4. The 30th Session of IGCP Scientific Board (4-8, Feb 2002, Paris)

By Yuan Daoxian

A Scientific Symposium was held during the session to mark the 30th Anniversary of IGCP, 4 papers were presented.

1. The IGCP: retrospect and prospect, by Edward Derbyshire (UK)
2. Geology and geohydrology of karst and its relevance to society, by Yuan Daoxian (China)
3. Ore-bearing Granites of Eurasia: A network Experience, by R. Seltmann (UK)
4. IGCP and Global Geoscience, by I Dalziel (USA, Chairman of IGCP Scientific Board)

The outline of Yuan Daoxian's speech is followed:

Geology and Geohydrology of Karst and its Relevance to Society

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I. Introduction
II. Water Resources in Karst
III. Karst ecosystems and Rehabilitation
IV. Global Change in Karst
V. Concluding Remarks

IGCP has supported continuously 3 karst projects since 1990. They have provided chance for world karst communities including karst commissions of IAH, IGU and UIS working together to tackle with those most urgent environmental and resource problems in karst.

IGCP299(1990-1994): Geology, Climate, Hydrology and Karst Formation
IGCP379(1995-1999): Karst Processes and the Carbon Cycle
IGCP448(2000-2004): World Correlation of Karst Geology and its Relevant Ecosystem

The Projects benefit better management of karst water, rehabilitation of deteriorated karst land and global change study.

I. Introduction: Importance of Karst

Karst is important for society because of its broad expanse, rich resources, fragile environment and high population pressure in many regions.

World karst area totals 20 million km^2, i.e. about 12% of the continental part of

the Earth Surface

Resources:

Scenery, Such as Tower Karst, Guilin and Stalagmite in Clamouse Cave, France

Water Underground streams such as the Soliao underground stream, Guangxi

Big karst springs

51% of fresh water used in Florida are from karst groundwater

Construction Material

Limestone

Mineral Deposits such as Malachite stalagmite, Placer cassiterite, Realgar, Bauxite

And **Oil and gas**

Fragile Ecosystem:

Karst has been regarded as a fragile environment since 1983, at the 149th conference of AAAS (Detroit).

It is because of leakage of water and thin soil as a result of intensive karstification. Rock desertification happened in many places.

Residents in many karst regions suffer from shortage of drinking water

Population pressure:

Malpractices in landuse intensify rock desertification. Water and soil are the two basic problems in karst

II. Water Resources in Karst: geological structure, Lithology and Karst Features

Groundwater is usually an important source of water supply in karst areas, but world comparison shows its circulation and storage are controlled by karstic (Fig.23) and lithological features

Exploitation of Underground Stream

Heterogeneity is not always a bad thing. It benefits exploitation of underground stream with many skillful ways, such as daming of underground stream with small engineering works to deliver water for irrigation.

Vulnerability of karst water

Cost Action 620 Project of EC made a special study on the issue. Mining, Quarrying, and overpumping may all bring about serious problems.

Epikarst spring, water source for millions people.

Underground streams are usually too deep for use, but Epikarst springs are generally feasible for water supply in mountainous karst regions .

Under good vegetation, an Epikarst spring with 1km^2 of catchment can survive dry season and provide enough water for 300 people.

III. Karst ecosystems and Rehabilitation

World Comparison.

Karst vegetation are considered as petrophile, Xerophile, and calciphile and brought about a condition difficult for human being to live.

But world comparison shows, that Karst ecosystems in different part of the world are quite different.

Such as Potato field near Kungur, SE Perm, Russia showing the advantage of enderground drainage system for agriculture.

However, boreal karst has other problems

And the function of Eucalyptus in Australian Karst is to lower down water table against salinization.

Rehabilitation of karst rock desert

To grow trees on limestone rock with both ecological and economical benefits is the basic requirement for the rehabilitation of karst rock desert, especially in those regions with high population pressure where ecological immigration is not feasible. Many petrophile and calciphile species are found to fit the aim .

On the other hand, harmful effects of calciphile plants, such as bracken , Eupatorium adenophorum plants should be avoided.

Subterranean karst ecosystem

The particular subterranean ecosystems in karst are also related to society in many respects.

The 100milliom bats in SW USA can swallow 100,000T of insects annually.

Cave Salamander can be used as a hydrological tracer

Quite a few cave enjoy such chemoautotrophic lifes, and provide more feasible conditions to study such special ecosystems.

Biological Engineering in Rehabilitation of Karst

Enzyme, such as Carbonic Anhydrase, moss, algae and lichen can enhance karst processes and increase porosity and water detention ability, thus favour afforestation

Some successes have been achieved in transferring petrophile genes into cash crops.

IV. Karst and Global Change Studies

CO_2 sink or source

The involvement of CO_2 in karst processes makes it an important sink(dissolution) or source (deposition) of atmospheric CO_2 depending on the behaviours of a Karst Dynamics System.

The latter can be clarified by several parameters(pH, HCO_3, Pco_2). On the bases of world limestone dissolution rate monitoring, the annual uptake of CO_2 from atmosphere could be estimated. It can also be estimated by the HCO_3^- content in water:

The results of the CO_2 sink estimation are

6.08×10^8/a(Yuan, 1997)

2.2×10^8/a(Kazuhisa,1996)

3.02×10^8/a(Philippe Gombert, 1999)

that is: 20-40% of the "missing sink"

On the other hand, a lot of calcareous tufa deposits in limestone regions along plate margins and its KDS behaviours indicate great amount of CO_2 emission in to the atmosphere.

There are a lot of tufa deposits around Rome used as building stone. According to the volume of tufa in 1000km^2 area around Rome. The annual emission of carbon is estimated to be: 100,000T.

Palaeoclimatic records in karst sediments

Like ice core, marine sediments, loess, tree ring, lake deposit, cave deposits are widely used as paleoclimatic proxies in the implementation of IGCP 299 and 379.

Many climatic change events in Pleistocene were recorded in speleothems.

V. Concluding Remarks

1. Karst is important for society because of its broad expanse, rich resources, fragile environment and high population in many areas.
2. karst is a fragile ecosystem because of leakage of water, and thin soil as a result of karst processes.
3. International comparison has shown that the impacts of karst to human life are different at different karst regions with varied geological, climatic, hydrological and biological background. A better understanding on such differences benefit reasonable use and protection of karst water, rehabilitation of karst ecosystem, and sustainable development in karst.
4. karst involves in Global Change Study in two ways: the carbon cycle, and the palaeoclimatic reconstruction with karst processes. Geological processes have not been sufficiently addressed yet in global carbon cycle model. The joint IGCP Projects promoted by Dr.E Derbyshire, the CHANGE including:

464 Continental Shelves
459 Terrestrial Carbon
413 Dry Land
and 448 karst

are making headway in this direction.