Hydrogeology and Environmental Geology Issues in Karst of China under Global Climate Change

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Contents

1. Chinese Leaders' Concern on Karst Problems

Problems raised by former leaders

Water tanks were dried in drought

Local people get drinking water from karst windows

In the 2008 drought, former premier Wen Jiabao said in Yunnan that there are "water shortage, water excess, and water pollution problems in south China Karst"

1.1 Xi Jinping's talk at the "Forum on Yangtze river economic Zone" held in Chongqing, January, 2016

On March 10, 2016, in a talk with the Qinghai delegation for the National People's Congress, he emphasized the importance of putting into implementation the plan of major ecological protection zones

"We should put the recovery of the ecological system of Yangtze River at an overwhelm position", "We should work together for great protection, and not great development. Our first choice is to harness the soil erosion and rock desertification problems in karst regions"

1.2 In the Government's Report made on March 5th, 2016 by former Premier Li Keqiang

"**To enhance the rehabilitaion of rock desertification regions**" **is included in the section of ecological rehabilitation**

2. Government's Funding for Scientific Research in the Field of Ecology and Environmental Problems

（1）On Feb. 22, 2016, The Ministry of Science and Technology delivered the Guideline of Funding for 6 fields, including: Key technologies for deep sea research; water resources; the protection and rehabilitation of typical fragile ecosystems; deep earth resources exploration; green construction; and public security.

（2）On March 7, 2016, The MOST delivered guideline for funding 9 more key fields, including Agricultural pollution; Big data & cloud calculation; global change and countermeasures.

Major projects for rehabilitation and protection of Fragile Ecological Systems" supported by MOST

1、生态监测与评估技术 Monitoring；
2、东北森林与湿地生态保护与恢复技术 NE China Wetland；
3、北方风沙区沙化土地综合治理 Wind Dust, North China；
4、黄土高原生态系统结构改善及稳定性维持技术Loess Plateau；
5、青藏高原生态系统功能提升与适应性管理Qinghai-Tibet Plateau；
6、长江中上游区生态保护与修复Upper & Middle Reach of Yangtze Basin
（1）西南生态安全格局形成演化机理；
（2）西南水电开发生态保护与恢复技术；
（3）喀斯特地区石漠化综合治理技术(Rehabilitation of Rock Desertification Areas)；
拟支持项目数：针对喀斯特峰从洼地，喀斯特高原，喀斯特断陷盆地，喀斯特槽谷，拟分别支持一个项目
7、东部城市化地区及海岸带生态安全与修复 Urbanization &Eastern Coast Area
8、国家生态安全保障技术体系 Ecological Security System
（1）珍稀濒危动物及极小种群植物物种保护技术 Endangered species；
（2）自然遗产地生态保护与管理技术 World Heritage；
（3）区域生态资源统计核算业务化技术 Ecological Resources Budget

3. The Funding of karst-related projects from the NNSFC in2015

100 projects were approved for funding from the Earth Science Division That includes:

16 projects for karst ecology;
14 projects for karst carbon sink;
14 projects for paleoclimate records from speleothem;
and 7 for karst hydrology.

The institutions receiving support include:

China University of Geosciences (Wuhan),10 projects;
The Institute of Karst Geology, 6 projects;
The Institute of Geochemistry, 6 projects;
China University of Geosciences (Beijing), 5 projects;
Southwest University, 3 projects;
Guizhou Normal University, 3 projects;
Guilin University of Technology, 3 projects.

The total number of support received by the 7 frontier institutions is only 36 projects, showing great scatterly.

4. Hydrogeology and Environmental Geology Issues in Karst of China

16 Issues are summarized for discussion：

（1） The conflicts between major ecological protection zones and development (e.g. central Guizhou; North Guangdong)；

（2）The areal pollution problems brought about by the general Mineral -Land-Water resources distribution framework, such as “water below land” in South China, and “water below coal “ in North China, and the way to solve such problems;

（3）New problems happened in South China’s rock desertification rehabilitation areas, such as: obstacles following continuous plantation; species invasion; water, soil side effects of Eucaliptus plantation; water quality problems of water tank and its relation with epikarst zone；

（4）Distributed parameter discharge and hydrochemical models for typical karst hydrological system in South China；

（5）The stability of carbon sink in karst processes (the Rane Curl question);

（6）A comparable Paleomonson climate field for extreme event reconstructed from high resolution speleothem records；

（7）Change in the flow field of regional karst hydrological systems induced by traffic (tunnelling), mining and hydroelectic (reservoir) construction；

4. Hydrogeology and Environmental Geology Issues in Karst of China

16 Issues are summarized for discussion：

（8）karst water quality problems induced by damping in dolines, Injection of waste water in sinkhloes and traffic construction (gas stations) in karst regions；

（9）Pollution events on karst groundwater systems and prevention measures；

（10）The prediction and prevention of karst collapse events；

（11）The hydrological functions of karst forests :to regulate water resources? Or to increase evaporation?

（12） The hydrological functions of dolomite: porosity water? Fissure water? Karst water? Or an aquitard?

（13） The origin of high CO_2 concentration(up to 8000ppm) in the atmosphere of Xueyu Cave, Fengdu, Chongqing and the mechanism of its regular change over years；

（14） Scientific problems remained in some world heritage sites of South China Karst, such as： the origin of allogenic gravels in the caves of Jinfo Mountain; the origin of Furong Cave system.;

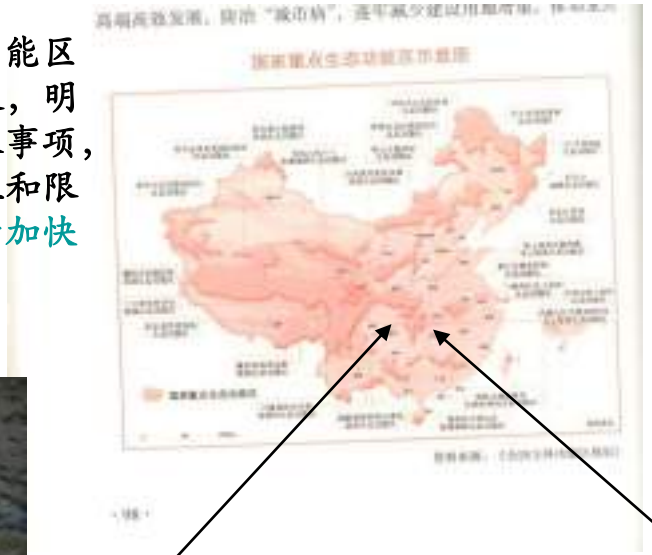
（15）6000米深岩溶的成因The origin of 6000m deep caves;

（16）The formation mechanism of long cave systems in the silicate rocks of Gondwana land.

4. Hydrogeology and Environmental Geology Issues in Karst of China

(1) The conflicts between the protection of major ecological functioning zones and Development (e.g. Central Guizhou, North Guangdong)

实施主体功能区战略：对不同主体功能区的产业项目实行差别化市场准入政策，明确禁止开发区域，限制开发区域准入事项，明确优化开发区域，重点开发区禁止和限制发展的产业。中央，国务院：关于加快生态文明建设的意见（2015.3.24）

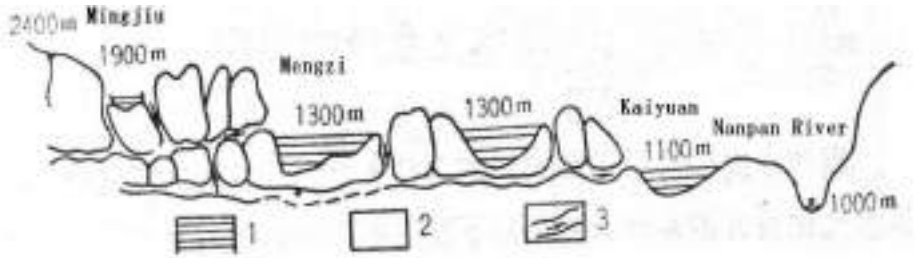


Tail water dam of Phosphate mining in Central Guizhou

Tail water of Dabaoshan mineral Deposit, N.Guangdong

4. Hydrogeology and Environmental Geology Issues in Karst of China

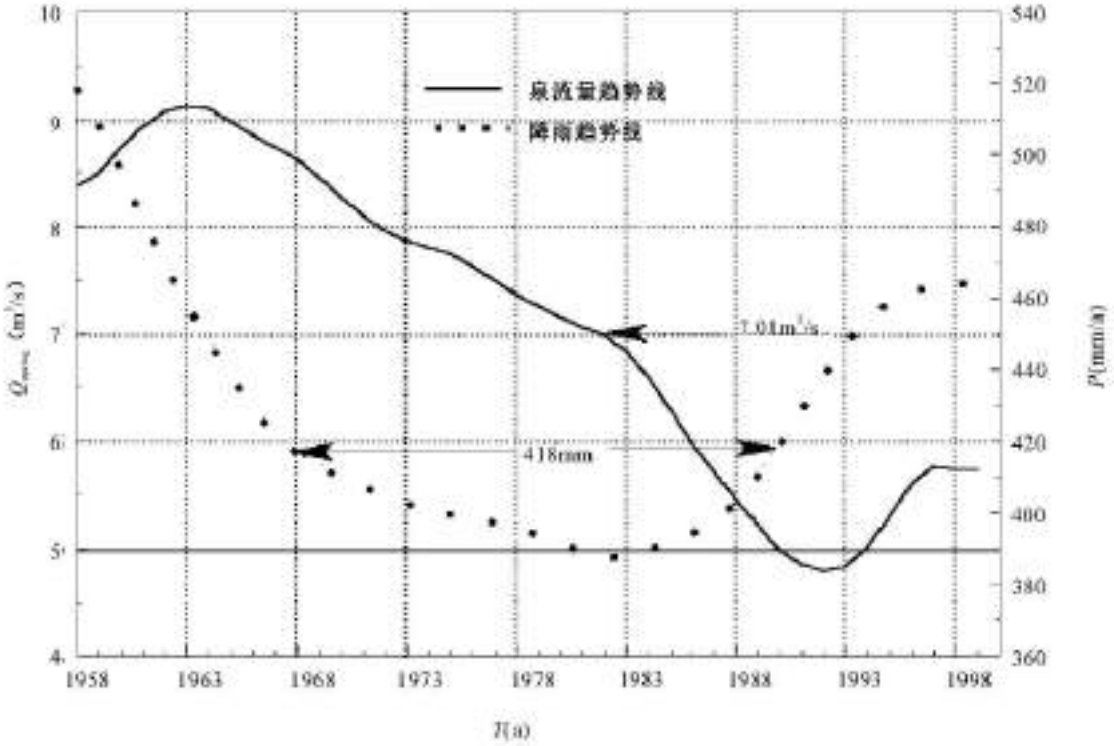
(2) Areal pollution problems brought about by the general Land-Water-Mineral deposits relationship of "coal on top and water below" in North China, and "land on top and water below" in South China, and way out !



A sketch profile of Mengzi-Kaiyuan-Nanpan River (upper reach of Pearl river)

Typical profiles in North China showing the relationship between Coal measures of Permo-Carboniferous and karst aquifers of Cambrian-Ordovician

But karst aquifers in north China enjoy a more stable discharge because of bigger recharge area, and better regulation function, such as the Shentou Karst Spring of Shanxi province



The discharge of Shentou spring showing an approximate 10 years of time lag from precipitation

4. Hydrogeology and Environmental Geology Issues in Karst of China

(3) New problems following the rehabilitation of Rock desert in southwest China: Slop land; Continuous Cropping obstacle连作障碍; Species Invasion（紫荆泽兰 Ageratina adenophora，肿丙菊 Tithonia diversifolia，黄花厥明 Cassia surattensis 等）; soil moisture problems of Eucaliptus; Stone terraced land or Bioterraced land(生物篱)? Relationship between water tank and Epikarst水柜水质及与表层岩溶带关系

Slop land along Nanpang river (upper rach of Pearl river)

广西弄那峰从洼地植被

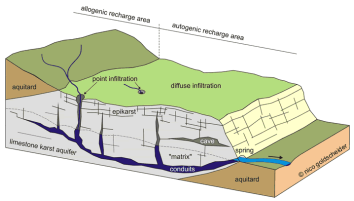
四川宁南生物篱

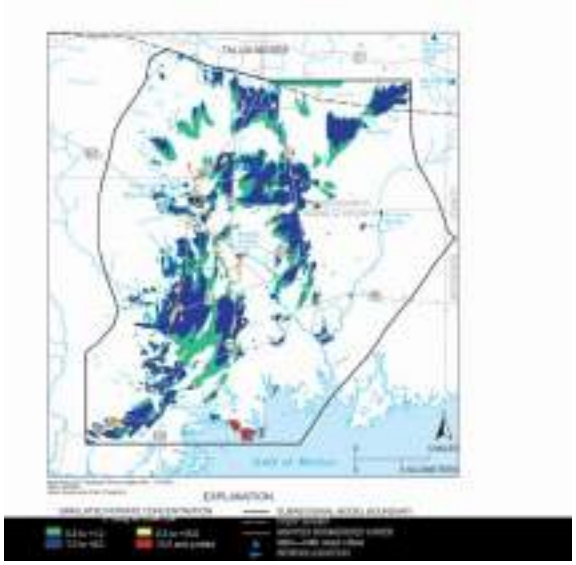
贵州金沙水柜 (2008)

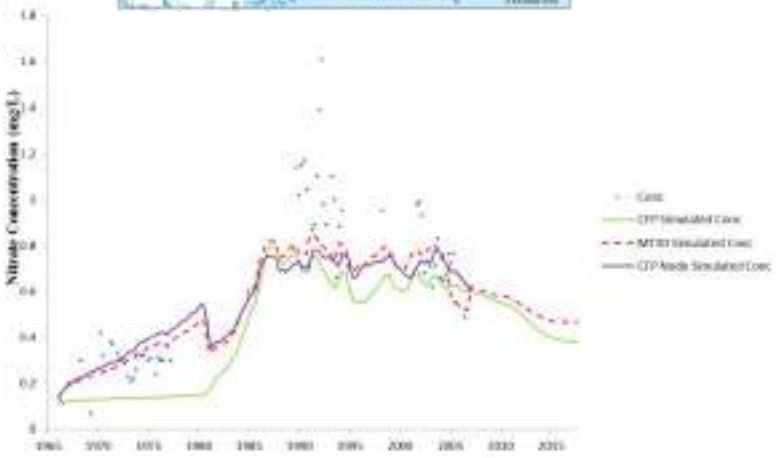
4. Hydrogeology and Environmental Geology Issues in Karst of China

(4) Distributed parameter models (hydrological & hydrochemical) for typical karst system in South China

徐泽轩:美国Woodville岩溶流域NO_3, CL预测模型(2000Km2): GSA,2013年会论文集P.198

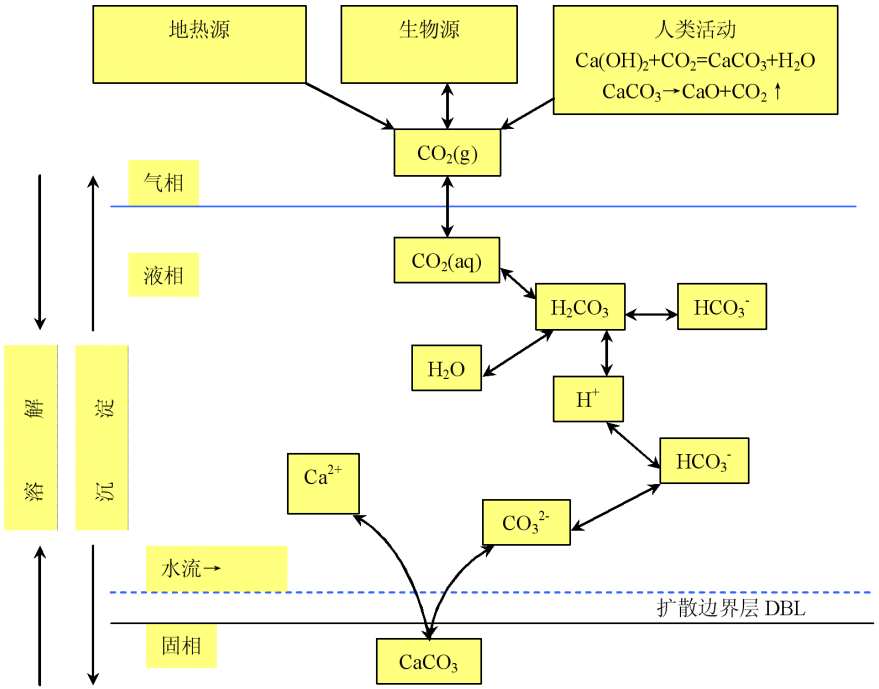






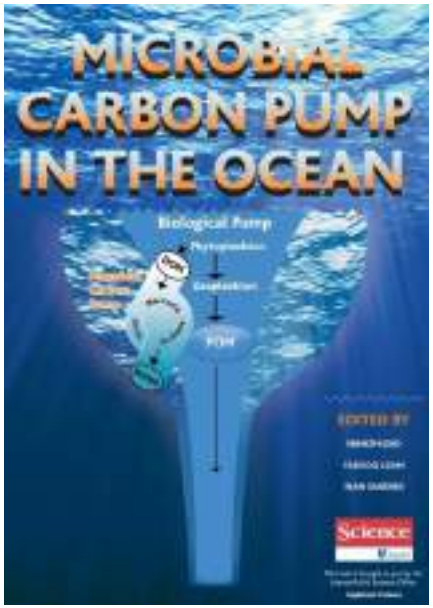
4. Hydrogeology and Environmental Geology Issues in Karst of China

(5) The Stability of carbon sink in Karst processes (debate raised by Rane Curl)



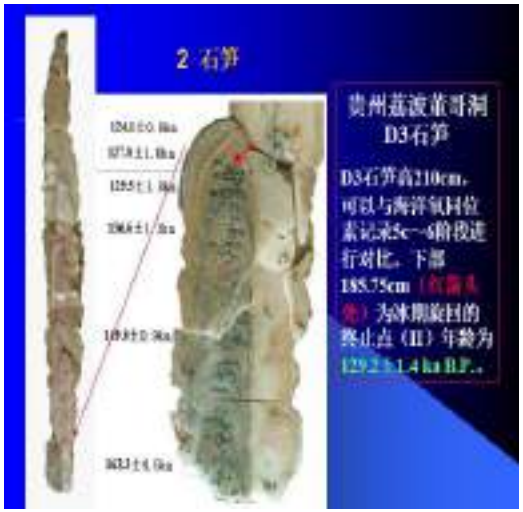
张莹：汇？通量？“中国岩溶”2015年第6期

AAPB (Aerobic Anoxygenic Phototrophic Bacteria 好氧不产氧光合异氧菌) can transfer HCO_3 into RDOC 陆地淡水中有AAPB, RDOC 吗?

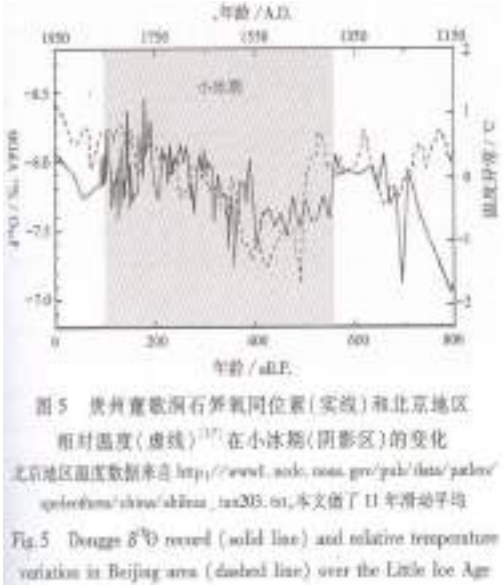


4. Hydrogeology and Environmental Geology Issues in Karst of China

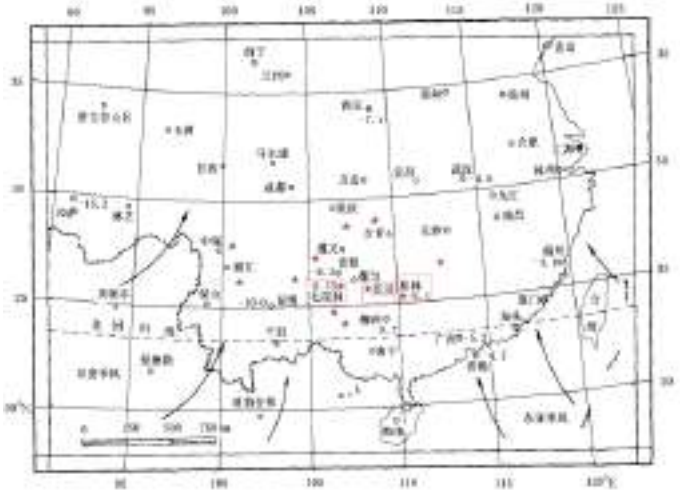
(6) High Resolution paleoclimate records from speleothem, and the reconstruction of comparable paleomonsoon field in extreme climate event



McDermont: Europe (2011)



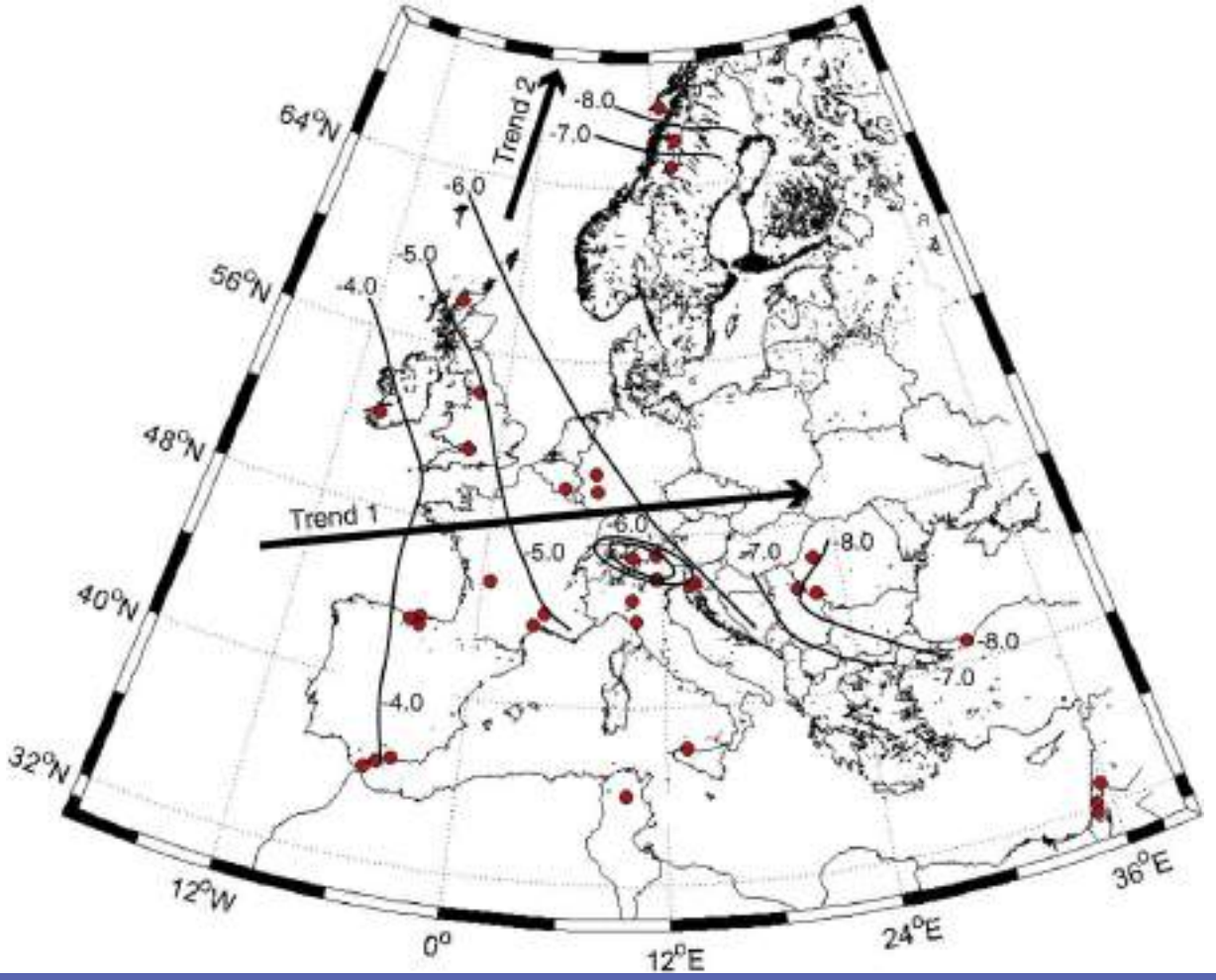
Hai Cheng: global(2012)



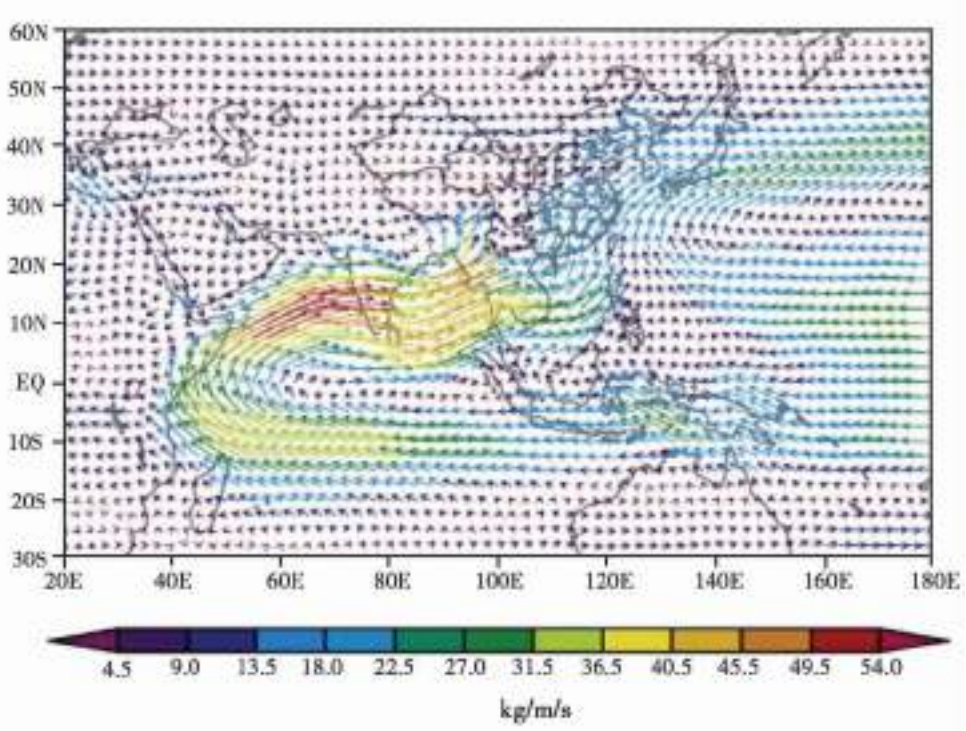
Tan Ming： China(2009)

Paleoclimate field in Europe from speleothem records

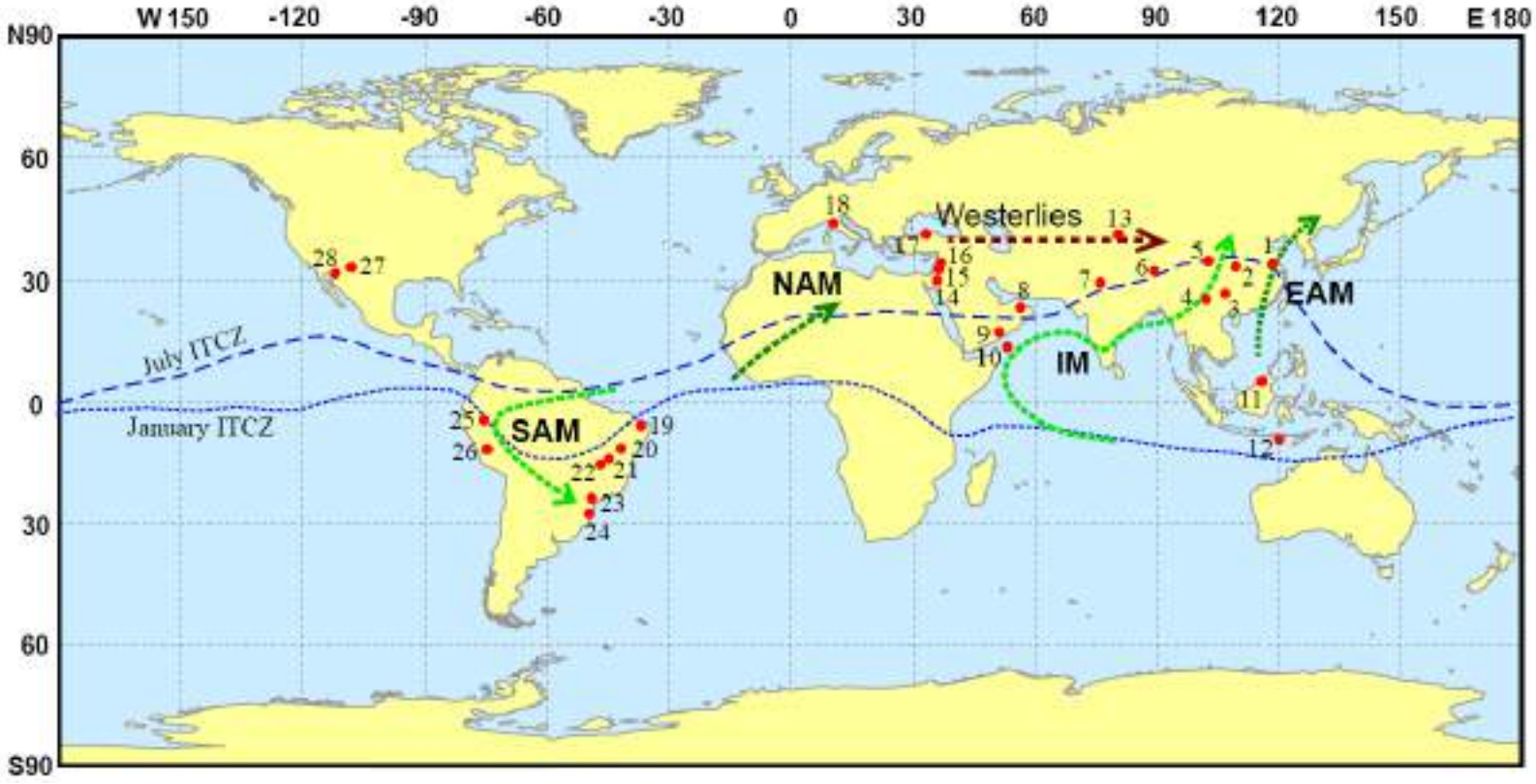
Oral talk from Frank McDermont (DublinUniversity)2011.6.18, Birmingham (Published on Global and Planetary Change, 2011, 275-287)



Paleomonsoon field in China from speleothem records (Tang Ming, Quaternary Research(Sept. 2009))

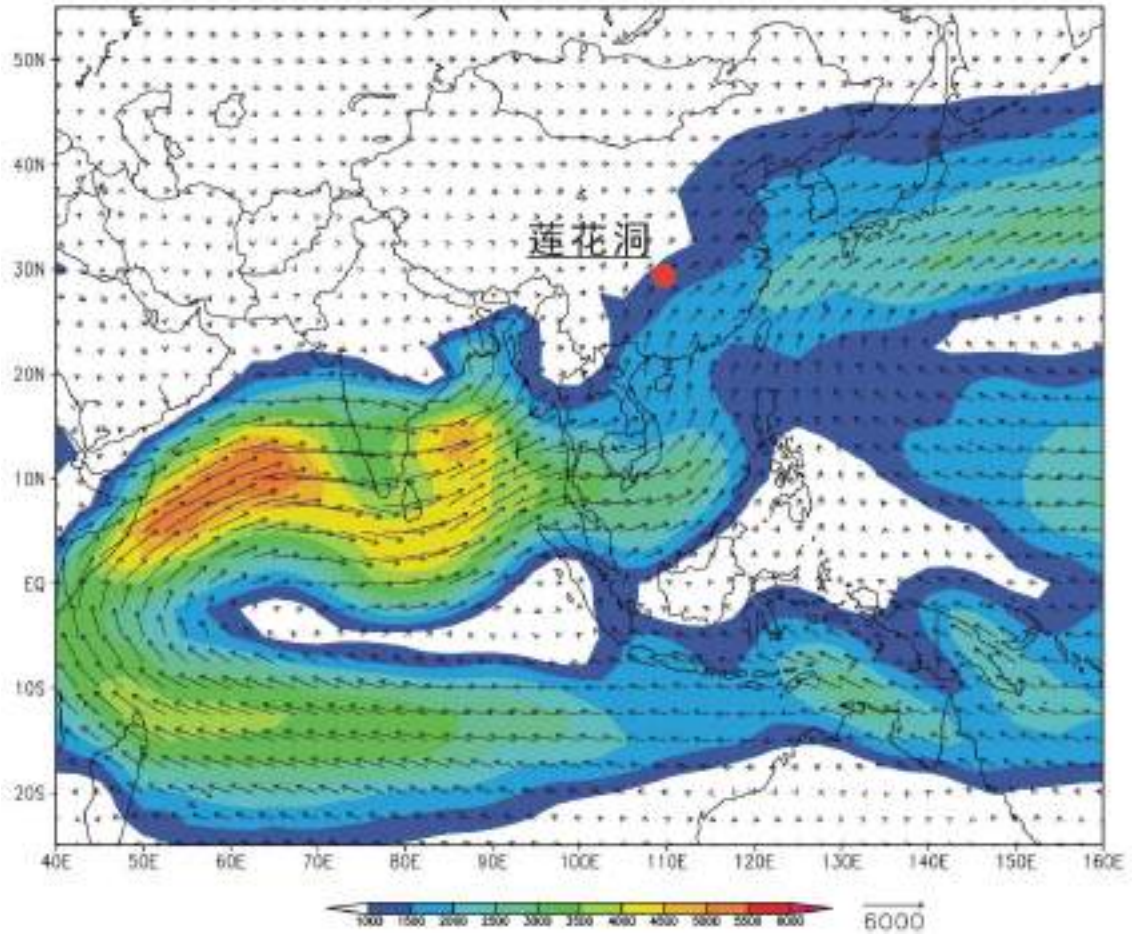


A Global Synthesis from Speleothem records(Hai Cheng) Climate Dynamic(2012)



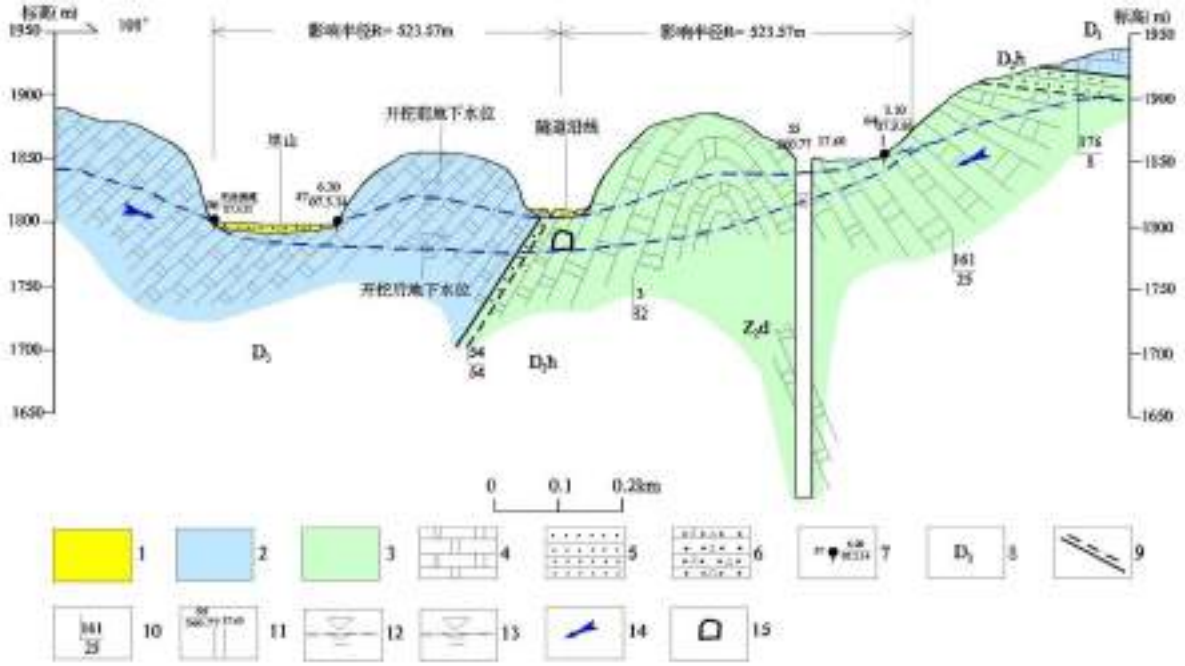
通过东亚,中东,地中海,南北美.28处石笋资料,揭示几个冰期终止点的空间变化.

A Holocene Monsoon field in the bordering area between Hunan, Hubei, Chongqing and Guizhou（Yin Jianjun, 2013）



4. Hydrogeology and Environmental Geology Issues in Karst of China

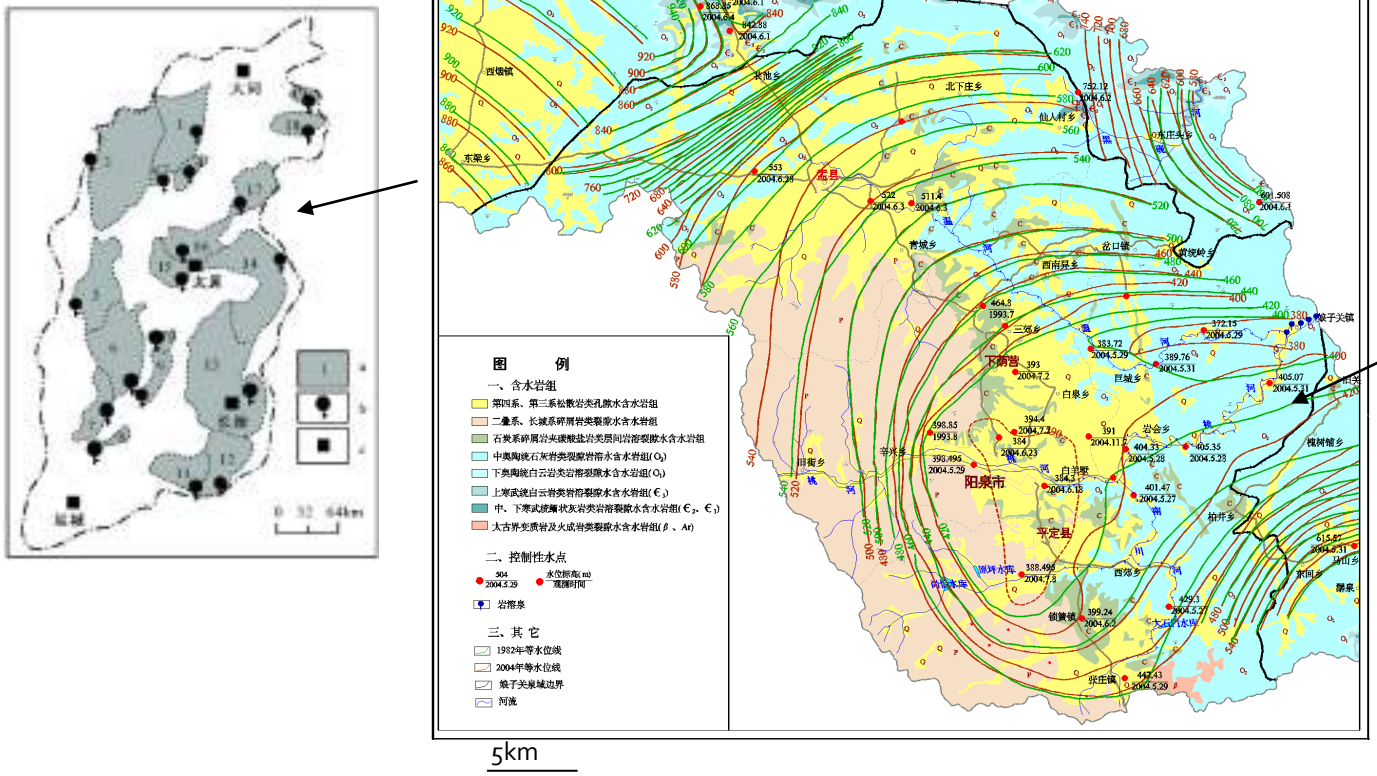
(7) Change of Karst Hydrological Flowfield following Traffic(Tunneling), Mining, and Hydroelectric (reservoir)construction in Karst regions



云南老挝铁路隧洞对杞麓湖的影响

Dewatering along A tunnel on the Yunnan-Lao Railway

The flow fields of Niangziguan Karst Spring, Shangxi, from 1982 (green) to 2004 (brown)



新问题：老煤矿闭井后对岩溶含水层的污染

4. Hydrogeology and Environmental Geology Issues in Karst of China

(8) Karst water pollution induced by damping in dolines, injection of waste water in sinkholes, and oil stations in karst areas, （高速公路加油站影响）

中华人民共和国环境保护法，2014年4月24日，12届全国人大常委第8次会议修订

第42条，严禁通过暗管，渗井，渗坑，管注...等逃避监管的方式违法排放污染物

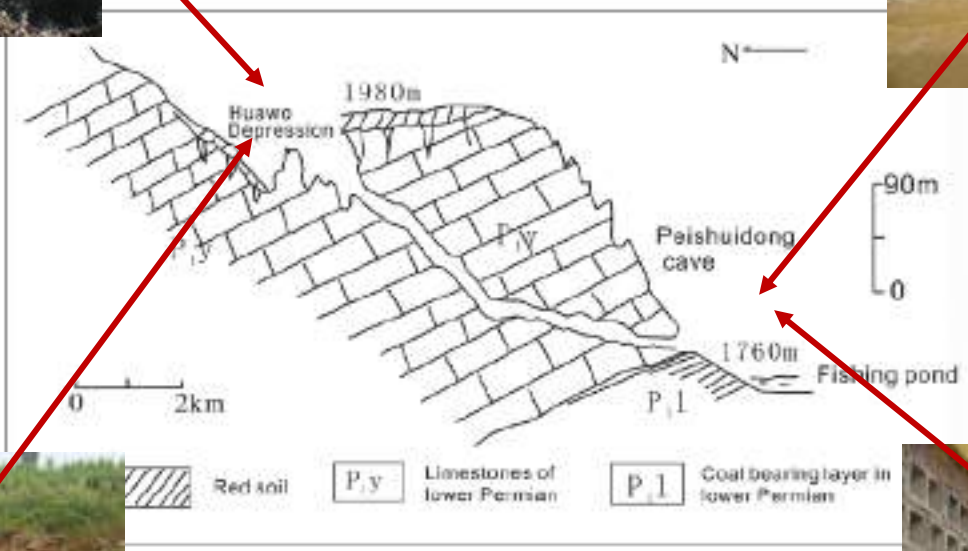
Waste floating on the outlet of Lianzhou underground stream, Guangdong

Karst Dolines are used as Waste water pond, Pingguo Bauxite Ore Deposit, Guangxi

A karst aquifer of Upper Devonian is filled by mud after a doline is used as tailwater pond, Beishan Limonite Ore, Huanjiang, Guangxi

Stream

The Pengshuidong underground stream, Songmin County, Yunnan was polluted by Waste disposal from A Phosphate Manufactory(2008.2.21)

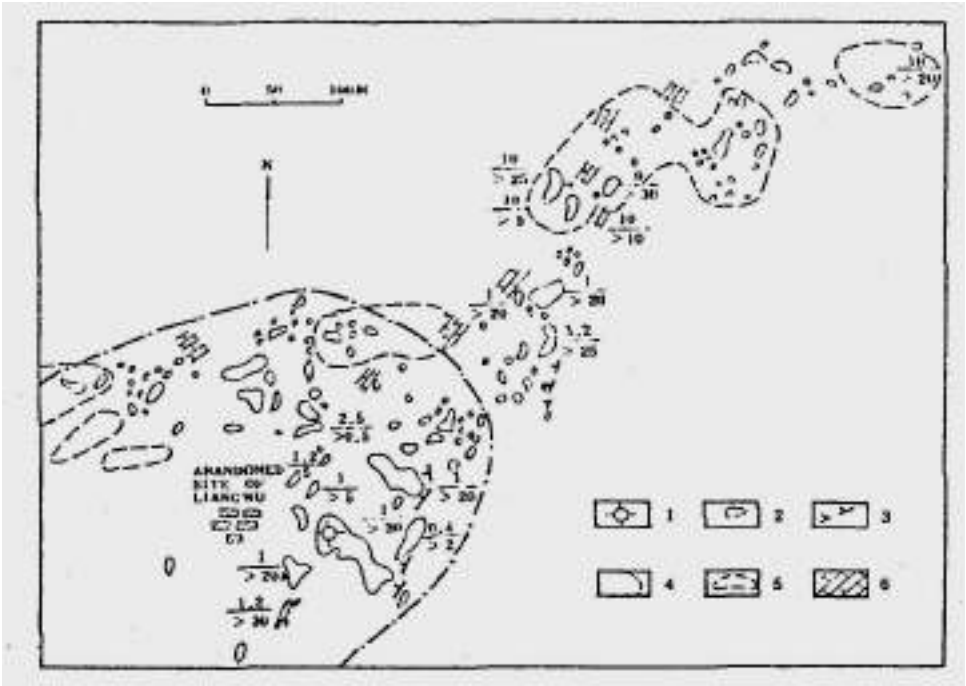


h hydrogeological profile of the cave of Peishuidong, Yunnan.

2008.9.17

4. Hydrogeology and Environmental Geology Issues in Karst of China

(10) Karst Collapse Event Karst Collapses in Liangwu Village, Zhangmu, Guixian, Guangxi, 1963



1、爆破点
2、1963年良吴村找水爆破引发的岩溶塌陷点
3、土层中的裂缝
4、最初的塌陷区
5、2-3月后塌陷延伸区
6、石灰岩露头

4. Hydrogeology and Environmental Geology Issues in Karst of China

(11) Hydrological Function of Karst Forest： Water conservancy？ or to increase evaporation？

贵州荔波世界岩溶遗产地森林

Karst forest of Libo WH site

云南邱北桉树(Eucalyptus, sp)
种植情况：速生，但需大量水份和养份：澳大利亚观测

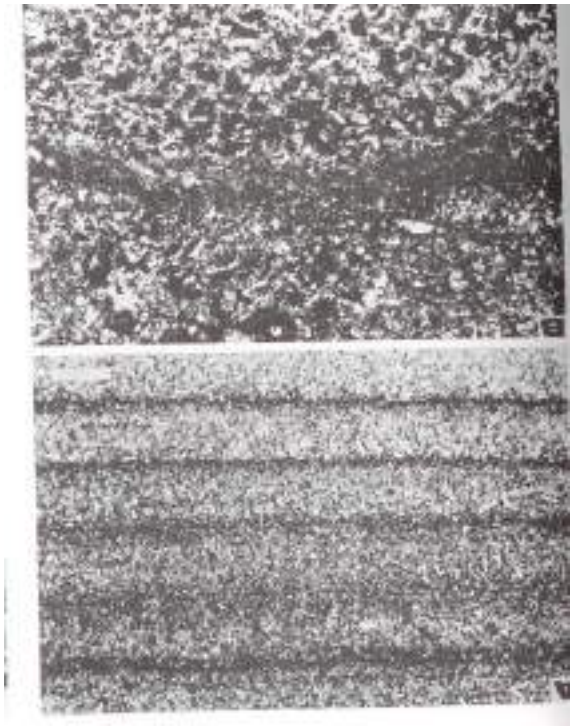
One piece of Eucalyptus tree can evaporate 200 liters water/day

4. Hydrogeology and Environmental Geology Issues in Karst of China

(12) The hydrological behaviour of Dolomite：

Pore water? fissure water? karst water； or an impermeable bed?

广西临桂西二塘，石炭系大埔白云岩露头（示小溶洞）



美国纽约州泥盆系白云岩（D.H.Zenger, Dolomitization,1982,P.359，

上图比例尺1mm,下图2mm)

4. Hydrogeology and Environmental Geology Issues in Karst of China

(13) The origin of high CO_2 concentration in Xueyu Cave, Fengdu, Chongqing, and mechanism of its regular change

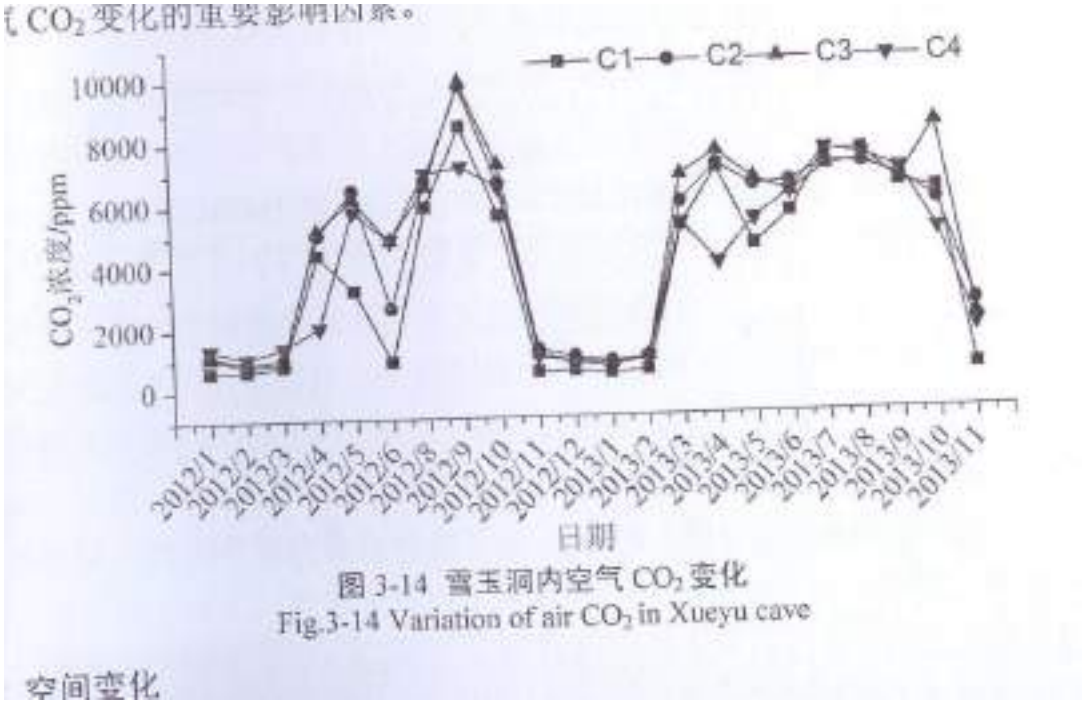


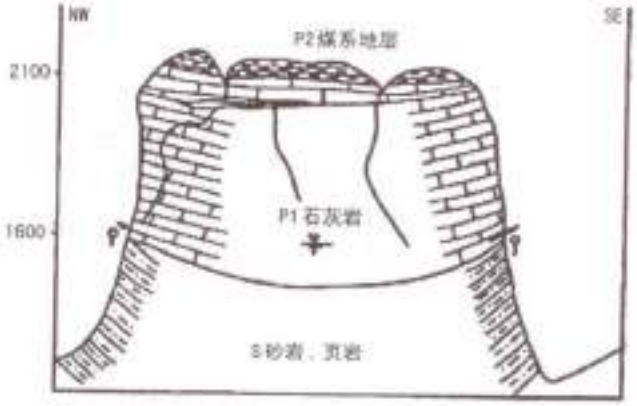
图 3-14 雪玉洞内空气 CO_2 变化

Fig.3-14 Variation of air CO_2 in Xueyu cave

空间变化

4. Hydrogeology and Environmental Geology Issues in Karst of China

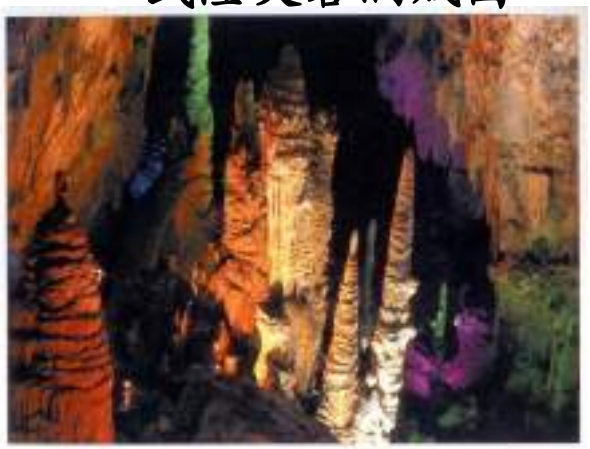
(14) Issues remained in World Heritage site of South China Karst



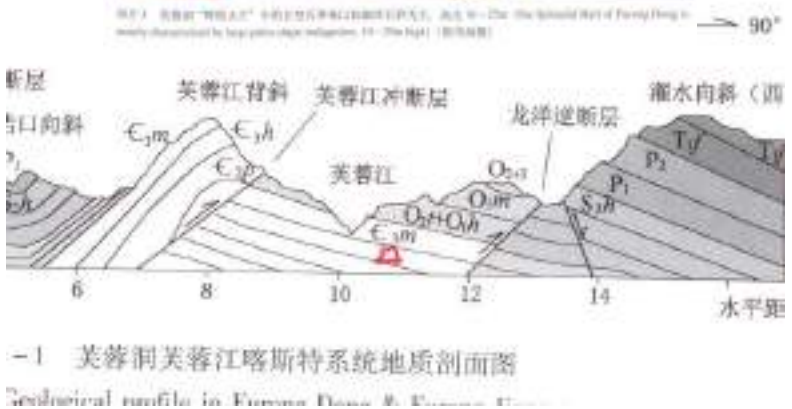
(1)金佛山顶外源砾石来源
在海拔2200米的台原上，
古佛洞内大量的砂岩砾石
从哪里来?
The origin of Quartzite Gravels
In a cave 2200m asl Chongqing

武隆芙蓉洞成因

古佛洞



芙蓉洞内景观

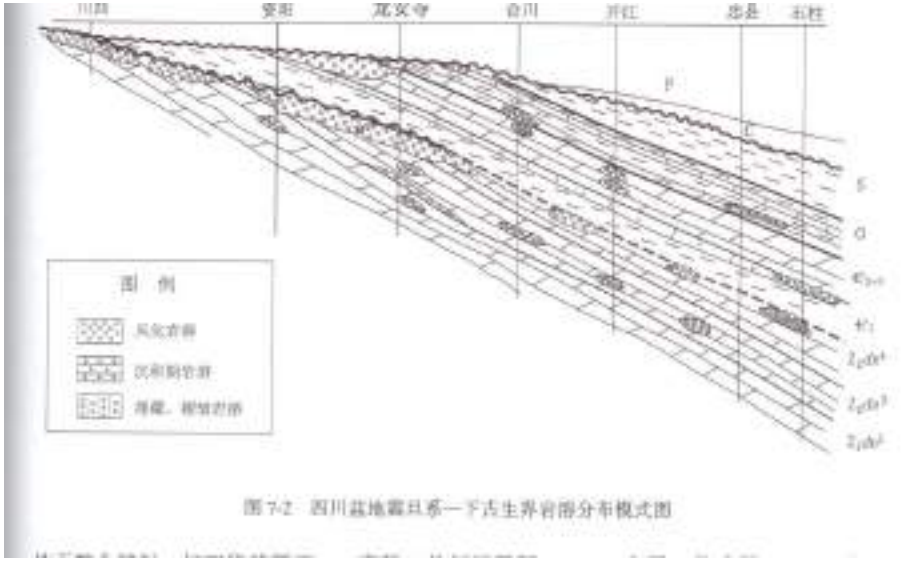


－1 芙蓉洞芙蓉江喀斯特系统地质剖面图

石膏花的来源（$CaSO_4$):硫的来源：三叠系地层?盆地油田？如美国新墨西哥州Carlsbad

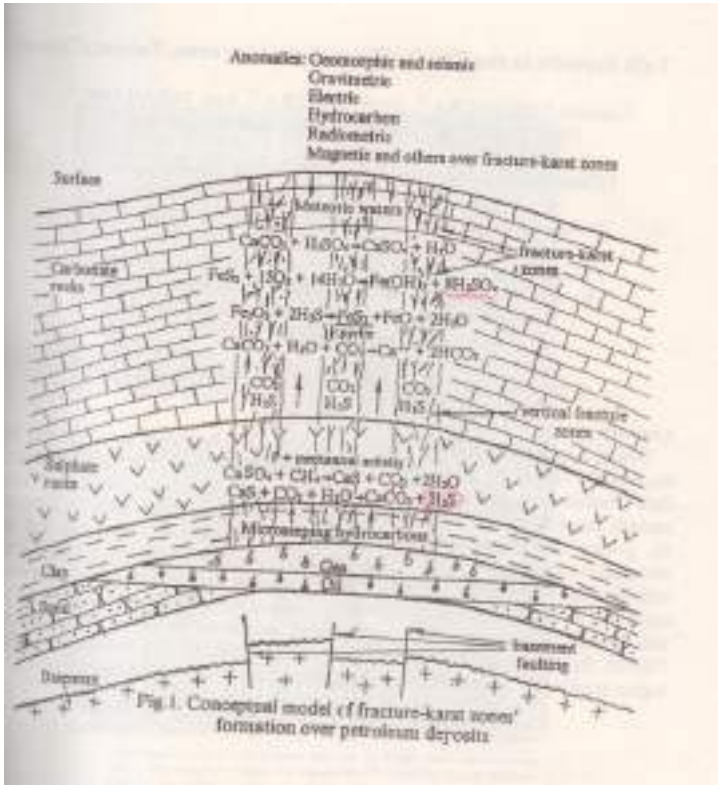
4. Hydrogeology and Environmental Geology Issues in Karst of China

(15) The origin of Karst 6000m deep
Paleokarst？ Or other mechanism of Formation?



引自：汪泽成，赵文智等，四川盆地构造层序与天然气勘探，P.193,地质出版社，2002

在埋深5918-5945.86处有溶蚀孔洞，P.192



A.V.Petukhov（俄）：油田深部岩溶成因模式（IGCP379: Karst Processes and the Carbon Cycle,Newsletter 1998,P.45)

4. Hydrogeology and Environmental Geology Issues in Karst of China

(16) The Formation environment and mechanism of big cave systems in Silicates in Gondwana land：

Factor of TIME？ Or special atmospheric contents of Gondwana land in Geological history? (In a geochemical modelling for the formation of Proterozoic Hematite in NE China,朱晓青 Zhu Xiaoqin suggests a high content of HCL in he paleo-Atmosphere)

Thank you very much for your attention !