响；学员评估
7	蒋忠诚	国际岩溶研究中心学术委员会委员/研究员	国际岩溶研究中心/岩溶地质研究所	中国西南地区岩溶地下水调查与开发
8	李林立	讲师	西南大学地理科学学院	金佛山岩溶生态考察-温带岩溶与亚热带岩溶对比
9	刘再华	国际岩溶研究中心学术委员会委员/研究员	中国科学院地球化学研究所	碳酸盐风化碳汇：来自于岩溶水文地球化学监测的启示；大气二氧化碳汇:硅酸盐风化还是碳酸盐风化的贡献？；表生钙华/内生钙华沉积系统地球化学变化对于古环境重建的意义
11	Nick Lawhon	助理研究员	美国西肯塔基大学霍夫曼环境研究所	岩溶含水层地下水资源调查：基于美国肯塔基州罗斯特河（Lost River）岩溶含水层35年研究成果
12	区绎如	助理研究	国际岩溶研究中心/岩溶地质研究所	岩溶水有机污染与治理
13	祁士华	教授/副院长	中国地质大学（武汉）环境科学学院	岩溶地区持久性有机污染物研究
14	沈立成	副教授	西南大学地理科学学院	重庆地质博物馆及西南大学校园参观
15	Tadej Slabe	教授/所长	斯洛文尼亚科学院	岩溶研究所岩溶学发展；学员评估
16	Tim Slattery	研究员	美国西肯塔基大学霍夫曼环境研究所	岩溶发育面临的挑战-以美国肯塔基州鲍林格灵为例
17	Vitor Moura	研究员	巴西岩溶所	巴西洞穴管理与保护监测规程面临的经验与挑战
18	杨平恒	讲师	西南大学地理科学学院	武隆中国南方喀斯特世界自然遗产地-典型岩溶地貌景观考察

20	章典	教授	香港大学地理系	历史上气候变化与大规模人类灾难的因果分析
21	张远海	副研究员	国际岩溶研究中心/岩溶地质研究所	武隆中国南方喀斯特世界自然遗产地–典型岩溶地貌景观考察

List of lecturers

No.	Name	Position/Title	Affiliation	Lecture topic
1	Au Yik Yu	Assistant Researcher	IRCK/IKG	Organic pollution of karst groundwater and remediation
2	Bartolome Andreo	Professor/Director	Center of Hydrogeology, University of Malaga	Protecting groundwater in karst media; Trainee assessment
3	Ben Miller	Associate Researcher	Hoffman Environmental Research Institute, Department of Geology and Geography, Western Kentucky University	Methodologies & case studies of groundwater tracing application in karst areas
4	Cao Jianhua	IRCK Executive Deputy Director/Research Fellow	IRCK/IKG	Carbon Fluxes and Sinks: the Consumption of Atmospheric and Soil CO_2 by Carbonate Rock Dissolution; Biokarst and Karst Ecosystem; Introduction on IRCK and IKG
5	David D. Zhang	Professor	Department of Geography, University of Hong Kong	Causality analysis of Climate change and large-scale human crisis during historical time
6	He Shiyi	Researcher	IRCK/IKG	Introduction to tracing methodology; Fluorescent tracers: analytical methods, lab technology applications, and a sampling tracing test in Guilin
7	Jiang Yongjun	Professor	School of Geographical Sciences, Southwest University	Diel biogeochemical processes and their effect on CO_2 fluxes from a karst stream; Trainee assessment
8	Jiang Zhongcheng	Researcher/ Deputy Director	IRCK/IKG	Karst ground water survey and exploitation in southwest China
9	Li Linli	Lecturer	School of Geographical Sciences, Southwest University	Karst ecological investigation at the Mt. Jinfo -correlation of temperate karst and subtropical karst
10	Liu Zaihua	Researcher	Institute of Geochemistry, Chinese Academy of Sciences	Co_2 sink by carbonate weathering: insights from karst hydrogeochemical monitoring; Atmospheric CO_2 sink by rock weathering: Silicate weathering or carbonate weathering?; Geochemical variations in the tufa/ travertine-depositing systems: implications for the paleoenvironmental reconstruction Cases from Guizhou, Guangxi, Yunnan and Sichuan

11	Martin Knez	Senior Researcher	Karst Research Institute, Scientific Research Centre of the Slovenian Academy of Sciences and Arts	Planning traffic roads crossing karst; Trainee assessment
12	Nick Lawhon	Assistant Researcher	Hoffman Environmental Research Institute, Department of Geology and Geography, Western Kentucky University	Groundwater resource investigations of karst aquifers: insights from 35 years of research on Kentucky's Lost River Karst Aquifer
13	Qi Shihua	Professor/Associate Dean	School of Environmental Studies, China University of Geosciences (Wuhan)	Persistent organic pollutants(POPs) in karst areas
14	Shen Licheng	Associate Professor	School of Geographical Sciences, Southwest University	Chongqing Geological Museum visit and Southwest University campus tour
15	Tadej Slabe	Professor/Director	Karst Research Institute, Scientific Research Centre of the Slovenian Academy of Sciences and Arts	Karstology; Trainee assessment
16	Tim Slattery	Researcher	Hoffman Environmental Research Institute, Department of Geology and Geography, Western Kentucky University	Bowling Green, Kentucky: an example of the challenges of developing on karst
17	Vitor Moura	Researcher	Instituto do Carste (Brazilian Karst Institute)	Monitoring procedures for management and protection of caves in Brazil - experiences and challenges
18	Yang Pingheng	Lecturer	School of Geographical Sciences, Southwest University	Field investigation of the World Natural Heritage Site of South China Karst at Wulong, Chongqing - typical karst landscapes: natural bridge, cave and valley
19	Yang Yan	Associate Professor	School of Geographical Sciences, Southwest University	Environmental isotope introduction: techniques and applications; Visit to the laboratories of the School of Geographical Sciences of Southwest University
20	Yuan Daoxian	Professor / Academician	IRCK/IKG	Origin, structure and function of the Karst Dynamic system; Climate change and Karst Hydrogeology; Trainee assessment
21	Zhang Yuanhai	Associate Researcher	IRCK/IKG	Field investigation of the World Natural Heritage Site of South China Karst at Wulong, Chongqing - typical karst landscapes: natural bridge, cave and valley

武隆中国南方喀斯特世界自然遗产地考察合影

Group photo at the World Natural Heritage Site of South China Karst at Wulong

培训班闭幕式合影

Group photo at the closing ceremony

2013 年流域岩溶水文地质调查、动态监测与应用国际培训班

培训主题：流域岩溶水文地质调查、动态监测与应用

Theme: Karst Hydrogeology and Karst Carbon Cycle Monitoring

培训时间：2013 年 11 月 17 日-11 月 29 日

Duration: 17 to 29 November, 2013

培训地点：广西桂林

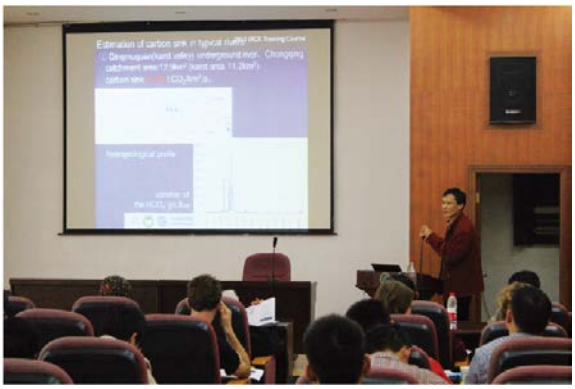
Avenue: Guilin, Guangxi

2013 年 11 月 17 日-11 月 29 日国际岩溶研究中心于桂林举办“流域岩溶水文地质调查、动态监测与应用”第 5 次国际培训班。来自巴西、尼日利亚、墨西哥、越南、马来西亚、乌干达、泰国、津巴布韦、伊朗、斯洛文尼亚、印尼、罗马尼亚、匈牙利、斯洛伐克、俄罗斯、美国、南非等 18 个国家的 21 名学员将参加为期 12 天的培训。有来自伊朗、美国、中国、南非、德国、塞尔维亚等 6 个国家的 16 名专家，作为教员参加了培训班。此次培训的主要内容为岩溶水文调查、监测方法；岩溶流域边界的确定和地球物理方法；监测站的设计与建设；流域水资源评价；岩溶作用与碳汇效应。

The 5th International Training Course on Karst Hydrogeological Survey, Dynamic Monitoring and Application in River Basins was organized by IRCK from November 17 to 19, 2013 in Guilin, China. 21 trainees from 18 countries (Brazil, Nigeria, Mexico, Vietnam, Malaysia, Uganda, Thailand, Zimbabwe, Iran, Slovenia, Indonesia, Romania, Hungary, Slovakia, Russia, US and South Africa) took part in the 12-day training course. 16 lecturers from 6 countries (Iran, US, China, South Africa, Germany and Serbia) joined the course as facilitators. The training course focused on following five topics: 1) karst hydrological survey and monitoring approaches, 2) geophysical method of defining karst river basin boundaries, 3) design and construction of monitoring sites, 4) river basin water resources assessment, and 5) karst processes and carbon sink effects.

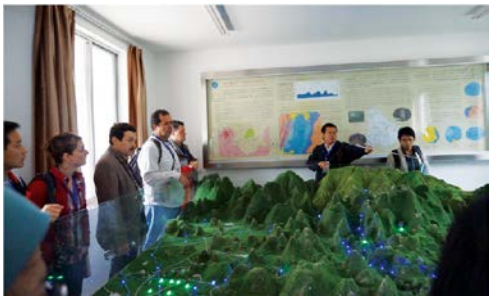
袁道先院士在做“岩溶动力系统的起源、结构和功能”的报告

Academican Yuan Daoxian lecturing on Origin, structure and function of karst dynamic system



章程研究员在做“岩溶系统的碳循环和对大气碳汇的潜在贡献”的报告

Prof. Zhang Cheng lecturing on Carbon cycle of karst system and its potential contribution to atmospheric carbon sink



野外考察 Field excrusion

讲师名单

序号	姓名	性别	职务/职称	单位	教授课程
1	袁道先	男	教授/院士	国际岩溶研究中心/岩溶所	岩溶动力系统的起源、结构和功能；岩溶水文地质学
2	Ezzatollah Raeisi ardekani	男	教授	设拉子大学科学院 地球科学系	岩溶含水层的特征通过监测岩溶泉水的物理化学参数；通过岩溶大坝网站和监测方法确定潜在的泄漏
3	甘伏平	男	研究员/主任	国际岩溶研究中心/岩溶所	岩溶地球物理学
4	George Veni	男	执行所长	美国国立洞穴与岩溶研究所	染料示踪技术在岩溶地下水系统的应用；岩溶含水层的井和泉的水文地球化学监测；环境影响评价
5	Harrison Hursiney Pienaar	男	博士	科学与工业研究委员会 自然资源与环境部	半干旱区可持续的供水系统：资源保护对策和管理法
6	何师意	男	研究员	国际岩溶研究中心/岩溶所	示踪技术的介绍；基于水文监测的碳汇估算
7	蒋忠诚	男	国际岩溶研究中心学术委员会委员/研究员/副所长	国际岩溶研究中心/岩溶所	岩溶地区的水利建设

8	Jonathan D. Arthur	男	首席地质学家/主任	弗罗里达环保厅弗罗里达地质调查院	佛罗里达州的塌陷类型；岩溶地区含水层脆弱性建模
9	Ralf Kaldenhoff	男	正教授/副主编	达姆斯塔特科技大学应用植物科学植物学研究所	藻类技术对大气二氧化碳浓度的消除
10	章程	男	研究员/副主任/秘书长	国际岩溶研究中心/岩溶所	岩溶系统的碳循环和对大气碳汇的潜在贡献
11	Zoran Stevanovic	男	教授/主任	塞尔维亚贝尔格莱德大学矿产与地质系	岩溶含水层水分平衡和储量评估方法；气候变化和岩溶含水层的影响–工程解决方案
12	姜光辉	男	副研究员	国际岩溶研究中心/岩溶所	野外考察: 丫吉野外试验场
13	李强	男	副研究员/副主任	国际岩溶研究中心/岩溶所	参观水文化学实验室、光谱测定法实验室和中国岩溶博物馆
14	韦跃龙	男	副研究员/主任助理	国际岩溶研究中心/岩溶所	柳州香桥岩地质公园 – 热带岩溶地貌
15	易连兴	男	研究员	国际岩溶研究中心/岩溶所	野外考察: 寨底试验场– 流域判断和监测技术
16	赵良杰	男	研究实习员	国际岩溶研究中心/岩溶所	野外考察: 寨底试验场– 流域判断和监测技术

List of lecturers

No.	Name	Sex	Title/Job Title	Employer	Subjects Taught at the Training Course
1	Yuan Daoxian	Male	Prof. /Academician	IRCK/IKG	Origin, structure and function of karst dynamic system; karst hydro-geology
2	Ezzat Raeisi	Male	Prof.	Department of Earth Sciences, Shiraz University, Iran	Defining features of karst aquifers by monitoring the physiochemical parameters of karst spring; defining potential leakage through website of karst dam and monitoring methods
3	Gan Fuping	Male	Prof./Director	IRCK/IKG	Karst geophysics
4	George Veni	Male	Executive Director	US National Cave and Karst Research Institute	Dye tracing techniques for karst groundwater basin delineation; hydrological and geochemical monitoring of wells and springs in karst aquifers; Environmental Impacts Assessment
5	Harrison Hursiney Pienaar	Male	Dr.	Department of Natural Resources and Environment, the Council for Scientific and Industrial Research, South Africa	Sustainable water supply on semi arid areas: resource protection measures and management interventions
6	He Shiyi	Male	Prof.	IRCK/IKG	Overview of tracing techniques; estimating carbon sink based on hydrological monitoring
7	Jiang Zhongcheng	Male	Prof./IRCK Academic Committee Member/ IKG Deputy Director	IRCK/IKG	Water conservancy projects construction in karst areas
8	Jonathan D. Arthur	Male	Chief Geologist/Director	Florida Geological Survey, Florida Department of Environmental Protection, US	Types of sinkholes in Florida; vulnerability modeling of aquifers in karst areas
9	Ralf Kaldenhoff	Male	Prof./Vice Editor-in-Chief	Workgroup for Applied Plant Sciences, Technical University of Darmstadt, Germany	Removing atmospheric CO_2 concentration with algae techniques
10	Zhang Cheng	Male	Prof./IRCK Deputy Director/ IRCK Secretary-General	IRCK/IKG	Carbon cycle in karst system and its potential contribution to atmospheric carbon sink

11	Zoran Stevanovic	Male	Prof./Dean	Faculty of Mining and Geology, University of Belgrade, Serbia	Methods of water balance and storage assessment of karst aquifers; impact of climate change on karst aquifers: engineering solution
12	Jiang Guanghui	Male	Associate Prof.	IRCK/IKG	Field trip: Yaji Karst Experimental Site
13	Li Qiang	Male	Associate Prof./ Deputy Director	IRCK/IKG	Visits to hydrochemistry and spectrometry labs, and the Karst Geology Museum of China
14	Wei Yuelong	Male	Associate Prof./ Assistant Director	IRCK/IKG	Field trip: Liuzhou Xiangqiao National Karst Geopark - tropical karst landforms
15	Yi Lianxing	Male	Prof.	IRCK/IKG	Field trip: Zhaidi Karst Hydrological Monitoring Station - techniques to define & monitor river basins
16	Zhao Liangjie	Male	Intern Researcher	IRCK/IKG	Field trip: Zhaidi Karst Hydrological Monitoring Station - techniques to define & monitor river basins

寨底岩溶水文地质基地合影

Group photo in Zhaidi Karst Hydrogeological Base

培训班合影

Group photo in IRCK/IKG

2014 年岩溶生态系统与地质微生物国际培训班

培训主题：岩溶生态系统与地质微生物

Theme: Karst Hydrogeology and Karst Carbon Cycle Monitoring

培训时间：2014 年 10 月 15 日-28 日

Duration: 15 to 28 October, 2014

培训地点：广西桂林

Avenue: Guilin, Guangxi

联合国教科文组织国际岩溶研究中心/中国地质科学院岩溶地质研究所主办，UNESCO 北京办事处、中国地质大学（武汉）、国际地学计划项目 IGCP/SIDA598 协办的，国际岩溶研究中心第六期国际培训班——“岩溶生态系统与地质微生物”， 2014 年 10 月 16 日在中国桂林岩溶地质研究所正式开班。经筛选，来自老挝、俄罗斯、塞尔维亚、南非等 14 个国家的 17 名外籍相关专业和管理人员，录取为本次培训班学员。同时，培训班共邀请到了来自美国、塞尔维亚、斯洛文尼亚、中国等四个国家的 18 位教员为本次培训班授课。

The Sixth International Training Workshop “Karst Ecosystem and Geological Microorganism” took place from October 15 to 28, 2014 at the Institute of Karst Geology, Guilin, China. The training workshop was organized by IRCK/IKG, and co-organized by UNESCO Beijing Office, China University of Geosciences (Wuhan) and IGCP/SIDA 598.

培训班开幕式

The opening ceremony of training course

本次培训班时间为 10 月 15-28 日，培训由课堂授课、室内、室外实习和学员评估 4 部分组成。室内授课着重岩溶生态系统、岩溶动力学和地质微生物专业知识讲解，室外培训以丫吉岩溶水文地质试验场、海洋-寨底地下河系统实验研究基地和毛村岩溶试验场为依托开展现场教学，强调学员实际操作和专业演练。授课内容主要包括岩溶动力学系统在生态系统中的应用、岩溶生态系统与石漠化、地质微生物在岩溶地区的功能及研究方法、岩溶生态系统中碳循环监测方法、岩溶地区地下水评价等 5 个方面。授课内容设计体现由浅入深，以突出基础性、实效性。

The training workshop consists of four parts: classroom teaching, indoor practice, field visit and participants' assessment. The classroom teaching focused on the expertise of karst ecosystem, karst dynamics, and geological microorganism, while the field visit was based on Yaji Karst Experimental Site, Haiyang-Zhaidi Experimental and Research Base on Subterranean Stream System, and Maocun Karst Experimental Site for the participants to conduct practical operation. The teaching covered five major topics: application of karst dynamic system in ecosystems, karst ecosystem and rocky desertification, functions and research methods of geological microorganism in karst areas, monitoring methods on carbon cycle in karst ecosystem, and assessment of underground water in karst areas. From the simplest to more complex topics, the training courses integrated basic theory with practice.

室内授课
Indoor lecturing

实验室参观
Lab visit

野外基地考察
Field excursion

学员评估
Trainees' assessment

10 月 25 日下午举行本次培训班毕业典礼，UNESCO（Beijing）代表 Hans 先生、中国地质科学院院长董树文、中国地质科学院岩溶地质研究所原所长姜玉池、袁道先院士、中国地质科学院岩溶地质研究所党委书记张发旺、原副所长黄庆达、国际岩溶研究中心秘书长章程、副秘书长罗劬侃参加了结业仪式。Hans 先生及董树文教授等人在结业仪式上作发言，并颁发毕业证书，仪式由国际岩溶研究中心常务副主任曹建华主持。

The closing ceremony for the training workshop was held in the afternoon of October 25. Present at the ceremony were Mr. Hans, representative from UNESCO Beijing Office; Dong Shuwen, president of CAGS; Jiang Yuchi, former director-general of IRCK/IKG; Academician Yuan Daoxian; Zhang Fawang, secretary of the party committee of IKG; Huang Qingda, former deputy director-general of IKG; Zhang Cheng, secretary-general of IRCK; and Luo Qukan, deputy secretary-general of IRCK. The ceremony was chaired by Prof. Cao Jianhua, executive deputy director of IRCK. Mr. Hans, Prof. Dong and other distinguished guests delivered speeches at the closing ceremony and presented the certificates of completion to the trainees.

讲师名单

序号	姓名	性别	职务/职称	单位	教授课程
1	袁道先	男	教授/院士	国际岩溶研究中心/岩溶所	当今岩溶研究中的微生物问题
2	蒋忠诚	男	副所长/研究员	国际岩溶中心/岩溶所	岩溶石漠化及其治理
3	王红梅	女	副院长/教授	中国地质大学（武汉）环境学院	岩溶地区地质微生物概念、功能及研究方法
4	Annette Engel	女	教授	田纳西大学地球与行星科学研究所	地球化学分析方法及其在抑制微生物碳循环和地质微生物交互作用研究中的应用
5	李强	男	副主任/副研究员	国际岩溶中心/岩溶所	铅锌矿尾砂坝塌陷区区土壤微生物和酶的活动
6	李为	女	副教授	华中科技大学生命科学与技术学院	岩溶作用中微生物和碳酸肝酶作用的研究进展
7	李伟	男	主任/研究员	中国科学院武汉植物园	岩溶水中的水生植物、水生植物的光合作用、水生植物的种群、群落
8	黄玉清	女	主任/研究员	中国科学院广西植物研究所	Granier树干液流法测定林分蒸腾
9	李恋卿	女	教授	南京农业大学资源与环境科学学院	岩溶地区土壤微生物生物量及碳氮特征
10	Janez Mulec	男	教授	斯洛文尼亚科学艺术院岩溶研究院	地下环境中的地质微生物
11	Natasa Ravbar	女	教授	斯洛文尼亚科学艺术院	岩溶环境重要性、脆弱性及
12	Sasa Milanovic	男	教授	贝尔格莱德大学矿产地质学院	岩溶（水坝）对生态、人类生存的支持作用
13	冉景丞	男	局长/研究员	贵州省林业厅荔波茂兰自然保护区	岩溶环境生物多样性问题思考——以贵州为例
14	黄俊杰	男	研究员	国际岩溶中心/岩溶所	实验室实践教学
15	唐伟	女	助理研究员	国际岩溶中心/岩溶所	实验室实践教学
16	姜光辉	男	副研究员	国际岩溶中心/岩溶所	野外考察与实践：丫吉野外试验场
17	易连兴	男	研究员	国际岩溶中心/岩溶所	野外考察与实践：寨底试验场流域判断和监测技术
18	曹建华	男	副主任/研究员	国际岩溶中心/岩溶所	野外考察与实践：毛村野外试验场

List of lecturers

Name	Sex	Position/title	Employer	Course
Yuan Daoxian	M	Prof./Academician	IRCK/IKG	Microbial Issues in Current Karst Study
Jiang Zhongcheng	M	Deputy director-general/Prof.	IRCK/IKG	Rocky desertification and its treatment

Wang Hongmei	F	Vice dean/Prof.	School of Environmental Studies, China University of Geosciences (Wuhan)	Geomicrobiology
Annette Engel	F	Prof.	Department of Earth and Planetary Sciences, University of Tennessee	Analytical geochemical methods and their application to constrain microbial carbon cycling and geomicrobial interactions
Li Qiang	M	Deputy director of KDL(Kasrt Dynamic Laboratory)/ Associate Prof.	IRCK/IKG	Activities of soil microorganism and enzyme in collapse area of Pb-Zn mine tailings
Li Wei	F	Associate Prof.	College of Life Science and Technology, HUST	Research progress on the role of microbes and carbonic anhydrases in the karstification
Li Wei	M	Director/Prof.	Wuhan Botanical Garden, CAS	Aquatic Vegetation in Karst Water
Huang Yuqing	F	Director/Prof.	Guangxi Institute of Botany, CAS	Measurement and estimation of stand transpiration using Granier's Sap Flow approach
Li Lianqing	F	Prof.	Department of Soil Science,Nanjing Agricultural University	Soil microbe biomass carbon and nitrogen and features in karst
Janez Mulec	M	Prof.	Karst Research Institute, Scientific Research Centre of the Slovenian Academy of Sciences and Arts	Geomicrobiology of underground habitats
Nataša Ravbar	F	Prof.	Karst Research Institute, Scientific Research Centre of the Slovenian Academy of Sciences and Arts	Environmental importance, vulnerability and conservation of karst
Sasa Milanovic	M	Prof.	Faculty of Mining and Geology, the University of Belgrade	Karst (water dam) to support ecology and human survival
Ran Jingcheng	M	Director/Prof.	Libo Maolan Nature Reserve Administration, Guizhou Forestry Department	Biodiversity issues in karst environment: a case study in Guizhou
Huang Junjie	M	Prof.	IRCK/IKG	Laboratory visit
Tang Wei	F	Assistant Prof.	IRCK/IKG	Laboratory visit
Jiang Guanghui	M	Assistant Prof.	IRCK/IKG	Field trip/practice:Yaji Experimental Site
Yi Lianxing	M	Prof.	IRCK/IKG	Field trip/practice:watershed identification and monitoring technologies at Zhaidi Experimental Site
Cao Jianhua	M	Deputy director/Prof.	IRCK/IKG	Field trip/practice:Maocun Experimental Site

闭幕式合影

Group photo on the closing ceremony

2015 岩溶景观、地质公园、自然遗产地、环境地质编图与数据挖掘国际培训班

培训主题：岩溶景观、地质公园、自然遗产地、环境地质编图与数据挖掘

Theme: Karst Landscape, Geopark, Natural Heritage Sites, Environmental Geology Mapping and Data Mining

培训时间：2015 年 9 月 20 日- 10 月 3 日

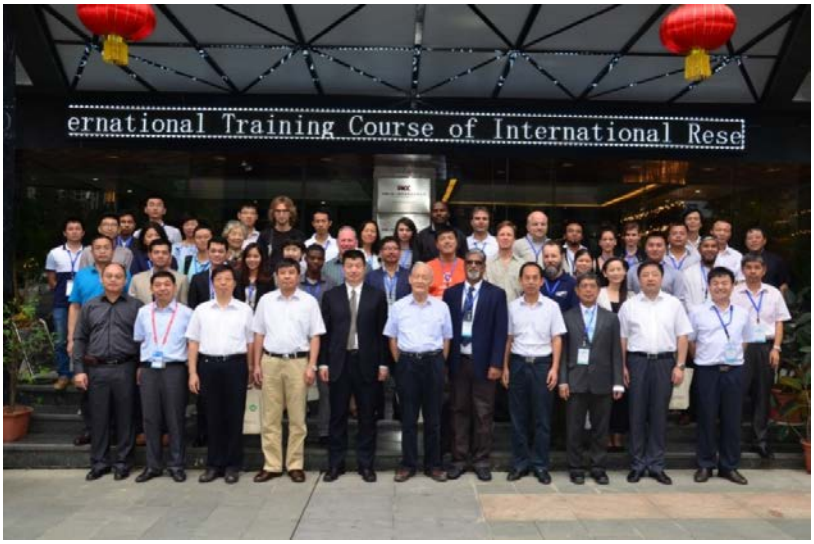
Duration: 15 September to 3 October, 2015

培训地点：广西南宁

Avenue: Nanning, Guangxi

2015 年 9 月 21 日上午，由中国地质科学院岩溶地质研究所/联合国教科文组织国际岩溶研究中心主办，广西壮族自治区科学技术厅、广西壮族自治区国土资源厅、联合国教科文组织北京办事处、联合国教科文组织国际自然与文化遗产空间技术中心、联合国教科文组织国际工程科技知识中心、中国地质公园网联合协办的第七届国际培训班在东盟博览会（东盟-矿业合作论坛）期间于南宁开幕。

The 7th International Training Course, sponsored by IRCK/IKG, opened on September 21, 2015 in Nanning during the occasion of China-ASEAN Exposition (China-ASEAN Mining Cooperation Forum). The training course was jointly organized by the Department of Science and Technology of Guangxi Zhuang Autonomous Region, the Department of Land and Resources of Guangxi Zhuang Autonomous Region, UNESCO Beijing Office, the International Center on Space Technologies for Natural and Cultural Heritage (HIST) under the Auspices of UNESCO, International Knowledge Centre for Engineering Sciences and Technology (IKCEST) under the Auspices of UNESCO, China Geoparks Network.



培训班开幕式合影

Group photo on the opening ceremony

联合国教科文组织曼谷办事处官员贾库玛在开幕式上致辞

Dr. Jayakumar from Bangkok office, UNESCO giving speech on the opening ceremony

中国地质科学院岩溶地质研究所所长/联合国教科文组织国际岩溶研究中心主任刘同良在开幕式上致辞

Mr. Liu Tongliang, Director of IRCK/IKG, giving speech on the opening ceremony

本次培训班时间为 9 月 20 日-10 月 3 日，主题为“岩溶景观、地质公园、自然遗产地、环境地质编图与数据挖掘”，共招收了来自 20 个国家的 38 名学员，其中外籍学员 25 人，分别来自泰国、南非、斯洛文尼亚、澳大利亚等 19 国家。其中，来自“一带一路”国家的学员 13 人。特别邀请到了来自联合国教科文组织北京办事处项目专员汉斯和曼谷办事处项目官员 Ramasamy Jayakumar 担任培训班教员，共邀请到了来自美国、丹麦、印度、斯里兰卡、中国等五个国家的 21 位教员为本次培训班授课。本次培训班列入中国-东盟矿业合作论坛正式议程之中，吸引了大量来自全国各地相关行业的学员参与，包括来自中国地质调查局成都地质调查中心和武汉地质调查中心、山东地矿工程勘察院以及来自云南石林地质公园研究中

心、乐业-凤山世界地质公园、乐业县地质公园管理局、西南大学和桂林理工大学等多家单位的 13 名中国学员参与。本次培训班也是招生人数最多，参与国家最多，国内单位参与最多的一届培训班。

Focusing on “karst landscape, geopark, natural heritage sites, environmental geology mapping and data mining”, the training course was held from September 20 to October 3. A total of 38 participants from 20 countries took part in the training course, including 25 foreign participants from 19 countries (e.g., Thailand, South Africa, Slovenia and Australia). Among them, 13 participants came from the countries along “One Belt and One Road” Initiative. Mr. Hans Thulstrup from UNESCO Beijing Office and Jayakumar from UNESCO Bangkok Office were specially invited to serve as lecturers of the training course. Other 21 scholars from five countries (i.e., USA, Denmark, India, Sri Lanka, and China) were also invited to be the lecturers. As the training workshop was firstly included in the agenda of China-ASEAN Mining Cooperation Forum, it attracted 13 Chinese participants from relevant industries, who came from Chengdu Geological Center, CGS; Wuhan Geological Center, CGS; some administrations of global geoparks in China, Southwest University in Chongqing and Guilin University of Technology, among others. Therefore, this training workshop has been the most successful one with the largest number of participants from both China and foreign countries since 2009.

室内授课交流

Indoor lecturing and discussing

野外考察

field excursion

野外考察

本次培训着重岩溶景观开发与保护、地质公园与自然遗产地和环境地质编图知识讲解，野外考察以乐业-凤山世界地质公园为依托开展，强调学员实际领悟与学习。授课内容主要包括 5 个方面：1）岩溶动力系统在岩溶景观开发保护中的应用；2）岩溶区地质公园、自然遗产地的特征，开发保护现状；3）岩溶区地质公园、自然遗产地案例分析及规范讲解；4）岩溶环境地质编图的方法与应用；5）数据平台建立及数据挖掘。

The classroom training focused on the topics of karst landscape development and protection, geoparks and natural heritage sites, environmental geology mapping. The topics mainly cover five areas: 1) application of karst dynamic system to karst landscape development and protection; 2) characteristics of geoparks and natural heritage sites in karst areas, and the current status of their development and protection; 3) case studies on geoparks and natural heritage sites in karst areas and explanation on rules; 4) methods of karst environmental geo-environmental mapping and their application; and 5) data platform development and data mining. The field study was conducted in

Leye-Fengshan Global Geopark, which provided the participants with an opportunity to apply what they have learned into practice.

学员评估

Trainees' assessment

颁发结业证书

Awarding certificates

讲师名单

姓　名	性别	职务/职称	单位	教授课程
蒋忠诚	男	副所长/研究员	国际岩溶研究中心/岩溶所	中国岩溶地质与岩溶地质地貌景观
Ramasamy Jayakumar	男	自然科学部主席/项目专家	联合国教科文组织曼谷办事处	地质公园、自然遗产地与可持续地质旅游/世界水文编图及评估项目
张发旺	男	党委书记/常务副所长/研究员	国际岩溶研究中心/岩溶所	中国及东南亚岩溶地质系列编图
程彦培	男	主任/研究员	中国地质科学院水环所	亚洲地下水资源及环境地质编图
时坚	男	主任/研究员	国际岩溶研究中心/岩溶所	中国岩溶地质数据库
周立新	男	副研究员	国际岩溶研究中心/岩溶所	岩溶地区水文地质及环境地质编图
肖时珍	女	研究员	贵州师范大学	世界自然遗产地网络与中国南方喀斯特自然遗产地/世界自然遗产地保护、管理与可持续发展
郑元	男	主任	中国地质科学院国家地质公园网络办公室	中国地质公园发展成就
张远海	男	副研究员	国际岩溶研究中心/岩溶所	地质遗迹调查与评估
Hans Thulstrup	男	自然科学部主席	联合国教科文组织北京办事处	世界遗产公约中的喀斯特
Natarajan Ishwaran	男	教授	国际自然与文化遗产空间技术中心	世界生物圈保护生态文明建设与可持续发展
洪天华	男	教授	国际自然与文化遗产空间技术中心	中国世界自然遗产概况/空间监测技术在吴哥窟的应用

陈岭	男	教授	浙江大学	大数据管理与数据挖掘
曹学军	男	教授	国际工程科技知识中心	搜索引擎技术与知识服务
张金川	男	教授	中国地质大学（北京）	页岩气工业发展过程中的关键问题
王章俊	男	教授	地质出版社	化石与生命——生命的进化

List of lecturers

Name	Gender	Title	Employer	Course
Jiang Zhong cheng	M	Deputy Director-general/Prof.	IRCK/IKG	Karst geology and karst geological landforms in China
Ramasamy Jayakumar	M	Chair of Natural Sciences Sector /Project consultant	UNESCO Bangkok	Geoparks, natural heritage sites and sustainable geological tourism/World -wide Hydrogeological Mapping and Assessment Programme(WHYMAP)
Zhang Fawang	M	Executive Deputy Director /Prof.	IRCK/IKG	Mapping of hydrogeology in China and Southeast Asia
Cheng Yanpei	M	Director/Prof.	Institute of Hydrog eology and Environmental Geology, CAGS	Mapping of underground water resources and environmental geology in Asia
Shi Jian	M	Director/Prof.	IRCK/ IKG	Database on karst geology in China
Zhou Lixin	M	Associate Prof.	IRCK/ IKG	Mapping of hydrogeology and environmental geology in karst areas
Xiao Shizhen	F	Prof.	Guizhou Normal University	Network of World Natural Heritage Sites, protection, management and sustainable development of South China karst natural heritage sites/ world natural heritage sites
Zheng Yuan	M	Director	Office of National Geoparks Network under CAGS	Progress of geoparks in China
Zhang Yuanhai	M	Associate Prof.	IRCK/ IKG	Geological relics survey and assessment
Hans Thulstrup	M	China of Natural Sciences Sector	UNESCO Beijing Office	Karst in the Convention Concerning the Protection of the World Cultural and Natural Heritage
Natarajan Ishwaran	M	Prof.	International Center on Space Technologies for Natural and Cultural Heritage (HIST)	Ecological civilization and sustainable development of world biosphere reserves
Hong Tianhua	M	Prof.	International Center on Space Technologies for Natural and Cultural Heritage (HIST)	Overview of world natural heritage sites in China/Application of spatial monitoring technologies in Angkor Wat
Chen Ling	M	Prof.	Zhejiang University	Big data management and data mining
Cao Xuejun	M	Prof.	International Knowledge Centre for Engineering Sciences and Technology (IKCEST)	Searching engine technology and knowledge service

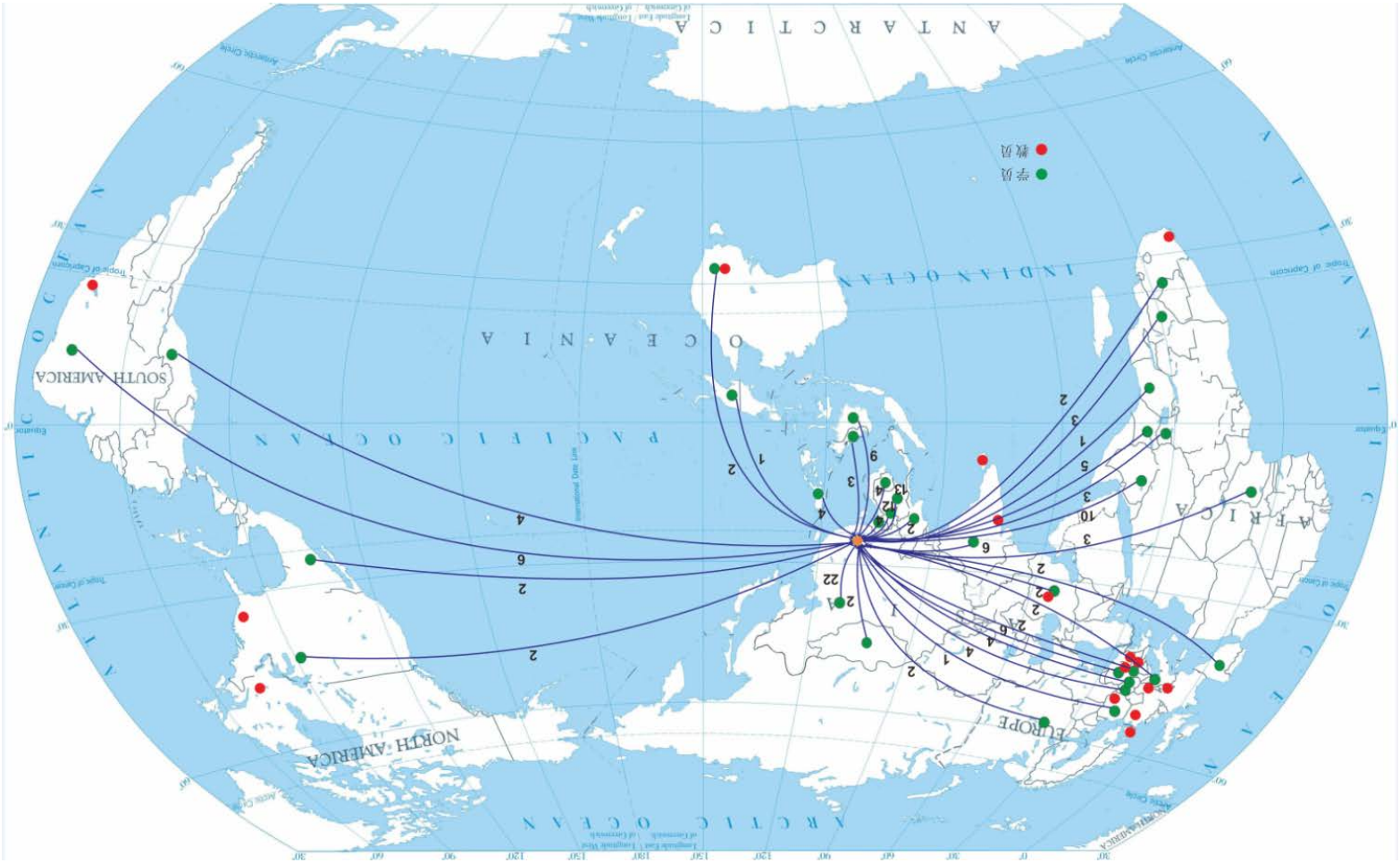
Zhang Jinchuan	M	Prof.	China University of Geosciences (Beijing)	Key issues in the process of shale gas industrial development
Wang Zhangjun	M	Prof.	Geological Publishing House	Fossils and life-evolution of life
Erin Lynch	F	Dr.	IRCK/ IKG	Introduction to Leye-Fengshan Global Geopark
Stephen Michael Futrell	M	Prof. in GIS Sector	Draper Aden Co.,Ltd.	Application of cave model visualization technology in 3D karst topography
Zhang Jie	M	Prof.	Nanjing University	Tourism and karst

乐业凤山野外地质考察合影

Group photo in Leye-Fengshan field excursion

培训班教员、学员分布图（2009-2015）

Distribution of Lecturers and Trainees around the World



国际合作协议 International Cooperation Agreements

自 2009 年以来，利用出访参加国际学术会议、联合执行境外地质调查项目、及外宾来访等机遇，中心同 11 个国家的友谊合作单位签署了 15 项合作协议，旨在加强岩溶地质领域内的双边或多边合作，并以合作协议的形式明确规定双方或多方的义务及权利，为中心更好地开展国际合作交流提供保障。

Since 2009, by the chances of attending international academic conferences, implementing the foreign geological survey project jointly and foreign guests visiting, IRCK has signed 15 cooperative agreements with friendly units from 11 countries. It is aimed to enhance the bilateral or multilateral cooperation in karst geology, and provides guarantee to conduct the international cooperation better, in forms of agreements signing to regulate the duties and rights of parties signing the agreement.

已签署合作协议（按签署时间顺序 2009-2015）：

Agreements (chronological order, from 2009 to 2015)

2009

与瑞士纳沙泰尔大学水文地质中心签署合作意向备忘录

Signed MOU with Center for Hydrogeology of University of Neuchatel, Switzerland

为了更好地建设、实现中心的目标，发挥中心的功能，由原中国地质科学院董树文副院长为团长的4人代表团于2009年2月15日至17日对瑞士纳沙泰尔大学水文地质中心(CHYN)进行考察。

To better develop IRCK, achieve the objectives of IRCK and better leverage the functions of IRCK, a delegation of four members led by Prof. Dong Shuwen, former deputy director-general of the Chinese Academy of Geological Sciences, visited the Center for Hydrogeology of University of Neuchatel (CHYN) in Switzerland from February 15-17, 2009.

瑞士纳沙泰尔大学水文地质研究中心是瑞士，也是欧洲著名的水文地质研究机构，已有两位学者当选为IHA岩溶专业委员会主席。该中心可接纳来自世界各国的研究者学习交流，先后为越南、斯洛文尼亚、中国等国家培养了水文地质研究方面的专门人才。此次参观考察的目的是学习其管理模式、国际学术交流和学科建设经验，对 IRCK 的建设和发展有所借鉴。

CHYN is one of the most prestigious research institutions on hydro-geology in Switzerland and Europe. Two scholars from CHYN have previously been elected as president of IAH Karst Commission. Researchers from all over the world visit CHYN for learning and academic exchange, which has trained many specialists on hydro-geology for developing countries such as Vietnam, Slovenia and China. The objectives of IRCK's visit to CHYN were to learn from the best practices of CHYN in management model, international academic exchange and discipline development, and promote the development of IRCK.

形成的合作意向备忘录主要包括 3 个方面的内容，中心将邀请 CHYN 的学者参加由其

主办的培训班讲师团，CHYN 将中心的培训计划列入 IAH 岩溶专业委员会的网页中，同时推荐发展中国家，尤其非洲、拉丁美洲的学员，同时也积极邀请 IAH 岩溶专业委员会的成员为培训班做出相应贡献。

Francois Zwahlen 主任与姜玉池先生签署合作备忘录

Francois Zwahlen, director of CHYN, signed the MOU with Mr. Jiang Yuchi

During their visit, a Memorandum of Understanding (MOU) on cooperation was signed between IRCK and CHYN. The MOU mainly covers three components: 1) IRCK will invite scholars from CHYN to be trainers in the training courses organized by IRCK, while CHYN will list the training program of IRCK into the web pages of IAH Karst Commission; 2) CHYN will recommend trainees from developing countries, especially African and Latin American countries, to take part in the training courses organized by IRCK; and 3) Actively invite members of IAH Karst Commission to make due contributions to the success of these training courses.

与奥地利格拉茨水资源管理水文地球物理研究所签署合作意向备忘录

Signed MOU with Institute of Water Resources Management and Geophysics-Hydrogeology

在结束对瑞士纳沙泰尔大学水文地质中心的访问后，中心代表团于 2009 年 2 月 22 日-23 日访问奥地利格拉茨水资源管理水文地质和地球物理研究所（WRM）。

Following the visit to CHYN, the delegation of IRCK paid a visit to the Institute of Water Resources Management and Geophysics-Hydrogeology (WRM), Graz, Austria from February 22-23, 2009.

WRM 是奥地利最大的研究组织之一，具有广泛的欧洲合作伙伴，开展过大量的国际合作项目，1969 年起，承办 UNESCO 资助下的地下水示踪技术培训班。通过访问 WRM，并签署相关合作意向备忘录，对中心开展国际合作、国际培训班等多方面大有裨益。水文地质与流域水文学研究部主任 Ralf Bennischke 教授，在地下水示踪及岩溶水文地质演化等研究方面具有深入的研究，同时也是 UNESCO 资助下的地下水示踪技术培训班的主讲者，2008 年增选为国土资源部岩溶动力学重点实验室学术委员会成员，并于 2009 年吸收成为中心学术委员会的委员。出访期间中心代表团与研究所所长 Zojer Hans 进行了合作意向和合作方式的讨论，并签署了合作意向备忘录。备忘录主要包括 5 个方面：1.巩固和促进现有的合作成果；2.中心将邀请 WRM 的学者为其主办的培训班授课，WRM 将中心的培训计划列入 WRM 的网页中，同时推荐发展中国家的学员，由于 WRM 也有地下水示踪技术培训的任务，IRCK 与 WRM 在培训班举办中可有更多形式的合作，同时也积极鼓励 WRM 成员为培训班作出相应贡献； 3.WRM 对 IRCK 建立野外自动观测站、同位素技术、示踪技术、地球化学过程模

型等方面给与协助；4.可能情况下，积极申请奥-中共同申请合作项目，围绕一个科学目标开展国际合作研究；5.研究生的交换培养。

As one of the largest research institutions in Austria, WRM boasts an extensive network of partners in Europe, and has implemented a good number of international cooperation projects. Since 1969, it has organized many training workshops on underground water tracing test technique sponsored by UNESCO. During the visit of IRCK delegation, an MOU on cooperation was signed between IRCK and WRM, which proved to benefit IRCK a lot in international cooperation and training program. Prof. Ralf Bennischke from the Joanneum Research Institute of WRM is well known for his research on groundwater tracing technology and karst hydro-geological evolution. He is also one of the trainers in the training workshop on ground water tracing test technique sponsored by UNESCO. In 2008, he was elected as a member of the Academic Committee of Ministry of Land and Resources (MLR) Key Laboratory of Karst Dynamics. In 2009, he became a member of the Academic Committee of IRCK. During the visit of IRCK delegation, Zojer Hans, director of WRM, signed an MOU between IRCK and WRM. The MOU mainly covers five components: 1) Consolidate and promote the existing cooperation results; 2) IRCK will invite scholars from WRM to be trainers for the training workshops organized by IRCK, WRM will recommend trainees from developing countries. As WRM is also interested in the training on ground water tracing test technique, both parties can work more closely in the training workshops. Members of WRM are also encouraged to make their due contributions to the training workshops; 3) WRM will support IRCK in building field observation station, and in developing isotope, tracing test and geochemical process modeling technologies; 4) if possible, both parties will jointly apply for an international cooperation project between Austria and China focusing on a common scientific topic; and 5) Joint training of graduate students.

WRM 主任 Zojer Hans 与姜玉池先生签署合作意向备忘录

Mr. Jiang Yuchi signed a MOU with Zojer Hans, director of WRM

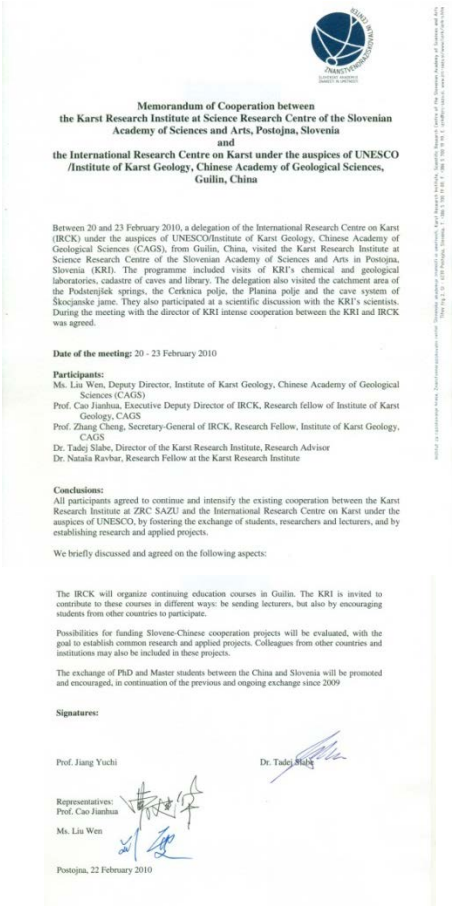
2010

与斯洛文尼亚岩溶研究所签订合作意向备忘录

Signed with Karst Research Institute at Science Research Centre of the Slovenian Academy of Sciences and Arts

应联合国教科文组织 IGCP 生态地学部秘书长 Robert Missotten 博士和斯洛文尼亚岩溶研究所（KRI）所长 Tadej Slabel 博士邀请，时任中国地质科学院副院长董树文带队，时任中国地质科学院岩溶地质研究所副所长刘雯，中心常务副主任曹建华研究员及国土资源部岩溶动力学重点实验室副主任章程研究员，中心代表团一行四人参加了 2010 年 2 月 17-23 日在联合国教科文组织巴黎总部召开的第 38 届 IGCP 科学委员会会议。会后访问了斯洛文尼亚岩溶研究所，并考察了迪纳里克（Dinaric）经典岩溶区。

Invited by Dr. Robert Missotten, Secretary of IGCP and Dr. Tadej Slabe, Director of the Karst Research Institute at Science Research Centre of the Slovenian Academy of Sciences and Arts (KRI), the delegation of IRCK that lead by former deputy director of CAGS Mr. Dong Shuwen, attended by former deputy director of IKG, Mr. Liu Wen, and deputy executive director of IRCK Dr. Cao Jianhua and Dr. Zhang Cheng general secretary of IRCK, attended the 38th Session of the IGCP Scientific Board, visited KRI and had a field excursion to the classic Dinaric Karst area on February 17-23, 2010.



Memorandum of Cooperation between
the Karst Research Institute at Science Research Centre of the Slovenian Academy of Sciences and Arts, Postojna, Slovenia
and
the International Research Centre on Karst under the auspices of UNESCO /Institute of Karst Geology, Chinese Academy of Geological Sciences, Guilin, China

Between 20 and 23 February 2010, a delegation of the International Research Centre on Karst (IRCK) under the auspices of UNESCO/Institute of Karst Geology, Chinese Academy of Geological Sciences (CAGS), from Guilin, China, visited the Karst Research Institute at Science Research Centre of the Slovenian Academy of Sciences and Arts in Postojna, Slovenia (KRI). The programme included visits of KRI's chemical and geological laboratories, cadastre of caves and library. The delegation also visited the catchment area of the Podstenjšek springs, the Cerknica polje, the Planina polje and the cave system of Škocjanske jame. They also participated at a scientific discussion with the KRI's scientists. During the meeting with the director of KRI intense cooperation between the KRI and IRCK was agreed.

Date of the meeting: 20 - 23 February 2010

Participants:
Ms. Liu Wen, Deputy Director, Institute of Karst Geology, Chinese Academy of Geological Sciences (CAGS)
Prof. Cao Jianhua, Executive Deputy Director of IRCK, Research fellow of Institute of Karst Geology, CAGS
Prof. Zhang Cheng, Secretary-General of IRCK, Research Fellow, Institute of Karst Geology, CAGS
Dr. Tadej Slabe, Director of the Karst Research Institute, Research Advisor
Dr. Nataša Ravbar, Research Fellow at the Karst Research Institute

Conclusions:
All participants agreed to continue and intensify the existing cooperation between the Karst Research Institute at ZRC SAZU and the International Research Centre on Karst under the auspices of UNESCO, by fostering the exchange of students, researchers and lecturers, and by establishing research and applied projects.

We briefly discussed and agreed on the following aspects:

The IRCK will organize continuing education courses in Guilin. The KRI is invited to contribute to these courses in different ways: be sending lecturers, but also by encouraging students from other countries to participate.

Possibilities for funding Slovene-Chinese cooperation projects will be evaluated, with the goal to establish common research and applied projects. Colleagues from other countries and institutions may also be included in these projects.

The exchange of PhD and Master students between the China and Slovenia will be promoted and encouraged, in continuation of the previous and ongoing exchange since 2009

Signatures:

Prof. Jiang Yuchi　　Dr. Tadej Slabe

Representatives:
Prof. Cao Jianhua
Ms. Liu Wen

Postojna, 22 February 2010

与斯洛文尼亚岩溶研究所签署的合作协议
MOU signed with KRI

通过与斯洛文尼亚岩溶研究所探讨合作方式与途径，双方就一下三方面内容达成了合作意向，并签署了合作意向备忘录：1. 斯洛文尼亚岩溶研究所将应邀通过派遣专家加入中心培训班讲师团和鼓励他国学员参加等不同方式为培训班做出相应贡献；2.计划筹集资金支持中斯双方开展合作项目，以建立并实施双方科研合作项目和应用性建设工程。并允许他国或其他单位的科研人员参与其中；3.促进并鼓励中斯两国博士和硕士研究生的交换培养。

After the discussion on the cooperation approach with KRI, IRCK signed the MOU with KRI and agreed on the following three aspects, 1. IRCK will organize continuing education courses in Guilin, KRI is invited to contribute to these courses in different ways, such as sending lectureers and encouraging students from other countries to participate, 2. Possibilities for funding Slovenian-Chinese cooperation projects will be evaluated, with the goal to apply fundamental and applied projects. Colleagues from other countries and institutions may also be included in these projects, 3. The exchange of PhD and Master students between China and Slovenia will be promoted and encouraged.

与巴巴多斯政府、美国西肯塔基大学霍夫曼环境研究所签署三方合作意向备忘录

Signed MOU with Government of Barbados and Hoffman Environmental Research Institute of Western Kentucky

2010 年 9 月 26-30 日，巴巴多斯驻华特命全权大使 Lloyd Erskine Sandiford 爵士，美国西肯塔基大学霍夫曼环境研究所所长 Chris Groves 博士一行访问了中心，并与 28 日签署了《中国-巴巴多斯-美国在岩溶资源研究及教育领域的三方合作意向备忘录》。

On September 26-30, 2010 Barbados' first resident Ambassador to China, The Right Honorable Sir Lloyd Erskine Sandiford and the Director of the Hoffman Environmental Research Institute of the Western Kentucky University (USA), Dr. Chris Groves visited IRCK, and sign the Memorandum of Understanding Trilateral Cooperation on Karst Resource Research and Education in China, Barbados, and the United States of America with former director of IRCK Mr. Jiang Yuchi on September 28.

时任国际岩溶研究中心主任姜玉池与巴巴多斯驻华特命全权大使 Lloyd Erskine Sandiford 爵士（左）和美国西肯塔基大学霍夫曼环境研究所所长 Chris Groves 博士（右）签署《中国-巴巴多斯-美国在岩溶资源研究及教育领域的三方合作意向备忘录》

Former IRCK Director Mr. Jiang Yuchi signed the MOU with Barbados' first resident Ambassador to China, the Right Honorable Sir Lloyd Erskine Sandiford (left) and the Director of the Holffman Environmental Research Institute of the Western Kentucky University (USA), Dr. Chris Groves (right)

备忘录的主要内容为改善中、美、巴三个国家现有的环境资源和配套设施；联合开展世界性、综合性岩溶研究和公众教育项目；支持当地公共环境健康和经济可持续发展；并在一下三个区域开展国际合作：1.巴巴多斯哈里森洞穴、科尔斯洞穴，2.中国贵州茂兰自然保护区，3.美国西肯塔基大学及肯塔基州中部岩溶地区，进一步改善合作三方及其他国家人民的生活质量。本协议旨在汇集三方的共同努力、共享中国、巴巴多斯和美国的学术成果与资源，在环境保护意识，水资源，公共健康，旅游产业和经济发展等诸多方面加强国际交流与合作。三方承诺将充分发挥各自在相关领域的优势地位，巩固本国科研学术影响力，并使其不断扩展到加勒比海及东南亚地区。时任中心主任姜玉池表示，合作意向备忘录的签署体现了国际

岩溶研究中心、美国西肯塔基大学霍夫曼研究所和巴巴多斯政府三方真诚合作的意向，为今后开展合作研究、学术交流和培训奠定了基础，必将极大地促进三方合作、交流和研究水平的提高。

The main contents of this memorandum include augmenting existing landscape resources and facilities in the three countries through trilateral cooperation, developing karst research and public education programs, supporting local public, environmental health and sustainable economic development, and conducting international collaborative research at three main sites, (1)the Harrison's Cave/Cole's Cave complex, Barbados, (2)Maolan, Guizhou, P. R. China, and (3) south central Kentucky karst region, USA, to improve the quality of life of constituents in partner countries and abroad. This agreements aims to bring together joint efforts, culminate in a beneficial sharing of knowledge and resources among China, Barbados and the United States, improve environmental awareness, and strengthen international exchange and cooperation in water resources, public health, tourism and economic development. The participants of this initiative could well develop leadership positions in these technical areas not only in their own countries, but gradually addressing related concerns regionally in the Caribbean and Southeast Asia.

2011

南非西开普大学自然科学学院联合国教科文组织水文地质教席地下水资源管理及岩溶水文地质双边科技合作意向书

Signed the bilateral cooperative technical letter on groundwater management and karst hydrogeology with Chair holder and Director of the UNESCO Chair in Geohydrology, Faculty of Natural Sciences, University of The Western Cape, South Africa

2011 年 12 月 3 日下午，中心学术委员会成员、南非西开普大学自然科学学院、联合国教科文组织水文地质教席主任徐永新教授与国际岩溶研究中心主任姜玉池研究员签署了地下水资源管理及岩溶水文地质科技合作意向书。双方同意在该合作意向框架下巩固充实合作内容，加深交流，增进了解，扩展已有合作范围，推动岩溶水文地质研究，为实现联合国宗旨服务。

In the afternoon of December 3, 2011, Dr. Yongxin Xu, IRCK Academic Committee Member, Chairholder and Director of the UNESCO Chair in Geohydrology, Faculty of Natural Sciences, University of The Western Cape (South Africa) had a constructive talk with IRCK Director Mr. Jiang Yuchi and signed the Letter of Intent entered into between IRCK and UNESCO Chair Center in Groundwater, University of the Western Cape. Both sides agreed to promote and establish the mutual co-operation in the field of science and technology of sustainable management of groundwater resources and karst hydrogeology in particular.

合作意向书签署

Signed the bilateral cooperative technical letter

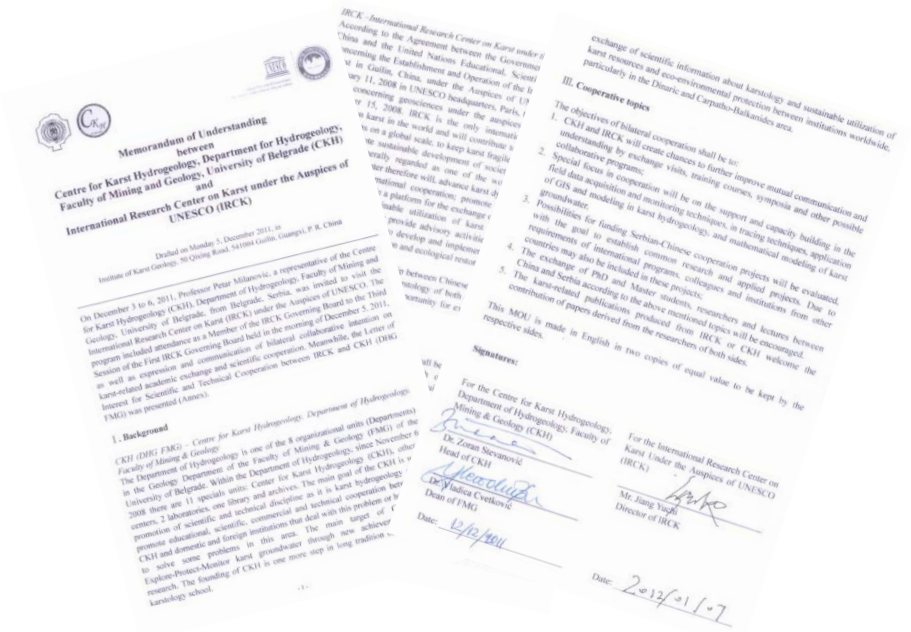
与塞尔维亚贝尔格莱德大学矿产地质学院岩溶水文地质中心签署合作意向备忘录

Signed MOU with Center for Karst Hydrogeology, Department for Hydrogeology, Faculty of Mining and Geology, University of Belgrade, Serbia

国际岩溶研究中心理事会成员、国际水文地质学家协会塞尔维亚分会主席、塞尔维亚贝尔格莱德大学矿产地质学院岩溶水文地质中心代表 Petar Milanovic 教授于 12 月 3 日-6 日应邀抵桂参加中心理事会议，并带来由该中心主任 Zoran Stevanovic 博士等签署的，与国际岩

溶研究中心展开岩溶相关科技合作的意愿书，表达了深入开展双边科技合作的美好意愿。12 月 5 日，中心秘书处正式起草双方合作备忘录并交付 Petar Milanovic 教授。12 月 15 日，国际岩溶研究中心收到该岩溶水文地质中心的来函及已由该中心主任 Zoran Stevanovic 博士和该校矿产地质学院院长 Vladica Cvetkovic 博士签署的合作意向备忘录。信中说明：岩溶水文地质中心完全同意国际岩溶研究中心在该备忘录中建议的各项合作目标及内容；希望两个中心在碳汇研究、地下水资源利用和岩溶含水层管理等方面开展切实合作；支持岩溶科学教育，合作举办专题培训班，互派授课讲师，积极参与培训活动；共同申请和开展相关的科研项目及其应用项目。更提及在来年 3-4 月份开展一次双方互访活动，以加深沟通，增进了解，开展具体合作项目。

During the IRCK Governing Board Session, Professor Petar Milanovic, IRCK Governing Board Member, a representative of the Center for Karst Hydrogeology (CKH), Department for Hydrogeology, Faculty of Mining and Geology, University of Belgrade (Serbia), delivered the Letter of Interest for Scientific and Technical Cooperation between IRCK and CKH, and expressed the bilateral collaborative intention on karst-related academic exchange and scientific cooperation. On December 5, the IRCK Secretariat prepared a draft Memorandum of Understanding (MOU). On December 15, the CKH side sent the signed MOU to IRCK and expressed that they were in full agreement with the IRCK's proposals presented in the MOU between IRCK and CKH including with suggested objectives and topics. They hope that the IRCK's experience in the field of CO_2 sink and its determination will be of particular benefit to the CKH, and the IRCK would be benefit to get some of the CKH's experiences in groundwater utilization and aquifer management. Mutual participation in lecturing including different training courses has to be one of the important aspects of the bilateral cooperation. Moreover, they suggested a mutual visit in the spring of 2012 so as to provide more opportunities for further discussion and information exchange. The IRCK accepted this kind invitation.


Memorandum of Understanding
between
Centre for Karst Hydrogeology, Department for Hydrogeology,
Faculty of Mining and Geology, University of Belgrade (CKH)
and
International Research Center on Karst under the Auspices of
UNESCO (IRCK)

与塞尔维亚贝尔格莱德大学矿产地质学院岩溶水文地质中心签署的合作意向备忘录

MOU with Center for Karst Hydrogeology, Department for Hydrogeology, Faculty of Mining and Geology, University of Belgrade, Serbia

与东亚东南亚地学计划协调委员会签署技术合作会议纪要

Signed a protocol on technical cooperation meeting with Coordinating Committee for Geoscience Programmes in East and Southeast Asia

2011 年 3 月 27 日—4 月 1 日，东亚东南亚地学计划协调委员会秘书处主任何庆成博士及泰国自然资源与环境部水资源厅、地下水资源厅、自然资源与环境对策与计划办公室、泰国水文协会等代表一行 15 人访问国际岩溶研究中心/中国地质科学院岩溶地质研究所。

From March 27 to April 1, 2011, a Thai delegation of 15 representatives from the Department of Groundwater Resources (DGR) and the Department of Water Resources (DWR), Ministry of Natural Resources and Environment of Thailand, the Office of Natural Resources and Environment Policy and Planning of Thailand and the Hydrogeology Association of Thailand, led by Dr. He Qingcheng, Director of Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) Technical Secretariat, visited the IRCK and IKG.

3 月 31 日下午，在岩溶所学术报告厅举办了一场旨在介绍中泰岩溶研究现状的学术研讨会。与此同时，国际岩溶研究中心/岩溶所分别与 CCOP、泰国水资源厅和地下水资源厅代表举行了双边会谈，并签署了东亚东南亚地学计划协调委员会-联合国教科文组织国际岩溶研究中心技术合作会议纪要，初步确定了双方的合作机制与基本合作内容，双方同意将进一步开展合作项目申请与交流互访。纪要指出，将在管理层面和技术工作层面开展密切合作；在开展合作的头一年，合作专题以双方互通科技信息和联合举办国际培训活动为主。

In the afternoon， 31st, March, a symposium on academic exchange was held in the Academic Hall of IKG. The Protocol of the Technical Cooperation Meeting between CCOP and IRCK was signed by Dr. He Qingcheng and Mr. Jiang Yuchi, which stipulated the cooperation mechanism and topics between both sides, and agreed to have further discussion on potential project proposals and upcoming meetings. In line with the protocol, both sides agreed that the CCOP-IRCK cooperation should be carried out in two levels of cooperation, which are Executives Level and Technical Working Group Level. There should be two topics of cooperation being executed during the first year of this bilateral cooperation, including: A. Exchange of scientific and technological information; B. Co-organization of international training course.

签署东亚东南亚地学计划协调委员会-联合国教科文组织国际岩溶研究中心技术合作会议纪要

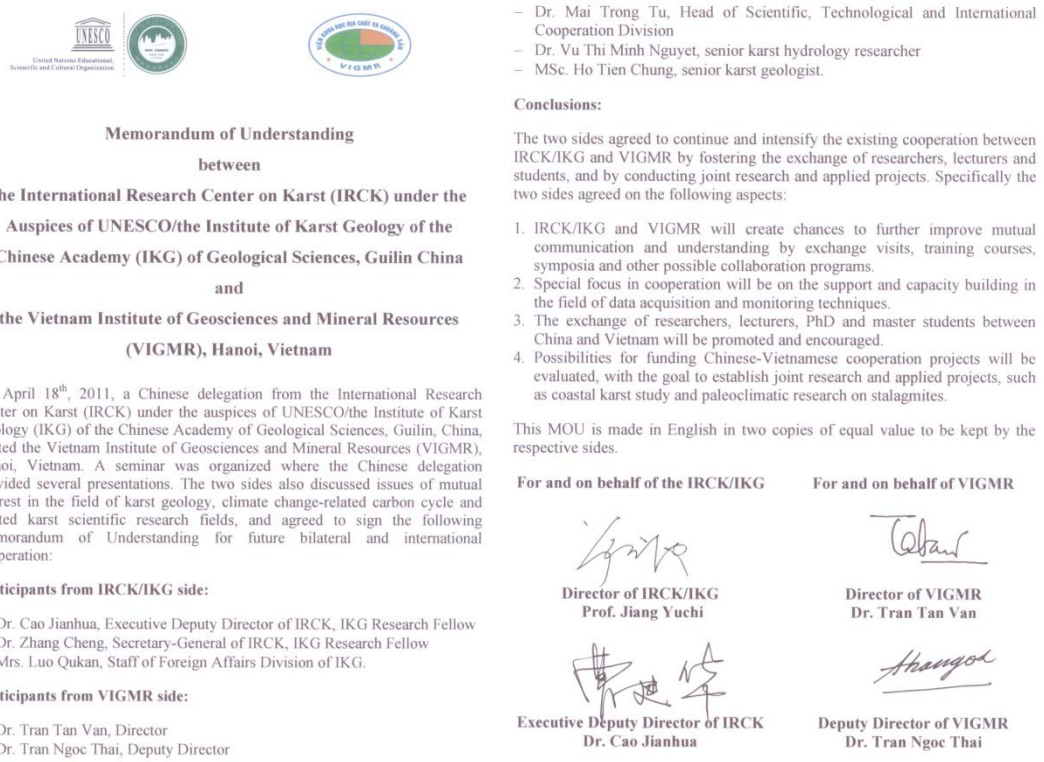
Signed a protocol on technical cooperation meeting between CCOP and IRCK

与越南地球科学与矿产资源研究所签署谅解备忘录

Signed MOU with Institute of Earth Sciences and Mineral Resources of Vietnam

4 月 15-19 日，中心代表团访问越南地球科学与矿产资源研究所。越南地球科学与矿产资源研究所，隶属于越南自然资源和环境部，位于越南首都河内，是一个以基础研究为主的科研机构。主要从事科研和技术研发，涵盖领域有矿产资源、地质资源、地下水资源、海洋地质，环境地质、城市地质、医药地质、工程地质，并设地质和矿产资源研究生培养点。访问期间，该所所长 Tran Tan Van 博士热情接待了中心代表团。代表们则就中国岩溶地质与生态环境的最新研究进展，岩溶碳汇研究研究进展和中心/岩溶所概况进行了重点介绍。

From 15th to 19th, April, IRCK visited the Institute of Earth Sciences and Mineral Resources of Vietnam (VIGMR). VIGMR located in Vietnam's capital city Hanoi, undertakes the fundamental research on earth science and mineral and ore. During this visit, Dr. Tran Tan Van, Director of this Institute, gave the IRCK delegation a warm welcome. The delegation members made three reports to the staff of the Institute on introduction IRCK/IKG; relationship between karst environment and vegetation; monitoring approach of karst carbon sink, respectively.



Memorandum of Understanding
between
the International Research Center on Karst (IRCK) under the Auspices of UNESCO/the Institute of Karst Geology of the Chinese Academy (IKG) of Geological Sciences, Guilin China
and
the Vietnam Institute of Geosciences and Mineral Resources (VIGMR), Hanoi, Vietnam

On April 18th, 2011, a Chinese delegation from the International Research Center on Karst (IRCK) under the auspices of UNESCO/the Institute of Karst Geology (IKG) of the Chinese Academy of Geological Sciences, Guilin, China, visited the Vietnam Institute of Geosciences and Mineral Resources (VIGMR), Hanoi, Vietnam. A seminar was organized where the Chinese delegation provided several presentations. The two sides also discussed issues of mutual interest in the field of karst geology, climate change-related carbon cycle and related karst scientific research fields, and agreed to sign the following Memorandum of Understanding for future bilateral and international cooperation:

Participants from IRCK/IKG side:

- Dr. Cao Jianhua, Executive Deputy Director of IRCK, IKG Research Fellow
- Dr. Zhang Cheng, Secretary-General of IRCK, IKG Research Fellow
- Mrs. Luo Qukan, Staff of Foreign Affairs Division of IKG.

Participants from VIGMR side:

- Dr. Tran Tan Van, Director
- Dr. Tran Ngoc Thai, Deputy Director
- Dr. Mai Trong Tu, Head of Scientific, Technological and International Cooperation Division
- Dr. Vu Thi Minh Nguyet, senior karst hydrology researcher
- MSc. Ho Tien Chung, senior karst geologist.

Conclusions:

The two sides agreed to continue and intensify the existing cooperation between IRCK/IKG and VIGMR by fostering the exchange of researchers, lecturers and students, and by conducting joint research and applied projects. Specifically the two sides agreed on the following aspects:

1. IRCK/IKG and VIGMR will create chances to further improve mutual communication and understanding by exchange visits, training courses, symposia and other possible collaboration programs.
2. Special focus in cooperation will be on the support and capacity building in the field of data acquisition and monitoring techniques.
3. The exchange of researchers, lecturers, PhD and master students between China and Vietnam will be promoted and encouraged.
4. Possibilities for funding Chinese-Vietnamese cooperation projects will be evaluated, with the goal to establish joint research and applied projects, such as coastal karst study and paleoclimatic research on stalagmites.

This MOU is made in English in two copies of equal value to be kept by the respective sides.

For and on behalf of the IRCK/IKG
Director of IRCK/IKG
Prof. Jiang Yuchi

Executive Deputy Director of IRCK
Dr. Cao Jianhua

For and on behalf of VIGMR
Director of VIGMR
Dr. Tran Tan Van

Deputy Director of VIGMR
Dr. Tran Ngoc Thai

越南地球科学与矿产资源研究所签署的谅解备忘录
The MOU signed with VIGMR

中心代表团与 Tran Tan Van 博士代进行了单独会谈，主要针对岩溶碳汇效应、古气候环境记录和岩溶区地质公园与自然遗产地申报及建设等问题展开讨论。Tran Tan Van 博士表示非常高兴能与中心/岩溶所开展切实合作，并有意启动双方合作项目的具体申请工作。同时，他希望中心能给予越南所相关技术方面的帮助与支持。最后，双方基于 2010 年 12 月 8 日及本次谈话内容起草并签署了国际岩溶研究中心/中国地质科学院岩溶地质研究所与越南地球科学与矿产资源研究所谅解备忘录。

The IRCK delegation had a constructive talk with Director Van, with the topics of the implication of karst carbon sink, stalagmite and paleoclimate record, geo-park and natural heritage sites in karst region. Director Van said it was a pleasure to cooperate with IRCK/IKG and he intended to make new proposals of relevant bilateral collaborative projects. In the meanwhile, he hoped that IRCK could provide technical support for the Vietnamese side. This successful talk led to the Memorandum of Understanding between IRCK/IKG and VIGMR being signed by both sides.

与昆士兰大学永续发展矿业研究所矿山土地修复中心签订合作备忘录

Signed MOU with Centre for Mined Land Rehabilitation, Sustainable Minerals Institute, University of Queensland

2011 年 10 月 6 日-8 日，中心代表团访问昆士兰大学矿山土地修复中心，并做学术交流。澳方研究人员及研究生对我所在全球气候变化和岩溶石漠化综合治理方面的研究表现强烈的兴趣，并就岩溶碳汇、石漠化综合治理、岩溶山区土地利用等方面的问题深入交流和讨论。

On October 6-8, the IRCK delegation visited the Centre for Mined Land Rehabilitation (CMLR), Sustainable Minerals Institute, University of Queensland. The Australian researchers and graduate students of the CMLR expressed their interest in the research on global climate change and karst rocky desertification comprehensive control being conducted by IRCK/IKG. Both sides exchanged ideas on karst carbon sink, rocky desertification treatment, and land use in karst mountainous region, etc.

双方就合作交流、互相邀请研究人员参与项目、联合培养研究生、科技人员互访、联合举行学术会议等达成了合作协议，并就将来双边合作签订了备忘录，为下一步在澳大利亚建立岩溶碳汇监测站奠定基础。

Both sides agreed with the preliminary intention on cooperating in exchange researchers and students, mutual visits, invitation of researchers to participate in relevant research projects, cosponsoring for academic symposia. And parties signed a MOU of bilateral cooperation to lay a foundation of karst carbon sink monitoring station construction in Australia.

与矿山土地修复中心师生进行学术交流

Communicated with technical staff of CMLR

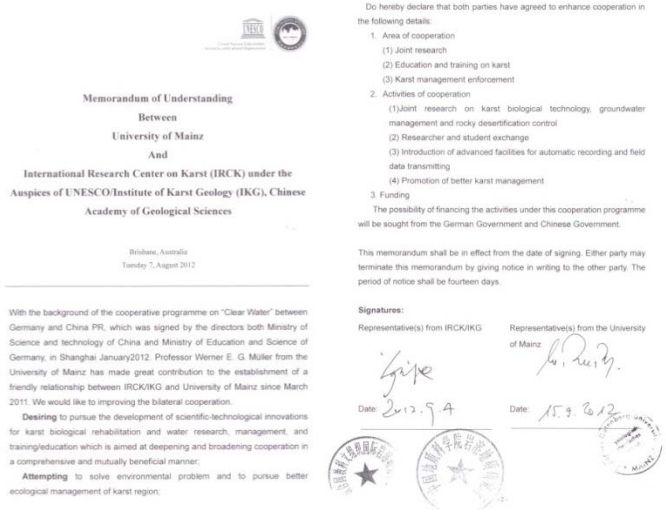
2012

与德国美因茨大学签署合作备忘录

Signed MOU with Mainz University, Germany

2012 年 8 月 5 日-12 日，第 34 届国际地质大会（IGC）在澳大利亚布里斯班市会展中心举行，作为分主题的召集人和协调人，蒋忠诚、曹建华和章程分别主持召开了两场专题研讨会：“岩溶过程、环境及古环境记录”和“环境变化与岩溶系统可持续性，IGCP/SIDA 598 项目”。来自美国、德国、中国、罗马利亚、澳大利亚、俄罗斯、西班牙、印度尼西亚等国家的 50 多名科学家参加了会议，其中 18 人做了会议学术报告。各国专家就岩溶碳汇问题、岩溶生态保护、岩溶水资源保护、岩溶地质灾害防治等国际岩溶领域的研究热点问题进行了深入交流，并就 IGCP/SIDA598 项目和国际岩溶研究中心的下一步国际合作和工作设想开展了讨论。

The 34th International Geological Congress (IGC) was held in the Conference Center in Brisbane, Australia, during August 5 to August 12, 2012. Nearly 6000 geologists from 137 countries and regions participated in the “Geo-Olympic” which is hold once every four years. The congress theme was “Unearthing our past and future- Resourcing Tomorrow” and it included presentations (3232 report, 37 themes, and 189 symposia), earth science exhibition (283 area), and field work (more than 50 routes). As the theme convener and coordinator, Jiang Zhongcheng, Cao Jianghua, and Zhang Cheng led two symposia: “Karst: processes, environment and paleo environmental records” and “Environmental change and sustainability in karst systems: relations to climate change and anthropogenic activities (2011-2016) [IGCP Project 598]”. More than 50 scientists from USA, Germany, China, Romania, Australia, Russia, Spanish, and Indonesia participated in the symposia, and 18 of them presented their academic reports. The scientists from different countries discussed hot research issues such as karst carbon sink, karst ecological protection, karst water resources protection, and karst geo-hazard prevention, and also made suggestions about the successful implementation of the IGCP/SIDA 598 project and the next step of the international cooperation of IRCK.



Memorandum of Understanding
Between
University of Mainz
And
International Research Center on Karst (IRCK) under the Auspices of UNESCO/Institute of Karst Geology (IKG), Chinese Academy of Geological Sciences

Brisbane, Australia
Tuesday 7, August 2012

With the background of the cooperative programme on “Clear Water” between Germany and China PR, which was signed by the directors both Ministry of Science and technology of China and Ministry of Education and Science of Germany, in Shanghai January2012. Professor Werner E. G. Müller from the University of Mainz has made great contribution to the establishment of a friendly relationship between IRCK/IKG and University of Mainz since March 2011. We would like to improving the bilateral cooperation.

Desiring to pursue the development of scientific-technological innovations for karst biological rehabilitation and water research, management, and training/education which is aimed at deepening and broadening cooperation in a comprehensive and mutually beneficial manner;

Attempting to solve environmental problem and to pursue better ecological management of karst region;

Do hereby declare that both parties have agreed to enhance cooperation in the following details:

1. Area of cooperation
   (1) Joint research
   (2) Education and training on karst
   (3) Karst management enforcement
2. Activities of cooperation
   (1)Joint research on karst biological technology, groundwater management and rocky desertification control
   (2) Researcher and student exchange
   (3) Introduction of advanced facilities for automatic recording and field data transmitting
   (4) Promotion of better karst management
3. Funding

The possibility of financing the activities under this cooperation programme will be sought from the German Government and Chinese Government.

This memorandum shall be in effect from the date of signing. Either party may terminate this memorandum by giving notice in writing to the other party. The period of notice shall be fourteen days.

Signatures:

Representative(s) from IRCK/IKG — Date: 2012.9.4

Representative(s) from the University of Mainz — Date: 15.9.2012

与德国美因茨大学合作备忘录 MOU with Mainz University

此外，国际岩溶研究中心代表在会议期间积极开展活动，与参会人员广泛交流、密切联系，与美因茨大学（University of Mainz）威那·穆勒教授（Werner E. G. Müller）密切沟通，起草国际岩溶研究中心/岩溶所与美因茨大学合作备忘录。旨在促成双方在岩溶生物技术、地下水管理和石漠化治理等相关领域的项目合作，引进先进的自动化数据传输技术，并开展人才培养计划。该合作协议于 2012 年 9 月签署。

Furthermore, the IRCK had wide and active communications with other participants during the meeting. In particularly, they had a close communication with Prof. Werner E. G. Müller from the Institute for Physiological Chemistry of Mainz University. As a result, they made a draft MOU between University of Mainz and IRCK/IKG, attempting to pursue joint research on karst biological technology, groundwater management and rocky desertification treatment, introduce advanced facilities for automatic recording and field data transmission, and conduct researcher and student exchange as well. This MOU was eventually signed in Sep. 2012.

与斯洛文尼亚科学与艺术研究院岩溶研究所签署技术合作会议纪要

Signed the protocol of technical cooperation meeting with KRI

联合国教科文组织国际岩溶研究中心与斯洛文尼亚科学与艺术研究院岩溶研究所代表于 2012 年 12 月 6 日在西南大学举办科技合作座谈会。经双方讨论协商，达成以下共识：1、在岩溶学研究院和国际岩溶研究中心框架下，通过双方合作促进岩溶科学发展；2、双方合作机制确定为在行政管理和科技工作两个层面共同开展；3、双方合作内容包括：在下一个年度切实开展科技信息共享；青年科技人员交换培养；并联合举办国际培训班；4、在国际岩溶研究中心框架下，共同推进建立一个国际性岩溶地质协会，以推动岩溶水文地质、气候变化和岩溶学相关领域的交流与合作；5、国际岩溶研究中心主管人员将于 2013 年 7 月底（具体日期再议）访问斯洛文尼亚科学与艺术研究院岩溶研究所，进一步开展双边合作细节商讨。

该文件由合作双方于 2012 年 12 月 9 日在中国桂林岩溶地质研究所以英文文字签订，协议内容即刻生效。

Pursuant to the visit of the Karst Research Institute ZRC SAZU Delegation to China during 3-9 December 2012 to attend the IRCK international training course on karst and hydrochemistry and IGCP/SIDA 598 working group meeting, the meeting between Karst Research Institute ZRC SAZU and the International Research Center on Karst Under the Auspices of UNESCO (IRCK) was held on 6 December 2012 in Southwest University, Chongqing, China.Do hereby declare that both parties have agreed to enhance the cooperation in the following details:

(1) To promote the karst science in the framework of Karstology Academy and IRCK through bilateral Cooperation

(2) The mechanism of cooperation: the meeting agreed that the Karst Research Institute ZRC SAZU-IRCK cooperation should be carried out in two levels of cooperation, which are Executives Level and Technical Working Group Level.

(3) Topics of cooperation: the meeting agreed that there should be three topics of cooperation being executed during the first year including: a. exchange of scientific and technological information and young scientists; b. co-organization of international training course; c. possibility for funding Slovenian-Chinese cooperation projects will be evaluated, with the goal to establish common research and applied projects.

(4) To formulate bilateral cooperation proposals on karst hydrogeology and climate change and karst in total complex karstology, make co-effort to establishment of a International Karst Geological Association under the framework of IRCK.

(5) Upcoming meeting: IRCK’s Executives will visit the Karst Research Institute ZRC SAZU to discuss in details on bilateral cooperation and possible proposals, presumably in late July 2013(the exact dates of visit will be further discussed), in order to provide an opportunity for executives and experts of both sides to meet and further discuss on mentioned topics of cooperation.

Signed in the Institute of Karst Geology, Guilin, China on 9 December 2012 in English Language. This protocol shall be in effect from the date of signing.

Protocol of
The Technical Cooperation Meeting
Between
Karst Research Institute ZRC SAZU
And
International Research Center on Karst under the Auspices of UNESCO (IRCK)

Thursday 6 December 2012, 08.00-10.00 A. M.
Southwest University. Chongqing, China

Pursuant to the visit of the Karst Research Institute ZRC SAZU Delegation to China during 3-9 December 2012 to attend the IRCK international training course on karst and hydrochemistry and IGCP/SIDA 598 working group meeting, the meeting between Karst Research Institute ZRC SAZU and the International Research Center on Karst Under the Auspices of UNESCO (IRCK) was held on 6 December 2012 in Southwest University, Chongqing, China.

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Signed in the Institute of Karst Geology, Guilin, China on 9 December 2012 in English Language. This protocol shall be in effect from the date of signing.

For the Karst Research Institute ZRC SAZU	For the International Research Center on Karst Under the Auspices of UNESCO (IRCK)
2012.12.7.	2012.12.7
(Mr. Tadej Slabe) Director of Karst Research Institute ZRC SAZU	(Mr. Jiang Yuchi) Director of International Research Center on Karst, UNESCO (IRCK)

技术合作会议纪要

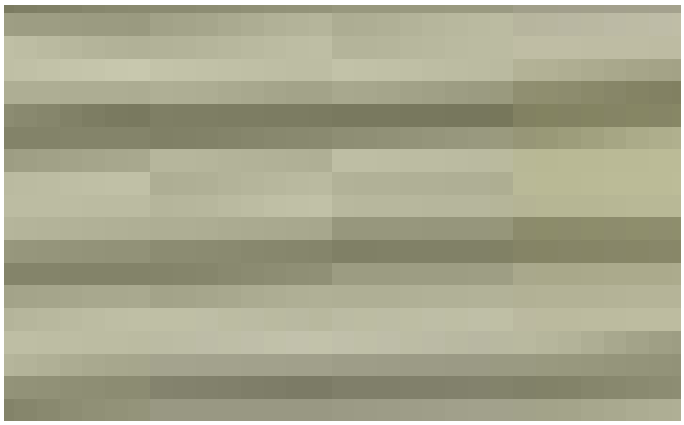
The protocol of technical cooperation meeting with KRI

2013

与泰国地下水资源厅副厅长签署《岩溶与地下水资源调查研究合作协议》

Signed Agreement on Karst and Groundwater Resources Survey and Study with DGR

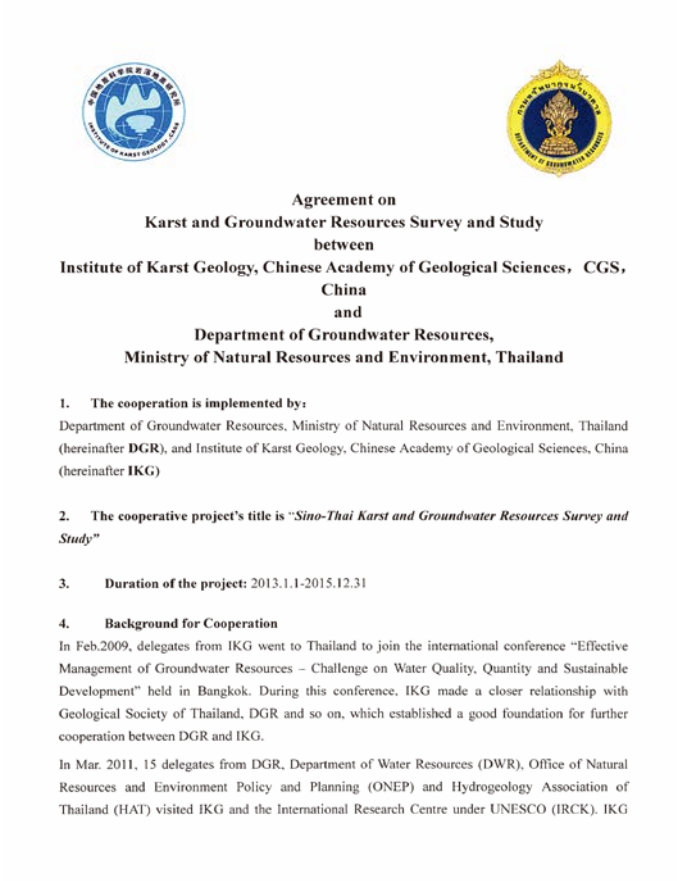
2013 年 4 月 11 日，泰国地下水资源厅副厅长塞姆瑞特.舒赛纳塔斯(Sumrit Chusanathas)一行三人，访问了国际岩溶研究中心/中国地质科学院岩溶地质研究所，并签署《岩溶与地下水资源调查研究合作协议》。岩溶所蒋忠诚副所长和塞姆瑞特副厅长代表中泰双方就各自的研究领域、研究优势等进行了介绍。泰方表示，希望在岩溶资源调查研究、岩溶水文地质填图、岩溶水文物探方法、岩溶洞穴调查与开发、地下水资源调查与开发等方面都能开展相关合作，引进中方的先进技术和经验等。



蒋忠诚副所长和塞姆瑞特.舒赛纳塔斯副厅长分别代表中泰签署《岩溶与地下水资源调查研究合作协议》

Prof. Jiang Zhongcheng and Dr. Sumrit Chusanathas signed the Agreement on Karst and Groundwater Resources Survey and Study between IRCK/IKG and DGR

On April 11, 2016, Deputy Director General Sumrit Chusanathas and two colleagues from the Department of Groundwater Resources (DGR), Ministry of Natural Resources and Environment, Bangkok, Thailand visited IRCK/IKG and signed the Agreement on Karst and Groundwater Resources Survey and Study between IRCK/IKG and DGR. Prof. Jiang Zhongcheng, Deputy Director of IKG and Deputy Director General Sumrit Chusanathas from Thailand introduced their organizations' research areas and recent advances. The Thai side expressed hope for future cooperation introducing advanced technology and experience from China for karst resources investigation research, karst hydrogeological mapping, karst hydrophysical exploration techniques, karst cave investigation and exploitation, and groundwater resources investigation and development.



Agreement on
Karst and Groundwater Resources Survey and Study
between
Institute of Karst Geology, Chinese Academy of Geological Sciences, CGS, China
and
Department of Groundwater Resources,
Ministry of Natural Resources and Environment, Thailand

1. **The cooperation is implemented by:**
Department of Groundwater Resources, Ministry of Natural Resources and Environment, Thailand (hereinafter **DGR**), and Institute of Karst Geology, Chinese Academy of Geological Sciences, China (hereinafter **IKG**)

2. **The cooperative project's title is "*Sino-Thai Karst and Groundwater Resources Survey and Study*"**

3. **Duration of the project:** 2013.1.1-2015.12.31

4. **Background for Cooperation**
In Feb.2009, delegates from IKG went to Thailand to join the international conference "Effective Management of Groundwater Resources – Challenge on Water Quality, Quantity and Sustainable Development" held in Bangkok. During this conference, IKG made a closer relationship with Geological Society of Thailand, DGR and so on, which established a good foundation for further cooperation between DGR and IKG.

In Mar. 2011, 15 delegates from DGR, Department of Water Resources (DWR), Office of Natural Resources and Environment Policy and Planning (ONEP) and Hydrogeology Association of Thailand (HAT) visited IKG and the International Research Centre under UNESCO (IRCK). IKG

岩溶与地下水资源调查研究合作协议

Agreement on Karst and Groundwater Resources Survey and Study

与美国国立洞穴与岩溶研究所签订合作协议

Signed cooperative agreement with US National cave and Karst Research Institute

美国国立洞穴与岩溶研究所所长乔治.维尼（George.Veni）先生应邀作为国际岩溶研究中心第一个六年评估专家组成员，第五届国际岩溶研究中心培训班教员，于 11 月下旬访问国际岩溶研究中心/岩溶地质研究所。期间，维尼先生与时任主任姜玉池进行了合作交流，并签署了合作协议。

Dr. George Veni, executive director of the US National cave and Karst Research Institute (NCKRI), visited IRCK/IKG in late November, 2013. He served as a member of the expert panel appointed by UNESCO to conduct the First 6-year Assessment of IRCK and as a lecturer of 5th training course. During his visit, Dr. Veni spoke with Mr. Jiang Yuchi and signed a cooperative agreement with IRCK/IKG.

姜玉池先生首先非常感谢维尼所长应邀来参加中心的活动，感谢他对国际岩溶研究中心建设的关注及对未来建设方向提供的非常有益的信息。很高兴看到维尼所长成为第二届国际岩溶研究中心学术委员会委员。中国和美国都是岩溶分布比较多的国家，长期以来，中美双方岩溶科学家有着密切合作、交流的历史和经验，相信双方的合作会有一个更好的未来。

Mr. Jiang Yuchi thanked Dr. Veni for participating in IRCK activities, and for providing support and input for IRCK development. He was also glad to learn that Dr. Veni has been elected as a member of the Second IRCK Academic Committee. He noted that both the US and China are rich in karst resources, and the karst scientists from the two countries have been working closely for a long time, believing the cooperation between the two parties will enjoy a brighter future.

乔治.维尼所长与姜玉池先生签署合作协议

Dr. George Veni signed agreement with Mr. Jiang Yuchi

2. Contributions of the parties

Each party will provide services, goods, opportunities, and activities (collectively "items") to the other as listed below, but not limited to those on the list if each party mutually agrees to additional items. Each party will endeavor to keep the other party informed in a timely manner of all developments and listed items that may be relevant to the other. These include:

a. The parties will host visiting scholars, students, and/or staff from each others' organization. The cost and duration of such visits will be negotiated to assure the benefits and costs are similar for mutual visits of personnel from each party.
b. All classes, workshops, conferences, seminars, field trips, and symposia organized by each party will be open free of charge to as many as three staff, students, or directors of the other party. The hosting party will not be responsible for the transportation, food, lodging, and other expenses of the attending party's members.
c. One copy of each publication (journal, book, guidebook, manual) produced by each party after the date of this MOU will be sent to the other party for its library, and both parties will share information.
d. When reasonably practicable and mutually agreed upon, the parties shall cooperate to develop research, management, and educational projects, programs, and conferences. Any such project, program or conference shall be the subject of a separate written agreement between the parties.
e. Both parties will make efforts to promote the karst carbon sink monitoring network.

3. Intellectual property

The parties shall retain exclusive right, title and interest to their individual underlying technologies. Should intellectual property be created, conceived or developed jointly in the performance of activities covered by this MOU, it shall be allocated by means of good faith negotiations between the parties. Both parties shall be free to publish their results with due acknowledgement of the other party where appropriate.

4. Amendments

This MOU may be amended only upon written agreement between the parties.

5. Entry into effect, duration and termination

This MOU will become effective upon signature and will remain in effect for 5 years. Following a one month review period, and unless modified or terminated, this MOU will automatically be renewed for an additional five year period on 01 January on each year ending in zero (0) and five (5). It is understood and agreed that either party, upon one hundred and twenty (120) days written notice, may terminate this MOU with or without cause.

6. Approvals

Each of the parties has duly executed this MOU in duplicate by its duly authorized officer and retains one copy of each duplicate, each having equal authenticity. This MOU shall become effective upon its approval by the governing body of each party. When the governing body of a party has given such approval, such party shall promptly notify the other party in writing.

7. Governing Law

Each party shall comply in all material respects with the applicable laws and regulations of the nation in which it is based.

8. Assignment

This MOU may not be assigned, replaced or otherwise transferred by operation of law or otherwise by either party without the prior written consent of the other party, which consent shall not be unreasonably withheld.

9. Legal Effect of this MOU

The relationship of the parties shall be that of independent organizations, and nothing in this MOU shall be deemed to constitute the parties as partners, co-owners, joint employers, or otherwise participants in a joint venture or common undertaking. Nothing in this MOU shall be deemed to give either party any power to direct or control any activities, or any power to bind or obligate the other. No employee of one party shall be deemed an employee of the other.

10. Communications

Communications between the parties will be through the undersigned officers and their addresses on the following page, or their duly authorized designees. Changes in addresses and/or representatives will be reported to the other party within thirty (30) days.

On behalf of
National Cave & Karst Research Institute, Inc
George Veni, Ph.D.
Executive Director
401-1 Cascades Avenue
Carlsbad, New Mexico 88220
USA
+1-575-887-5317
+1-575-887-3527 (fax)
gveni@nckri.org
www.nckri.org

Signature: _____ Date: 2013-11-29

On behalf of
International Research Center on Karst / Institute of Karst Geology
Jiang Yuchi
Director
50 Qixing Lu
Guilin, Guangxi 541004
China
+86-7735812943
yuchi@karst.ac.cn
www.karst.ac.cn

Signature: _____ Date: 2013.11.29

Cooperative agreement

2014

与南非南非水资源委员会、南非科学与工业研究委员会签署合作纪要

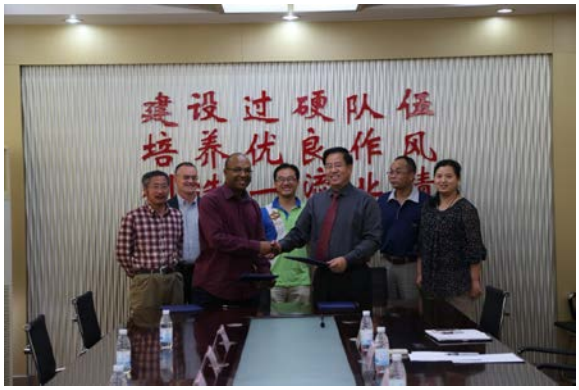
Signed Minutes on the seminar of cooperation with South African Water Research Commission and South African Council for Scientific and Industrial Research

2014 年 10 月 27 日下午，利用在桂林召开的“发展中国家水资源国际研讨会”间隙，来自南非水资源委员会的首席执行官 Dhesigen Pydiah Naidoo 先生、南非科学与工业研究委员会的水文领域负责人 Harrison Pienaar、南非西开普大学联合国教科文组织水文地质教席徐永新教授等 7 位南非方代表与时任国际岩溶研究中心/中国地质科学院岩溶地质研究所姜玉池和相关部门负责人等举行了会谈。

On October 27, 2014, Prof. Jiang Yuchi and heads of relevant departments under IRCK/IKG held talks with seven representatives from relevant research institutions in South Africa. The guests included Mr. Dhesigen Pydiah Naidoo, CEO of South African Water Research Commission (WRC); Harrison Pienaar, head of hydrology, South African Council for Scientific and Industrial Research(CSIR); and Prof. Xu Yongxin from the University of Western Cape and UNESCO Chair in Hydrogeology.

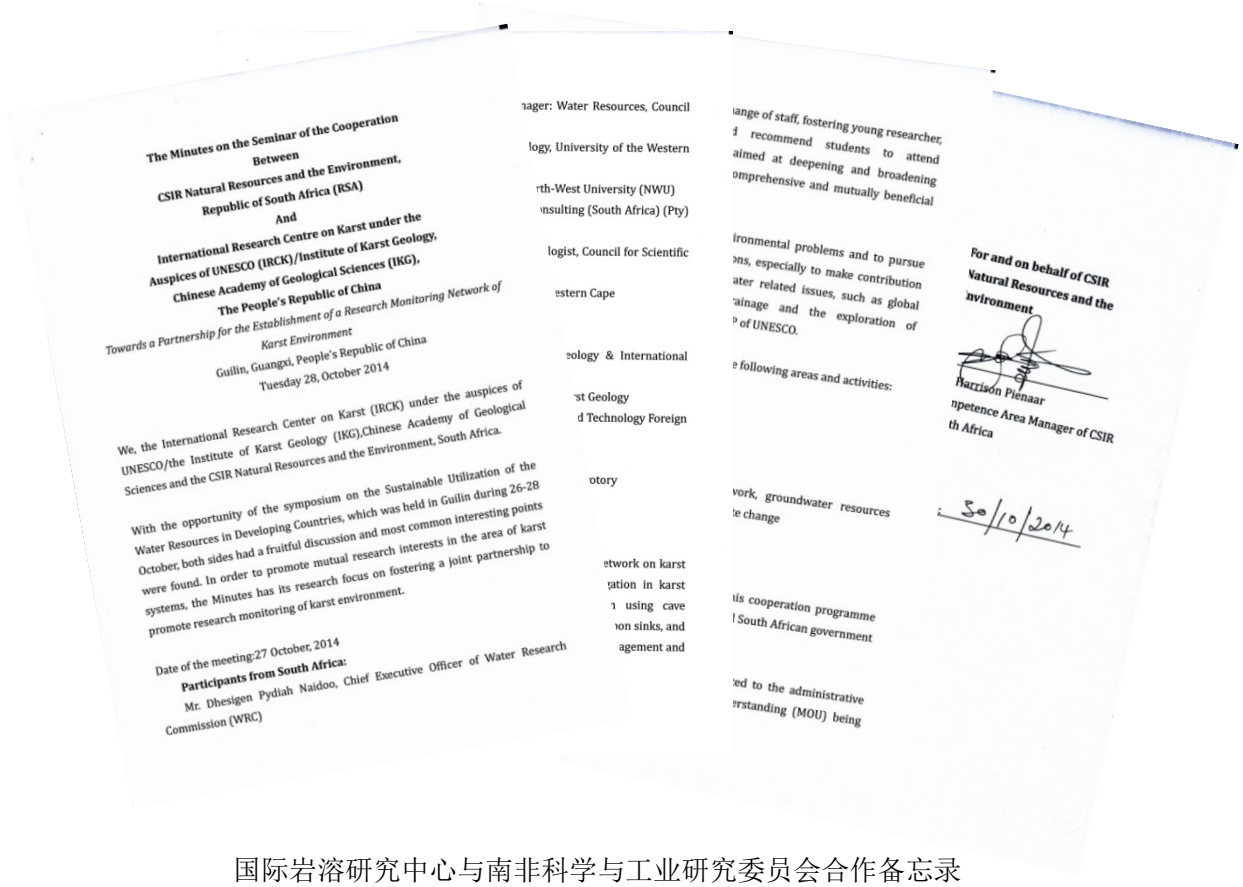
双方表示希望在水资源管理、水资源调查评价、地下水污染恢复治理及相关技术方法等方面加强交流与合作；同时利用各自的开放实验室和相应设备优势开展合作研究；同时，建议充分利用好联合国教科文组织国际岩溶研究中心及联合国教科文组织水文地质教席的平台作用，加强信息共享与国际合作，加深交流与合作，互派访问学者及研究生的方式开展学术交流和人才培养。此外，双方还就“岩溶碳汇循环国际监测网建设”项目的开展进行了沟通交流，并初步达成了共识。10 月 30 日下午，岩溶所（国际岩溶研究中心）分别与南非水资源委员会、南非科学与工业研究委员会自然资源和环境部等就上述初步合作意向签署了会议纪要。

Both parties expressed the intent to enhance exchange and cooperation in terms of water resources management, water resources survey and assessment, underground water pollution control and management and relevant technical methods; and to use each party’s laboratory and facilities to conduct cooperative research. It is also suggested that both parties fully leverage the platforms of IRCK and UNESCO to strengthen information sharing and international cooperation, and to conduct academic exchange (exchange of visiting scholars) and talent training (of postgraduate students). Both parties also reached initial consensus on the implementation of the project “Development of international monitoring network on karst carbon sink cycle”. On October 30, IRCK signed the minutes on the seminar of cooperation with South African Water Research Commission and South African Council for Scientific and Industrial Research Natural Resources and Environment Unit.



岩溶中心主任姜玉池研究员与 Harrison Pienaar 先生签署交换会议纪要

Mr. Jiang Yuchi exchanged minutes on the seminar of cooperation with Mr. Harrison Pienaar



The Minutes on the Seminar of the Cooperation
Between
CSIR Natural Resources and the Environment,
Republic of South Africa (RSA)
And
International Research Centre on Karst under the
Auspices of UNESCO (IRCK)/Institute of Karst Geology,
Chinese Academy of Geological Sciences (IKG),
The People's Republic of China

Towards a Partnership for the Establishment of a Research Monitoring Network of Karst Environment

Guilin, Guangxi, People's Republic of China
Tuesday 28, October 2014

We, the International Research Center on Karst (IRCK) under the auspices of UNESCO/the Institute of Karst Geology (IKG),Chinese Academy of Geological Sciences and the CSIR Natural Resources and the Environment, South Africa.

With the opportunity of the symposium on the Sustainable Utilization of the Water Resources in Developing Countries, which was held in Guilin during 26-28 October, both sides had a fruitful discussion and most common interesting points were found. In order to promote mutual research interests in the area of karst systems, the Minutes has its research focus on fostering a joint partnership to promote research monitoring of karst environment.

Date of the meeting:27 October, 2014
Participants from South Africa:
Mr. Dhesigen Pydiah Naidoo, Chief Executive Officer of Water Research Commission (WRC)

...nager: Water Resources, Council
...logy, University of the Western
...rth-West University (NWU)
...nsulting (South Africa) (Pty)
...logist, Council for Scientific
...estern Cape
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...using cave
...on sinks, and
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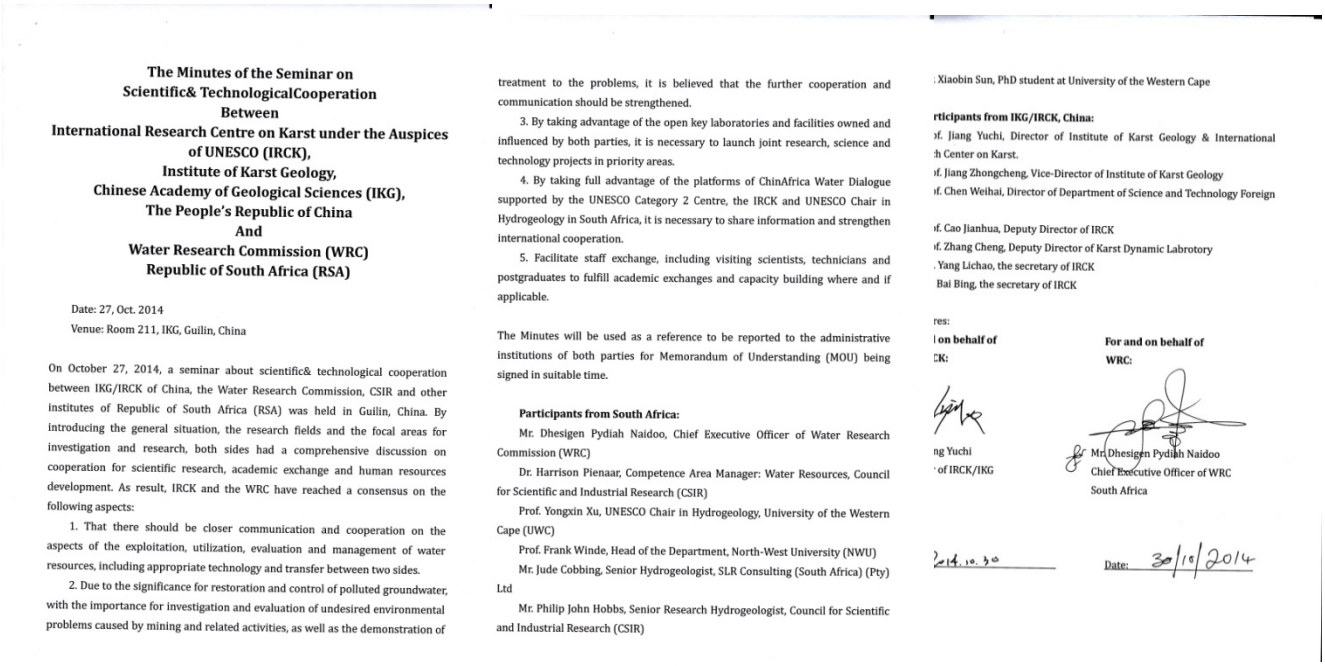
...ange of staff, fostering young researcher,
...recommend students to attend
...aimed at deepening and broadening
...omprehensive and mutually beneficial
...ironmental problems and to pursue
...ons, especially to make contribution
...ater related issues, such as global
...rainage and the exploration of
...of UNESCO.
...following areas and activities:
...work, groundwater resources
...te change
...is cooperation programme
...South African government
...ed to the administrative
...erstanding (MOU) being

For and on behalf of CSIR
Natural Resources and the
nvironment
Harrison Pienaar
npetence Area Manager of CSIR
th Africa
30/10/2014

国际岩溶研究中心与南非科学与工业研究委员会合作备忘录
Minutes on the seminar of cooperation between IRCK and CSIR



The Minutes of the Seminar on
Scientific& TechnologicalCooperation
Between
International Research Centre on Karst under the Auspices of UNESCO (IRCK),
Institute of Karst Geology,
Chinese Academy of Geological Sciences (IKG),
The People's Republic of China
And
Water Research Commission (WRC)
Republic of South Africa (RSA)

Date: 27, Oct. 2014
Venue: Room 211, IKG, Guilin, China

On October 27, 2014, a seminar about scientific& technological cooperation between IKG/IRCK of China, the Water Research Commission, CSIR and other institutes of Republic of South Africa (RSA) was held in Guilin, China. By introducing the general situation, the research fields and the focal areas for investigation and research, both sides had a comprehensive discussion on cooperation for scientific research, academic exchange and human resources development. As result, IRCK and the WRC have reached a consensus on the following aspects:

1. That there should be closer communication and cooperation on the aspects of the exploitation, utilization, evaluation and management of water resources, including appropriate technology and transfer between two sides.

2. Due to the significance for restoration and control of polluted groundwater, with the importance for investigation and evaluation of undesired environmental problems caused by mining and related activities, as well as the demonstration of treatment to the problems, it is believed that the further cooperation and communication should be strengthened.

3. By taking advantage of the open key laboratories and facilities owned and influenced by both parties, it is necessary to launch joint research, science and technology projects in priority areas.

4. By taking full advantage of the platforms of ChinAfrica Water Dialogue supported by the UNESCO Category 2 Centre, the IRCK and UNESCO Chair in Hydrogeology in South Africa, it is necessary to share information and strengthen international cooperation.

5. Facilitate staff exchange, including visiting scientists, technicians and postgraduates to fulfill academic exchanges and capacity building where and if applicable.

The Minutes will be used as a reference to be reported to the administrative institutions of both parties for Memorandum of Understanding (MOU) being signed in suitable time.

Participants from South Africa:
Mr. Dhesigen Pydiah Naidoo, Chief Executive Officer of Water Research Commission (WRC)
Dr. Harrison Pienaar, Competence Area Manager: Water Resources, Council for Scientific and Industrial Research (CSIR)
Prof. Yongxin Xu, UNESCO Chair in Hydrogeology, University of the Western Cape (UWC)
Prof. Frank Winde, Head of the Department, North-West University (NWU)
Mr. Jude Cobbing, Senior Hydrogeologist, SLR Consulting (South Africa) (Pty) Ltd
Mr. Philip John Hobbs, Senior Research Hydrogeologist, Council for Scientific and Industrial Research (CSIR)

...Xiaobin Sun, PhD student at University of the Western Cape

...rticipants from IKG/IRCK, China:
...f. Jiang Yuchi, Director of Institute of Karst Geology & International ...h Center on Karst.
...f. Jiang Zhongcheng, Vice-Director of Institute of Karst Geology
...f. Chen Weihai, Director of Department of Science and Technology Foreign
...f. Cao Jianhua, Deputy Director of IRCK
...f. Zhang Cheng, Deputy Director of Karst Dynamic Labrotory
. Yang Lichao, the secretary of IRCK
Bai Bing, the secretary of IRCK

...res:
...on behalf of ...CK:
...ng Yuchi
... of IRCK/IKG
...2014.10.30

For and on behalf of WRC:
Mr. Dhesigen Pydiah Naidoo
Chief Executive Officer of WRC
South Africa
Date: 30/10/2014

国际岩溶研究中心与南非水资源研究委员会合作备忘录
Minutes on the seminar of cooperation between IRCK and WRC

2015

与南非水资源委员会签署合作备忘录
Signed the MOU with South Africa Water Research Commission

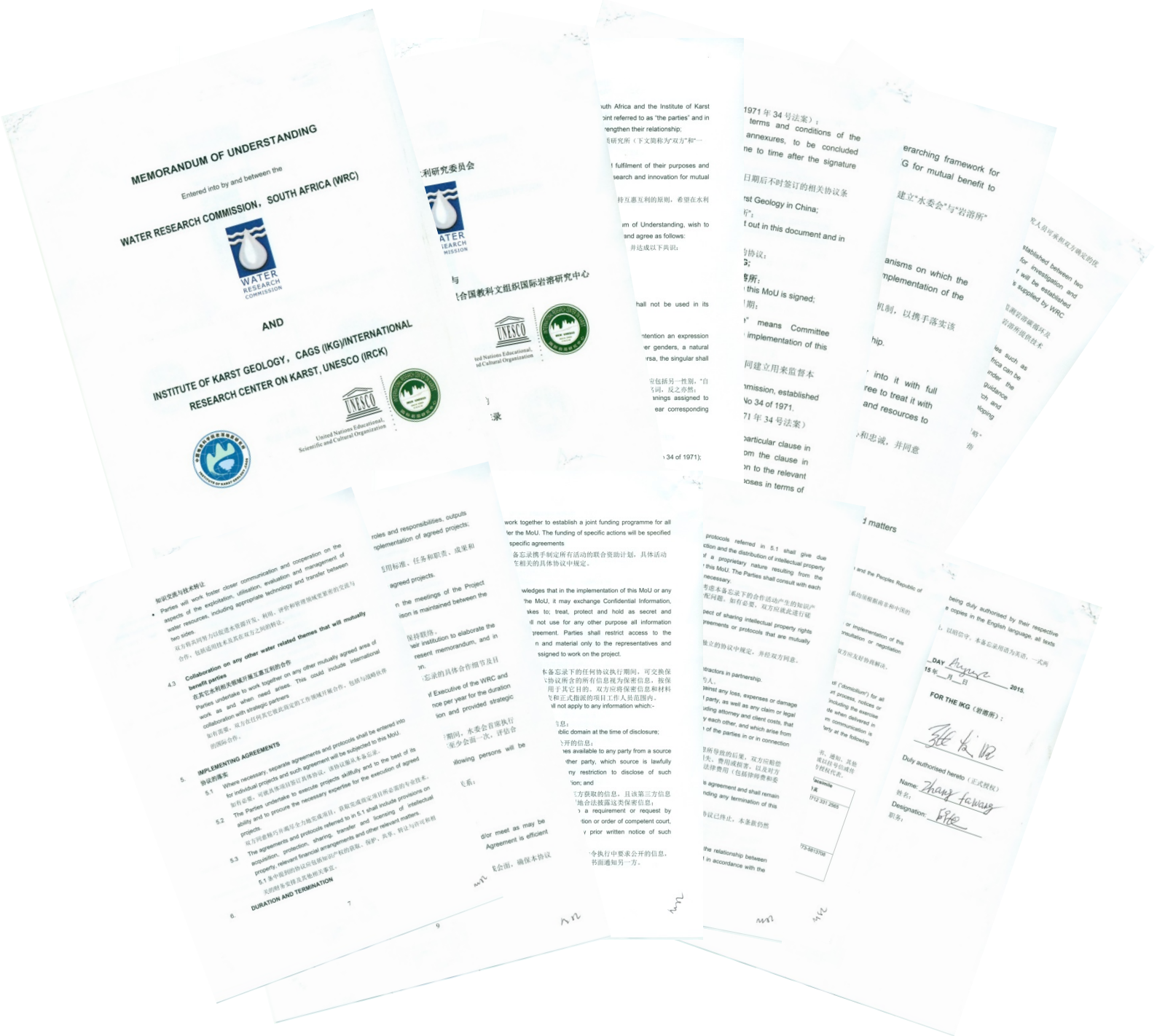
2015 年 8 月 17 日至 19 日，在南非西开普大学召开了第三届“发展中国家水资源可持续利用国际研讨会”，暨中非水资源论坛。中国地质科学院岩溶地质研究所/国际岩溶研究中心代表团由岩溶所党委书记、常务副所长张发旺研究员、白冰研究实习员参加。

The Third International Symposium of Sustainable Utilization of Water Resources in Developing Countries in South Africa and the Third Chinafrica Water Forum was held from August 17-19, 2015 in the University of the Western Cape, South Africa. Prof. Zhang Fawang, and research assistant Bai Bing from IRCK joined the symposium.

在会议期间，张发旺书记代表地科院岩溶所/国际岩溶研究中心与南非水利研究委员会副总执行官 Dr. Stanley Liphadzi 先生签署了《中国地质科学院岩溶地质研究所/联合国教科文组织国际岩溶研究中心与南非水利研究委员会合作谅解备忘录》/Memorandum of Understanding Entered into by and between the Water Research Commission， South Africa （WRC） and Institute of Karst Geology， CAGS（IKG）/International Research Center on Karst (IRCK)，UNESCO （附录）。根据合作备忘录，双方将在创新与研究、知识交流与技术转让、水利等相关领域开展合作。双方乐于通过履行各自职责，实现各自目标和任务，秉承互惠互利的原则，在水资源相关研究和创新领域开展合作。

During the meeting, a Memorandum of Understanding (MOU) was entered into by and between the Water Research Commission（WRC）, South Africa and Institute of Karst Geology（IKG），CAGS/International Research Center on Karst (IRCK)，UNESCO (see attached). The MOU was signed by Prof. Zhang Fawang and Dr. Stanley Liphadzi on behalf of the two organizations respectively. According to the MOU, both parties will conduct cooperation in terms of innovation and research, knowledge exchange and technical transfer, water conservancy and other areas. Both parties are willing to achieve the objectives and tasks by performing each party’s responsibilities, and conduct cooperation in water resources-related research and innovation areas according to a principle of mutual benefit.

张发旺研究员与南非水利研究委员会 Dr. Stanley Liphadzi 先生签署合作备忘录
Prof. Zhang Fawang signed the MOU with Dr. Stanley Liphadzi of WRC



与南非水资源委员会签署的合作备忘录

MOU signed with WRC

国际合作项目 International Cooperative Projects

国际地质对比计划 IGCP598 项目

IGCP Project Proposal 598

项目名称：岩溶系统的环境变化及可持续性与气候变化和人类活动的关系（2011-2016）

Project title: Environmental Change and Sustainability in Karst Systems: Relations to Climate Change and Anthropogenic Activities (2011-2016)

项目首要申请人：章程（联合国教科文组织国际岩溶研究中心、中国地质科学院岩溶地质研究所）

Project leader: Dr. Zhang Cheng (IRCK/IKG)

项目共同申请人：

袁道先（联合国教科文组织国际岩溶研究中心、中国地质科学院岩溶地质研究所）

Chris Groves（美国西肯塔基大学霍夫曼环境研究所）

Augusto Auler（巴西岩溶所）

蒋勇军（西南大学地理科学学院）

Martin Knez（斯洛文尼亚岩溶所）

Bartolome Andreo（西班牙马拉加大学水文地质中心）

Co-leaders:

Prof. Yuan Daoxian (IRCK/IKG)

Prof. Chris Groves (Hoffman Environmental Research Institute, Department of Geography and Geology, Western Kentucky University, USA)

Dr. Augusto Auler (Instituto do Carste, Brazil)

Dr. Jiang Yongjun (School of Geographical Sciences, Southwest University)

Dr. Martin Knez (Karst Research Institute ZRC SAZU, Slovenia)

Dr. Bartolome Andreo (Centre of Hydrogeology of the University of Malaga and Department **of Geology, Spain)**

研究内容：

Research Contents:

（1）研究地质生物过程和人类活动（土地利用、农业活动等）对碳酸盐岩溶蚀作用的影响，不断改进方法，更好的估算岩溶碳汇潜力；

(1) Significantly better estimation of the carbon sink potential from carbonate rock dissolution on the continents with improvement of approaches used for these estimations that

consider geobiological processes and anthropogenic influences;

（2）研究岩溶含水层与水资源过程对不同气象与气候条件（如极端干旱与洪涝事件）的水文地质响应；

(2) Research on the responses of hydrogeological behavior of karst aquifers and water resource processes under the influence of different weather and climatic events, including extreme events of droughts and floods;

（3）不同岩溶地貌/含水层地下水脆弱性评价研究，更加有针对性和科学地保护岩溶含水层，免于污染；利用岩溶扰动指数方法研究人类扰动对岩溶环境的影响，并进行方法对比；

(3) Research on the improvement of methods for groundwater vulnerability assessments to contamination and development karst disturbance indices in different kasrt landscape/aquifer system;

（4）提取记录在岩溶水体、沉积物、石笋以及文化记载中不同时间尺度环境变化信息（指标），并进行量化研究。

(4) Quantification of records of environmental change within water, sediments, speleothems, and cultural records preserved with in karst systems that provide information over various timescales.

根据项目的主要目标，国际地学计划项目“环境变化与岩溶系统可持续性(IGCP/SIDA598)”的主要成果概况如下：

In line with the objectives of the project, the major findings of “IGCP Project on Environmental Change and Sustainability in Karst System” (IGCP/SIDA 598 Project) are summarized as follows:

岩溶碳汇潜力及全球气候变化

地质过程对岩溶碳循环的影响，尤其是碳酸盐岩与大气CO_2之间的相互作用，受到了地质界科学家们的广泛关注。一些科学家及实验室研究人员参与到IGCP/SIDA598 项目中，并做出贡献，尤其是在量化岩溶地质化学过程和人类活动，例如土地利用变化对岩溶碳循环的影响。本项目还同时研究岩溶地表河流系统中水生植物是如何利用HCO_3^-作为碳源，从而影响相关碳汇的测量。Montety等人（2011）研究了岩溶水中生物地球化学循环对碳酸盐平衡的影响，并表明含有大量水生植物的大系统充当着自然碳汇的角色。章程等人（2012）研究了中国广西官村地下河中水生植物光合作用的碳汇影响。在 1350 米的官村河流中，无机碳随径流的流失量估计值为 94.9kg/day，这说明从岩溶地下河流进入地表河的重碳酸盐被植物所消耗或被自生的方解石所捕获，从而构成了官村岩溶系统的自然碳汇。从中国西南地区的监测站或实验基地中得到的数据显示做为低温地质化学开放系统的岩溶过程对环境变化非常敏感，并且是一个特殊的涉及到短期碳循环（土地利用方式改变的影响）的地质过程。地表生态系统中的碳汇速率会随着植被的生长或森林的恢复而增加，这表明由岩溶溶解剥蚀引起的相似的过程也会发生在地下。Chris Groves等人(Groves et al. 2013; Polk et al., 2013a)讨论了美国肯塔基州Pennyroyal高原地区表层岩溶带中的水-气-岩相互作用和地球化学环境的季节控制作用。中美两国的科学家们致力于合作建立一种高分辨率碳汇监测的标准方法，这种方法于 2013 年最先应用在中国广西的毛村流域和美国肯塔基州的Lost河洞穴中得到尝试。

Karst carbon sink potential and global climate change

The impact of geological processes on the carbon cycle, in particular the interactions between carbonate rocks and atmospheric CO_2, is receiving increasing attention among scientists in the geological community. Several scientists and laboratory coordinators affiliated with IGCP/SIDA 598 made contributions in this area, in particular quantifying the impact of karst geochemical processes and human activities such as land use change on the carbon cycle. Studies are simultaneously underway to understand how aquatic vegetation utilizing HCO_3^- as a carbon source is karst surface river systems may influence measurements of the relevant carbon sinks. Montety et al.(2011) studied the influence of biogeochemical cycles on carbonate equilibrium in a karst river and suggested that large systems with abundant subaquatic vegetation may act as natural sink of carbon. Zhang Cheng et al. (2012) studied the carbon sink effect of subaquatic vegetation photosynthesis in Guancun River, an underground stream-fed river, Guangxi, China. The loss of inorganic carbon along its flow path is estimated to be about 94.9 kg/day along the 1350 m of the Guangcun River. It means that bicarbonate entering the river from karst underground stream was consumed by plants or trapped in the authigenic calcite and thus constitutes a natural sink of carbon for the Guancun karst system. Data from monitoring and experimental sites in southwestern China areas showed that karst process, as a low-temperature geochemical open system, is a special geological process that is involved in the short-term carbon cycle (land use change impact) and very sensitive to environmental change. Carbon sink rates within terrestrial ecosystems increase with vegetation development or reforestation, here it was shown that similar processes caused by karst dissolutional denudation can occur underground as well. Chris Groves and others (Groves et al. 2013; Polk et al., 2013a) discussed water-gas-rock interactions and seasonal control of geochemical environments in the epikarstic zone of the Pennyroyal Plateau, Kentucky, USA. Chinese and American scientists continued to develop collaboration in establishing a standard methodology for high-resolution carbon sink monitoring with an initial pair of reference sites established at the Maocun Basin in Guangxi, China and Lost River Cave in Kentucky USA in early 2013.

岩溶含水层系统与水资源过程

在 IGCP/SIDA598 会议报告的例子中，Breneie(2013)描述了对斯洛文尼亚和伊斯特拉半岛岩溶地区的区域地下水流的理解的进展；Anita Eross 等人(2013)做了对放射性核素作为天然示踪物来确认热水混合的报告。Amelie Dausse 等人(2013)讨论了地下水径流的尺度影响和分级情况：以地中海岩溶系统为例。Heath(2012)汇报了南非距今 26 亿年的古 Transvaal 巨组中白云岩中与岩溶发展相关的条件和过程。南非存在重大的环境挑战，尤其是关于危害极大的落水洞的发展。Auler(2011)分析了巴西东北区域半干旱白云岩 Una 组岩溶中的水化学和硫同位素。结果表明该地区有两种机制（硫的氧化作用和蒸发浓度）起作用。Chris Groves 等人（2013）研究了一种监测方法，这种方法考虑了被土壤覆盖的岩溶含水层的天然补给的流量和水化学特点的定量特征，这种岩溶含水层在进入地下主含水层之前首先流经表层岩溶带。Tobin 等人（2011）叙述了加利福尼亚 Kaweah 河流域的岩溶泉的补给高程。同位素值的季节变化表明主要补给来源的季节变动，这种补给来源来自于高水位时期的高海拔冰雪融水径流到基流时期的局部衍生补给。

Karst aquifer systems and water resources processes

In examples reported at IGCP/SIDA 598 sponsored conferences, Brenèiè (2013) described

achievements in the understanding of regional groundwater flow in karstic regions of Slovenia and Istria; Anita Erõss et al. (2013) reported on radionuclides as natural tracers for identification of mixing of thermal waters; and Amélie Dausse et al. (2013) discussed scale effects and hierarchy of groundwater flow paths: take an example as a Mediterranean karst system. Heath (2012) reported on conditions and processes within South Africa related to karst development in the dolomite rocks of the 2.6 billion year old Transvaal Supergroup. In South Africa significant environmental challenges exist, especially with regard to catastrophic sinkhole development. Auler (2011) analyzed the hydrochemistry and sulfur isotope in the semi-arid dolomitic Una Group karst of northeastern Brazil. The results demonstrated that both mechanisms (sulfide oxidation and evaporative concentration) are operative in the area. Chris Groves et al. (2013) developed a monitoring strategy that allowed for quantitative characterization of flow and hydrochemical behaviors of autogenic recharge of soil-mantled karst aquifers travels through the epikarst zone before entering the main part of the aquifer. Tobin et al. (2011) assessed the recharge elevations for karst springs of the Kaweah River basin, California. Seasonal variations in isotopic values indicated seasonal shifts in the dominant recharge source from higher elevation snowmelt runoff during high flow conditions to more locally derived recharge during base flow.

岩溶水系统可持续利用保护

在过去的几年中，这个话题在研究和培训活动中得到重点强调。美国的西肯塔基大学岩溶野外研究项目中的岩溶水文地质课程强调了这一点，西班牙的马拉加大学和中国桂林国际岩溶研究中心培训班中教授了水文岩溶课程。在培训班上，来自美国的 George Veni 讲授了岩溶含水层中水井和泉的水文地质和地球化学监测方法，岩溶地下水流域的染料追踪方法，和环境影响评价。来自美国的 Jonathan Arthur 讲授了岩溶含水层的脆弱性模型。来自塞尔维亚的 Zoran Stevanovic 讲授了岩溶含水层特征方法、水平衡方法以及保护评价方法。

另外，Tim Slattery 致力于研究并找到美国肯塔基州 Bowling Green 地区由于城市发展所造成与岩溶水相关的环境问题的解决方法。Vitor Moura 和巴西的同事研究了巴西洞穴管理和保护的监测过程，并识别了来自于 Serra do Ramalho 地区的洞穴水生动物。Lebanon 地区的 Jeita 泉中的水是 Beruit 的供水来源，但已受到污染的威胁，多种紧急方案正在实施，以研究并找到解决这些危机的方法。肯塔基州的研究结果表明重要的降雨事件既影响储存特征，也快速影响污染物流经表层岩溶带的不同路径和时间（Vanderhoff 等，2011）。调查表明弗罗里达州的地形或附近的落水洞对生物多样性总体有 5%（地质多样性）的正面影响。岩溶扰动指数（KDI）是用来测量人为因素对环境影响的综合方法，并已在美国（弗罗里达）、波多黎各（阿雷西波）和意大利得到应用和改进，但在其他地区仍没有得到应用，并对改进比较敏感。

Karst water system sustainable protection

As in past years, this topic has been a major emphasis of both research and training activities. This was highlighted in the Karst Hydrology course in the WKU Karst Field Studies Program (USA), the karst hydrogeology course that was held at the University of Malaga (Spain) and the IRCK training course in Guilin, China. At that training course George Veni (USA) gave lectures on hydrological and geochemical monitoring of wells and springs in karst aquifers, dye tracing techniques for karst groundwater basin delineation, and environmental impact assessments. Jonathan Arthur (USA) lectured on aquifer vulnerability modelling in karst, and Zoran Stevanovic (Serbia) lectured on methods in karst aquifer characterization, water budget and reserve

assessments.

In addition, Tim Slattery was leading an effort to understand and find solutions to karst water-related environmental problems caused by urban development in Bowling Green, Kentucky USA. Vitor Moura and his Brazilian colleagues studied monitoring procedures for management and protection of caves in Brazil and identified aquatic cave fauna from the Serra do Ramalho. The waters of the Jeita spring of Lebanon, a water supply for Beruit, are being threatened with pollution sources and a multi-agency effort is underway to understand and identify solutions to these challenges. The results from Kentucky indicate that significant precipitation events affect both the storage properties and rapidly impact the various pathways and timing of contaminant transport through the epikarst zone (Vanderhoff et al., 2011). Investigation indicated that there is an overall positive effect of 5% (geodiversity) on the biodiversity of terrains in Florida in or near sinkholes (Booth, 201 1). The Karst Disturbance Index (KDI) is a holistic tool used to measure anthropogenic impacts on karst environments, and has been applied and refined in studies performed in USA (Florida), Puerto Rico (Arecibo) and Italy, yet still remains untested and susceptible to modification for other areas.

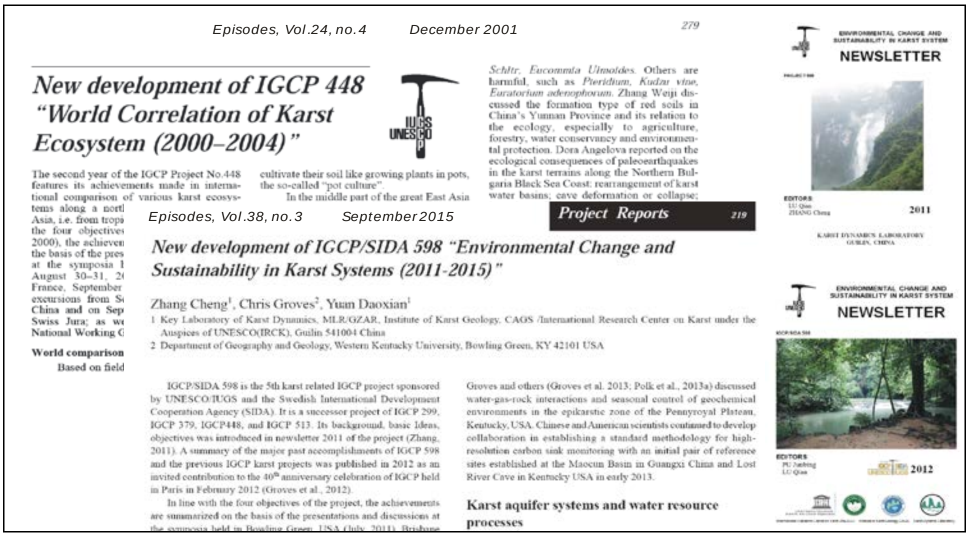
岩溶系统中的环境变化记录

由于目前对气候变化科学的关注和兴趣日益增加，包括对古气候记录的识别，了解岩溶系统中古气候的记录仍是一门热门的研究领域。Gilman Ouellette 和 Jason Polk(2013)从 Barbados 岛上的众多钟乳石中发明了一种高分别率重建降雨和气候变化的方法。钟乳石氧稳定同位素记录的气候结果结合高分辨率系列铀测年被用来解决 Caribbean 岛岩溶含水层中的水资源问题。Jason Polk 等人（2013b）利用洞穴沉积物研究 Caribbean 地区的干旱和风暴事件对伯利兹岩溶水资源的影响。李红春（2013）强调了在过去的一千年中亚洲夏季季风气候对中国西南岩溶地区水量平衡的影响。Truebe 等人（2011）研究了一种洞穴滴水 a18Odw 值的过程模型，以此来重建钟乳石气候记录在十年间的变化。这表明钟乳石氧同位素记录中的某些背景变化值可能是由于无气候过程，比如地下水的储存和混合。Casteel 等人（2011）报告了美国德克萨斯州洞穴监测研究在 12 年间的钟乳石古气候记录。结果表明高频率钟乳石 Mg/Ca 和 Sr/Ca 变化可能提供了古洞穴滴水组成的控制前景。McDermott 等人（2011）分析了更新世欧洲钟乳石 a18O 梯度变化的自然原因和其他可能的因素。总之，地带性流动和大西洋湿度来源是贯穿整个更新世的主要影响因素。

Environmental change records in karst systems

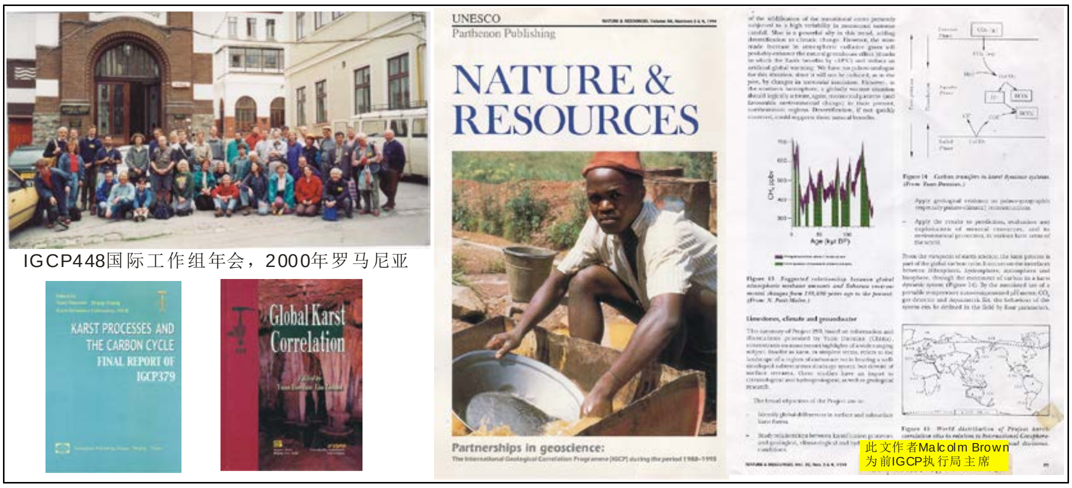
With the ever increasing concern and interest in climate-change, science, including identifying records of past climate, understanding the paleoclimatic records contained within karst systems remains an active area of research. Gilman Ouellette and Jason Polk (2013) are developing a high-resolution reconstruction of Late Holocene precipitation and climate variability on the island of Barbados from multiple speleothems. Proxy climate records from speleothem stable oxygen isotope records combined with high-resolution uranium-series dating are used to address water resource issues in Caribbean island karst aquifers. Jason Polk et al. (2013b) are conducting additional work on drought and storm event impacts in the Caribbean on karst water resources in Belize using cave deposits. Li Hongchun (2013) emphasized the influence of the Asian Summer Monsoon on the moisture budget of the karst region of Southwest China during the last millennium. Truebe et al. (201 1) developed a process model of cave dripwater ä18Odw values as a test of reconstructing decadal variability in speleothem climate records. This suggests that some

background level of variance in speleothem oxygen isotope records could be due to non-climatic processes, such as subsurface water storage and mixing. Casteel et al. (2011) reported speleothem paleoclimate records from twelve years of cave monitoring studies in Texas, USA. The results demonstrate that high-frequency speleothem Mg/Ca and Sr/Ca variation may provide insight into the controls of paleo-drip water compositions. McDermott et al. (201 1) analyzed the nature and possible causes of changes in speleothem ä18O gradients across Europe during the Holocene. Overall, the data indicate that zonal flow and Atlantic moisture sources were dominant throughout the entire Holocene.



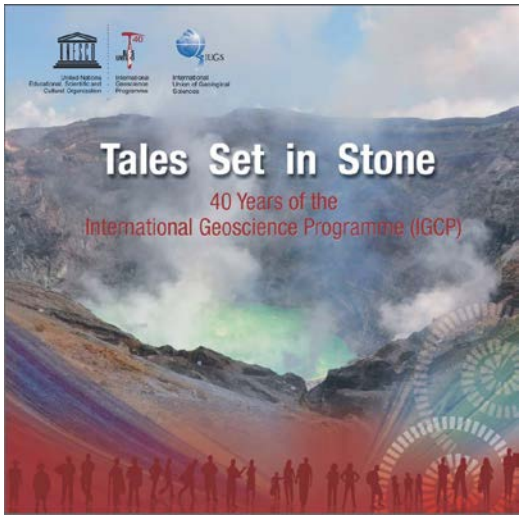
在地科联期刊(Episodes)上发表的项目成果论文及代表性通讯

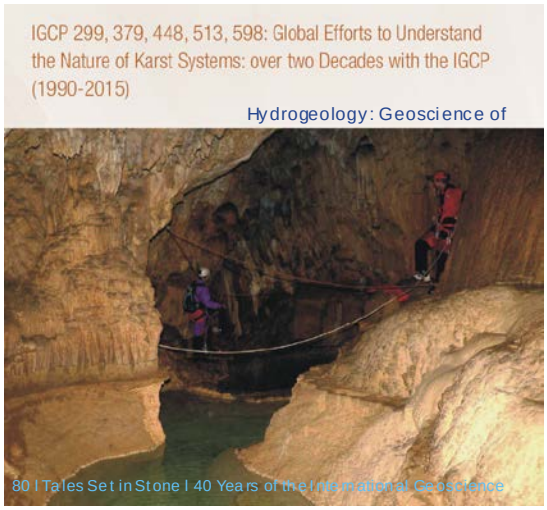
Report on the Episodes about the achievements and papers of IGCP 598



IGCP 项目报道及专著出版情况

Publication and report on IGCP





5 个岩溶 IGCP 项目成果总结（IGCP 成立 40 周年专著）

Summary about 5 IGCP achievements (Specific issue about IGCP 40th anniversary)

IGCP299-448 执行期间年度 Newsletter

Annual newsletter on IGCP 299-448

中国与中南半岛岩溶地质对比研究

Comparative study on karst geology in China and Indo-China Peninsula

中国地质调查局境外地质调查项目，课题负责人：章程；起止年限：2012 年 1 月 1 日-2014 年 12 月 31 日。

Foreign Geological Survey Project supported by China Geological Survey, Project leader: Dr. Zhang Cheng, from 1 January, 2012 to 31 December, 2014

以中南半岛岩溶区研究为重点，根据岩溶形态组合理论，进行中国与中南半岛岩溶研究对比，揭示两区域宏观、微观的，地表、地下的，溶蚀、沉积的岩溶形态组合、发育的基本规律及形成环境；开展中南半岛典型岩溶区岩溶作用与碳循环地质环境调查，揭示中南半岛岩溶作用过程中形成碳汇的机制及控制因素；建立中南半岛全球岩溶碳汇效应的动态监测站，为测算全球岩溶碳汇提供数据支持；开展中南半岛洞穴与石笋调查，进行沉积记录气候信息的对比与综合集成，揭示同为亚洲季风影响下的区域间的环境变化过程及差异。

According to karst feature complex theory, take Indochina karst area as an emphasis area to develop karst contrast research between China and Indochina. The purpose is to reveal karst feature complex of macro, micro, surface, underground, dissolution and deposition and basic rule of karst development and its formation environment. To develop karst process and carbon cycle geological environmental survey of typical karst area in Indochina. The purpose is to reveal mechanism of carbon sink and its control factors, to build dynamic monitoring station of global carbon sink effect. It can provide data for estimating global karst carbon sink, to develop cave and stalagmite survey, to develop contrast and comprehensive integration of climate recording from sediments in Indochina. To reveal environmental change process and differences between regions which are under the same influence of the Asian monsoon.

泰国北碧省 Wang Krathae 热泉

Wang Krathae Hot Spring in Kanchanaburi Province

地球物理剖面测量

Geophysical surveying

项目组利用收集到的地质、地貌资料，补充调查新的关键排泄点，补充调查前期未到达的关键岩溶洼地和消水洞，为示踪试验的优化提供支持。利用前期建设的自动监测站，取得了流域内水质、水位、降雨等资料，为研究泰国典型岩溶流域含水介质特征、地质碳循环特征提供了系统资料。为了对比中泰不同环境下的岩溶地质碳汇效应，采用标准试片法，选择泰国普特泉不同土地利用，分别在空中、地表、土下不同深度放置试片，同时采集不同深度的土壤样品，为下一步分析普特流域溶蚀速率及其控制因子研究提供基础数据。

The project team used previously collected geological and geomorphological data to conduct

survey of key discharge sites, karst depressions and sinkholes that were not previously accessed, and to support the optimization of tracer tests. The researchers also acquired water quality, water table and precipitation data from April to October 2013 via an automatic monitoring station that was constructed during the initial stage of the project. This provided systematic data for study of the characteristics of water-bearing media and the geological carbon cycle in typical karst basins in Thailand. To compare the karst geological carbon sink effects under different land uses were selected. Standard tablets were placed at different depths in the air, on the surface and in the soil, and soil samples were collected at different depths to provide basic data for further study of the dissolution ratio and its controlling factors in Phu Toej Basin.

工作期间得到泰国自然资源与环境部地下水资源厅的大力配合与帮助，泰方迫切希望利用岩溶地质研究所和国际岩溶研究中心的技术力量，促进泰国岩溶研究工作的前进。下一步工作方向是继续开展地下水自动化监测技术、地球物理探测技术应用，开展国际岩溶对比研究，整理相关数据联合发表相关成果。

The effort was strongly supported by the DGR. Thai government expected to leverage the technical strength of IRCK/IKG to promote karst research efforts in Thailand. The nextstep is to further apply technology for automatic monitor of groundwater and geophysical detection technologies, conduct international comparative studies on karst, and synthesize relevant data to jointly publish findings.

该境外地质调查项目的顺利实施对扩大岩溶地质研究所和联合国教科文组织国际岩溶研究中心在国际和地区岩溶研究工作中的影响力发挥了重要作用，有利于国际和地区岩溶研究工作的推进。

The successful implementation of the foreign geological survey project has played an important role in expanding the influence of IRCK/IKG in regional and international karst efforts, and in contributing to the progress of such efforts.

岩溶泉野外监测取样

Monitoring and sampling in karst water site

中国-斯洛文尼亚政府间科技合作项目

Sino-Slovenian inter-governmental S&T cooperative project

项目名称：中国季风气候、斯洛文尼亚次大陆气候下岩溶作用及碳汇效应对比研究

Name: Technical introduction and cooperative research on the biological indication of organic pollutants in karst water environment

项目内容：中国西南岩溶区和斯洛文尼亚经典岩溶区被视为世界上最重要的两大岩溶区域。位于热带、亚热带季风气候条件下的中国西南岩溶区具有典型的岩溶地貌如石林、峰丛、峰林；位于欧洲次大陆气候条件下的斯洛文尼亚经典岩溶区具有经典的岩溶现象和地貌特征。岩溶作用及碳汇效应是目前全球碳循环研究的热点之一，本项目根据岩溶作用及碳汇效应的最新进展，首先在欧洲和亚洲两大重要岩溶区，开展以下对比研究，深入揭示岩溶地质碳汇过程及影响机制：

Contents: It aims to establish a biological indication and monitoring method that is suitable for assessing the status of organic pollutants in karst water bodies in Guangxi by introducing the technologies from the University of Mainz on biological indication and monitoring of organic pollutants in karst water bodies, so as to provide theoretical basis and technical support for protecting karst water environment in Guangxi.

①自然条件（如温度、降雨）及人类活动（如不同的土地利用方式）对岩溶作用的影响及回收大气CO2 的效应；②揭示岩溶碳汇过程中水体中各碳形态（DIC/DOC）、碳来源及碳汇效应；③中国季风气候、斯洛文尼亚次大陆气候条件下岩溶作用及碳汇效应对比。

① The impact of natural conditions (e.g., temperature and rainfall) and human activities (e.g., different land use practices) onto karst process and capturing of atmospheric CO2; ② the carbon forms (DIC/DOC) in water bodies under karst carbon sink process, carbon source and carbon sink effect; ③ Comparative study on karst process and carbon sink effect under monsoon climate in China and sub-continental climate in Slovenia.

2015 年 7 月 22 日-7 月 28 日，国际岩溶研究中心常务副主任曹建华研究员和杨慧、张春来、黄芬助理研究员四人赴斯洛文尼亚执行中国季风气候/斯洛文尼亚次大陆气候下岩溶作用及碳汇效应对比研究项目。中国西南岩溶区和斯洛文尼亚经典岩溶区被视为世界上最重要的两大岩溶区域。位于热带、亚热带季风气候条件下的中国西南岩溶区具有典型的岩溶地貌如石林、峰丛、峰林；位于次大陆气候条件下的斯洛文尼亚经典岩溶区具有经典的岩溶现象和地貌特征。岩溶作用及碳汇效应是目前全球碳循环研究的热点之一，本项目根据岩溶作用及碳汇效应的最新进展，首先在欧洲和亚洲两大重要岩溶区，开展对比研究，深入揭示岩溶地质碳汇过程及影响机制。

From July 22 to 28, 2015, a delegation of four researchers, i.e., Prof. Cao Jianhua, executive deputy director of IRCK; Yanghui, Zhang Chunlai and Huangfen, assistant researchers from IRCK, visited Slovenia to conduct the project-- Comparative study of karst processes and carbon sequestration under China monsoon and Slovenia subcontinental climates. The karst areas in Southwest China and Slovenia are considered as the two most important karst areas in the world. While the karst areas in Southwest China under tropical and sub-tropical monsoon climate feature typical karst landforms such as stone forest, peak cluster and peak forest, the classic karst areas in Slovenia under sub-continental climate are known for their classic karst landforms. Karst

processes and carbon sequestration are one of the hot topics in global carbon cycle research. On the basis of the latest progress on karst processes and carbon sequestration research, this project aims to conduct comparative study in the two key karst areas in Europe and Asia so as to reveal the karst geological carbon sequestration process and impact mechanism.

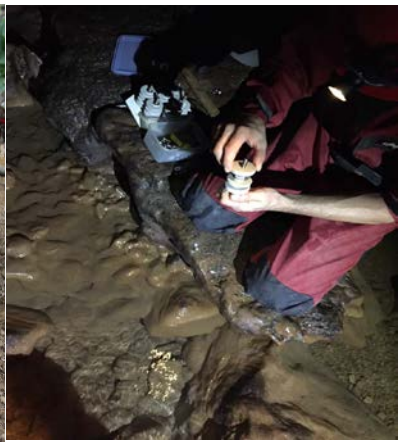
7 月 22 日，曹建华研究员等四人与斯洛文尼亚科学与艺术研究院岩溶研究所所长等 3 人互相介绍了各自的单位概况、研究领域及拟在斯开展的科研工作等。该所所长 Tadej Slabe 博士做了题为“Karst Research Institute”的报告。我方曹建华研究员做了题目“Introduction of Karst Research Institute and IRCK laboratory 和 Four main cooperation issues”的报告。四个合作方面包括：桂林泥盆纪及斯洛文尼亚侏罗纪及三叠纪岩石化学成分的对比；不同气候带土壤特性及溶蚀速率的对比；不同气候带岩溶碳循环强度的对比；不同气候带石笋沉积速率及洞穴碳循环的对比。并详细介绍了研究手段及使用的工具等。之后由 Mitja 及 Natasa 博士带领开展野外取样及考察工作。主要完成了不同岩性、土地利用方式下岩溶强度对比试验和取样；萨瓦河支流及源头水文地质考察与水化学分析；斯洛文尼亚不同气候条件下岩溶形态的考察。本次野外工作共采集 7 个剖面，30 个土壤样品及 7 个岩石样品。

On July 22, 2015, Prof. Cao and other three researchers visited the Karst Research Institute under Slovenian Academy of Sciences and Arts (SAZU) to exchange information. Dr. Tadej Slabe, director-general of the Karst Research Institute, briefed the Karst Research Institute, while Prof. Cao presented information about the Institute of Karst Geology and IRCK, as well the four main cooperation issues between IRCK and the Karst Research Institute. The four main cooperation issues include: comparison of the rock chemical compositions of Devonian period in Guilin and those of Jurassic and Triassic periods in Slovenia; comparison of soil properties and dissolution velocity in different climatic zones; comparison of karst carbon cycle intensity in different climatic zones; comparison of stalagmite deposition rate and cave carbon cycle in different climatic zones. Prof. Cao also gave a detailed introduction about the research methodology and tools. Then they were guided by Dr. Mitja and Natasa to have a field sampling and field visit. In this field study, they had completed the comparative experiment and sampling on karst intensity under different lithology and land use practices; conducted a hydro-geological survey and hydro-chemical analysis on the tributary of Sava River and its headstream; and studied the karst forms under different climatic conditions in Slovenia. 7 sections, 30 soil samples and 7 rock samples were collected this time.

2015 年 10 月 20 日-10 月 27 日，斯洛文尼亚自然与文化研究中心喀斯特研究所专家 Tadej Slabe 所长、Martin Knez 副所长、Oto Luthar 主任、 Metka Petrič 博士、Nataša Viršek Ravbar 教授、Mitja Prelovšek 博士来访国际岩溶研究中心/岩溶所，与曹建华研究员所带领的研究团队进行为期一周的合作研究。双方有过多年的合作基础，此次访问目的是为执行中国-斯洛文尼亚政府间科技合作项目——中国-斯洛文尼亚次大陆气候下岩溶作用及碳汇效应对比研究。本次工作包括室内讨论、野外取样、数据监测、示踪试验、溶蚀试片放置等多项内容，在漓江流域和潮田河流域进行了大量的实质性工作。

During the period from October 20 to 27, 2015, a delegation from the Karst Research Institute of SAZU, including Tadej Slabe, Director-general of the Institute; Martin Knez, Deputy Director-general; Oto Luthar; Dr. Metka Petrič ; Prof. Nataša Viršek Ravbar and Dr. Mitja Prelovšek, visited IRCK/Institute of Karst Geology to conduct cooperative research. The major work covered much substantive work: indoor discussion, field sampling, monitoring, tracing

experiment, and setting-up of dissolution tablets in Li River and Chaotian river basins.

中方与斯方进行野外工作、埋放试片

Chinese and Slovenian scientists are conducting field study, burying dissolution tablets in the field


在毛村地下河进行示踪试验、进行室内实验

Conducting tracing experiment in Maocun subterranean stream,

and indoor experiment

中国地质调查局境外地调项目

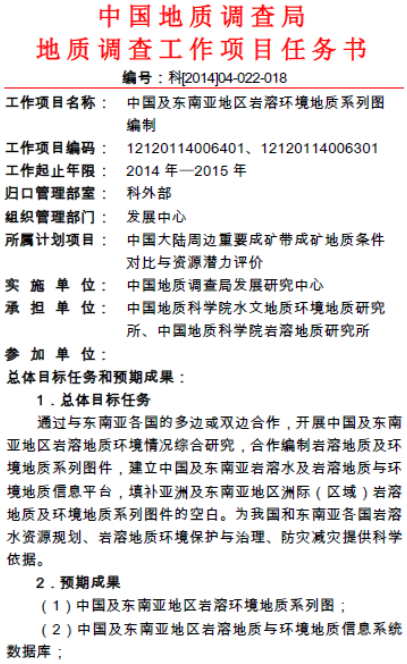
Foreign geological survey project under China Geological Survey

项目名称：中国及东南亚地区岩溶环境地质系列图编制

Name: Preparation of serial maps on karst environmental geology in China and South East Asia

项目内容：通过与东南亚各国的多边或双边合作，开展中国及东南亚地区岩溶地质环境情况综合研究；合作编制岩溶地质及环境地质系列图件；建立中国及东南亚岩溶水及岩溶地质与环境地质信息平台，填补亚洲及东南亚地区洲际（区域）岩溶地质及环境地质系列图件的空白。为我国和东南亚各国岩溶水资源规划、岩溶地质环境保护与治理、防灾减灾提供科学依据。

Contents: By working with the countries in South East Asia in the framework of bilateral or multilateral cooperation, the project aims to:1) conduct synthesis research on karst geological environment in China and South East Asia; 2) develop an information platform on karst water and karst geology and environmental geology in China and South East Asia so as to fill the gap in terms of serial maps on inter-continental (regional) karst geology and environmental geology in Asia, particularly South East Asia; and to provide scientific basis for China and South East Asian countries to conduct karst water resources planning, karst geological environmental protection and management, as well as disaster prevention and reduction.



中国地质调查局

地质调查工作项目任务书

编号：科[2014]04-022-018

工作项目名称： 中国及东南亚地区岩溶环境地质系列图编制

工作项目编码： 12120114006401、12120114006301

工作起止年限： 2014 年—2015 年

归口管理部室： 科外部

组织管理部门： 发展中心

所属计划项目： 中国大陆周边重要成矿带成矿地质条件对比与资源潜力评价

实 施 单 位： 中国地质调查局发展研究中心

承 担 单 位： 中国地质科学院水文地质环境地质研究所、中国地质科学院岩溶地质研究所

参 加 单 位：

总体目标任务和预期成果：

1．总体目标任务

通过与东南亚各国的多边或双边合作，开展中国及东南亚地区岩溶地质环境情况综合研究，合作编制岩溶地质及环境地质系列图件，建立中国及东南亚岩溶水及岩溶地质与环境地质信息平台，填补亚洲及东南亚地区洲际（区域）岩溶地质及环境地质系列图件的空白。为我国和东南亚各国岩溶水资源规划、岩溶地质环境保护与治理、防灾减灾提供科学依据。

2．预期成果

（1）中国及东南亚地区岩溶环境地质系列图；

（2）中国及东南亚地区岩溶地质与环境地质信息系统数据库；

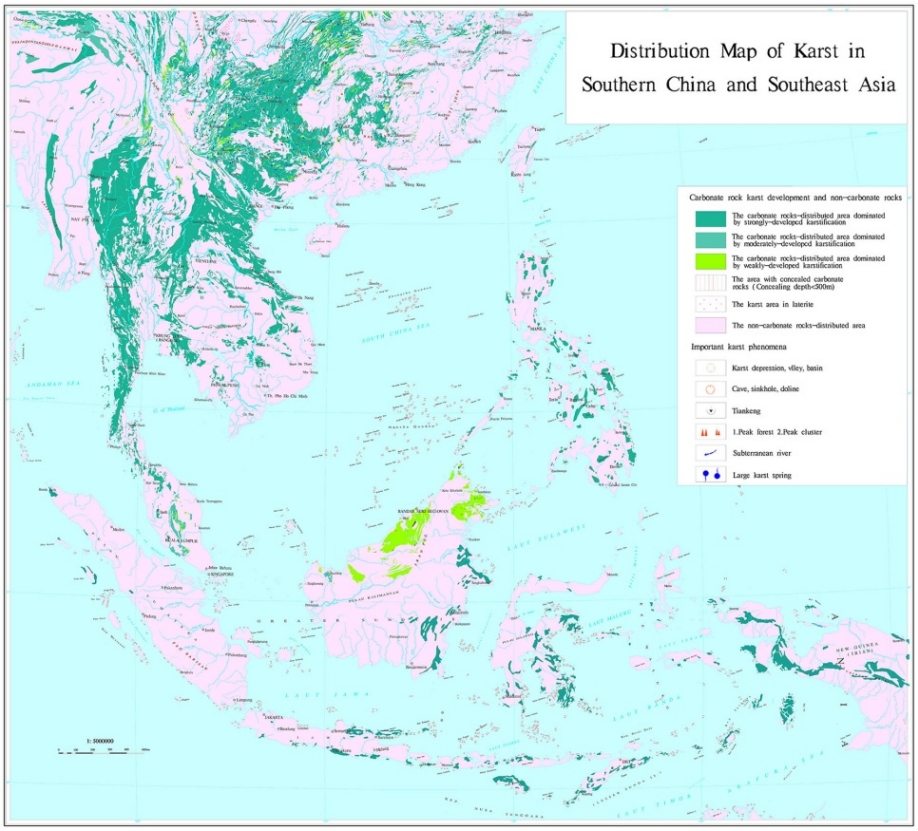
“中国及东南亚地区岩溶环境地质系列图编制”项目任务书

Approval of the project Preparing serial maps on karst environmental geology in China and Southeast China

中国地质调查局地质调查项目“中国与东南亚地区岩溶地质系列图编制”起止时间为2014 年-2016 年，由中国地质科学院岩溶地质研究所承担，参加单位有中国地质科学院水文地质环境地质研究所、中国地质图书馆、广西经济学会。项目的总体目标为：通过与东南亚各国的多边或双边合作，开展中国及东南亚地区岩溶地质环境情况综合研究，合作编制岩溶地质及环境地质系列图件，填补中国及东南亚地区岩溶地质及环境地质系列图件的空白，为我国和东南亚各国岩溶水资源规划、岩溶地质环境保护与治理、防灾减灾提供科学依据。2015

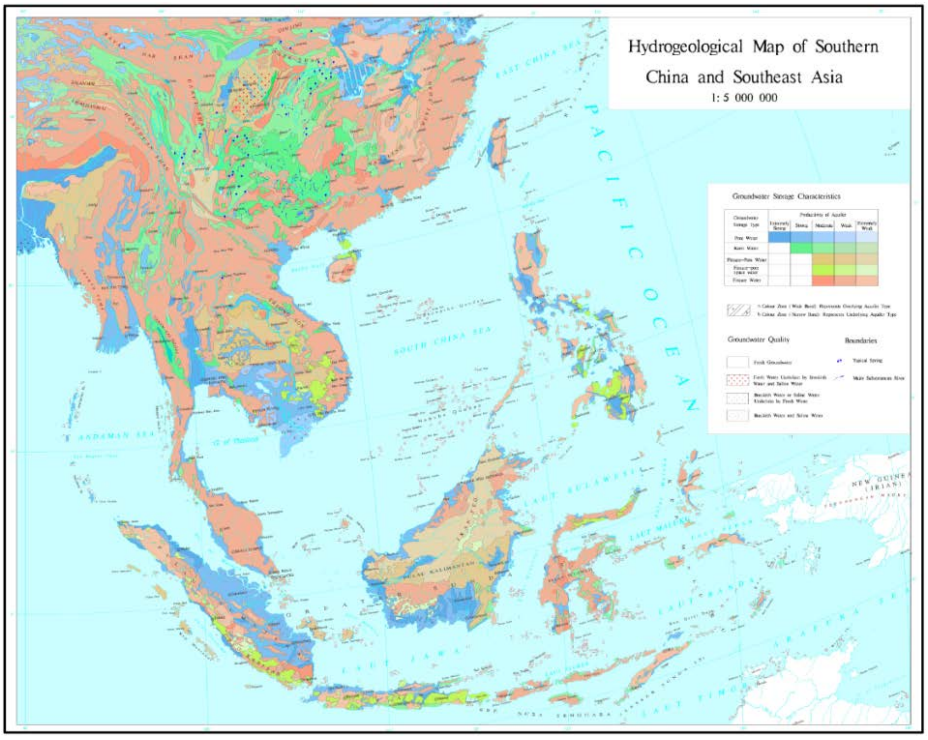
年，该项目通过收集、整理与分析中国与东南亚国家人文、社会、经济、地理、地质、资源利用、环境保护等相关资料，为系列图编制提供了参考；组织召开中国与东南亚国际科研人员参加的专题研讨会和编图工作交流会，进一步强化了合作关系，提高了编图质量；实地对比缅甸、老挝、柬埔寨岩溶地质、水文地质特征，提高了对这些国家岩溶地质、水文地质的认识，为系列图编制积累经验；开展泰国或印度尼西亚岩溶地质调查工作，进行了中国与中南半岛岩溶地质对比研究；通过综合分析中国与东南亚国家相关地质资料，并结合东南亚有关国家专家意见，在前期工作的基础上，进一步编制完善了中国南部及东南亚地区岩溶分布特征图、中国南部及东南亚地区水文地质图。

The international geological survey project under China Geological Survey—Mapping of karst geology in China and Southeast Asia last from 2014 to 2016. Led by the Institute of Karst Geology, CAGS, the project also involves other organizations including the Institute of Hydrogeology and Environmental Geology, CAGS; China Geological Library; and Guangxi Economic Society. The project is designed to: conduct study on karst geological environment in China and Southeast Asia, and compile series maps of karst geology and environmental geology through bilateral or multilateral cooperation, so as to fill in the gaps in terms of map series regarding karst geology and environmental geology in China and Southeast Asia, and provide scientific basis for karst water resources planning, karst geological environmental protection and control, as well as disaster prevention and reduction in China and Southeast Asian countries. In 2015, the project provided references for the mapping by collecting, sorting out and assessing data related to cultural, social, economic, geographical, geological areas, resource use and environmental protection in China and Southeast Asian countries. It has organized a thematic workshop and a working meeting, bringing together the researchers from China and Southeast Asian countries to enhance collaboration and improve the quality of mapping. By comparison of the karst and hydrological geological characteristics in Myanmar, Laos and Cambodia, the researchers in the project have improved their understanding on karst and hydro-geological conditions in these countries and enabled them to compile series maps. In addition, the karst geological survey was conducted in Thailand and Indonesia, and the comparative study on karst geology between China and Indo-China Peninsula was also implemented. By summarizing the geological data on China and Southeast Asian countries, and incorporating the inputs of consultants from Southeast Asian countries, the project has further revised the Distribution Map of Karst in Southern China and Southeast Asia, as well as the Hydrogeological Map of Southern China and Southeast Asia.



中国南部及东南亚地区岩溶分布特征图（草图）

Distribution of Karst in Southern China and Southeast Asia (Draft)



中国南部及东南亚地区水文地质图（草图）

Hydrogeological Map of Southern China and Southeast Asia (Draft)

中国与斯洛伐克政府间科技合作项目获批

China and Slovakia inter-governmental S&T cooperation projec was approved

由中国地质科学院岩溶地质研究所/联合国教科文组织国际岩溶研究中心和斯洛伐克帕沃尔约瑟夫大学自然科学学院地理研究所合作申请的中国与斯洛伐克政府间科技合作项目“岩溶生态环境恢复及岩溶碳循环、碳汇效应对比研究—中国亚热带、斯洛伐克温带”得到中国科技部的获批。项目实施时间为 2016 年 1 月至 2017 年 12 月。

The project Comparative study of karst ecological restoration and karst carbon cycle and sequestration in China’s subtropical zones and Slovakia’s temperate zones was approved by the Ministry of Science and Technology of China. The project will be jointly implemented by the Institute of Geology, CAGS/IRCK in China and the Institute of Geography, Faculty of Natural Sciences, Pavol Jozef Šafárik University in Slovakia. It will last from January 2016 to December 2017.

项目主要开展三方面的对比研究：（1）岩溶流域内生态环境恢复、演化过程及土地利用方式改变的调查研究；（2）岩溶流域内碳酸盐岩、硅酸盐岩和土地利用分布的空间布局特征调查，及对流域中水体中有机碳-无机碳含量、形态、转化的影响；（3）中国亚热带、斯洛伐克温带下岩溶作用及碳汇效应对比。本项目的合作目标是运用岩溶生态环境保护和恢复技术方法，全球视野开展岩溶碳循环及碳汇效应对比研究，揭示人为活动对增加岩溶碳汇效应的技术途径，以应对全球气候变化。

The project will focus on the following three comparative studies: (1) investigation and research on ecological restoration, evolution process and land use change in karst areas; (2) investigation on the characteristics of spatial distribution of carbonate rocks, silicate rocks and land use in karst areas, and their impacts on content, form and transfer of organic carbon-inorganic carbon in water; (3) comparison of karst processes and carbon sequestration in China subtropical zones and Slovakia temperate zones. The cooperation project aims to implement comparative study on karst carbon cycle and carbon sink with a global perspective by using technologies on karst ecological protection and restoration, and to reveal the technological approach of leveraging human activities to increase karst carbon sequestration and address global climate change.

广西科技厅中德合作项目获批

Sino-German cooperative project under the Department of Science and Technology of Guangxi was approved

项目名称：岩溶水环境有机污染物的生物指示技术引进与合作研究

Name: technical introduction and cooperative research on the biological indication of organic pollutants in karst water environment

项目内容：主要通过引进德国美因茨大学的（岩溶）水体有机污染物生物指示与监测技术，建立适用于评价广西岩溶水体有机污染状况的生物指示和生物监测方法，为广西岩溶水环境的保护提供理论依据和技术支撑。

Contents: It aims to establish a biological indication and monitoring method that is suitable for assessing the status of organic pollutants in karst water bodies in Guangxi by introducing the technologies from the University of Mainz on biological indication and monitoring of organic pollutants in karst water bodies, so as to provide theoretical basis and technical support for protecting karst water environment in Guangxi.