

## **Project Guizhou 2003**

### **Description of the research initiative**

#### **Introduction**

It has been shown by various studies carried out in diverse areas, both national and international, that karst environments represent a natural system characterized by a fragile equilibrium where the elevated permeability of the rock substrate together with the scarce presence of soil, imprints on the territory a remarkable vulnerability towards potential polluting events.

Therefore, the presence of numerous animals which, following diverse past geological and environmental events, sheltered in the interiors of subterranean environments, render these environments particularly important for studies of evolutionary biology and for the maintenance of biodiversity.

Furthermore, the unchecked increase of water consumption correlated with an extensive process of exploitation of the natural environment has provoked an imbalance in the water cycle which seems to be tending towards the gradual depletion of the water resources. The need for a continuous monitoring of the water resources of the territory is in fact fundamental in order to correctly conduct all the conservation operations related to them. The underground waters are the main potable source of the Guizhou (China) area.

Considering therefore, that the prevalent use of the subterranean waters is as water destined for drinking and irrigation purposes, it becomes essential that this is both in abundant supply and of good quality. The diverse quality of underground water is dependant not only on the natural features of the subsurface but also on the number and type of industrial and agricultural activities being carried out in the territory.

#### **Research Program**

The research will be carried out in four phases. The initial phase will include the collection of existing data in order to precisely identify the study areas. The next phase is for field investigation and there will also be periods of training for both the Italian and Chinese scientific and technical personnel. The next phase will include the elaboration of the data collected and its distribution.

A detailed outline of the various phases of the research project is given below.

### **1. Data collection and analysis**

- 1- analysis of existing bibliographic data;
- 2- selection of study areas and the main karstic aquifers identified on the basis of existing bibliographic data and unpublished sources collected during past hydrogeological research carried out by the Museum of Verona.;
- 3- collection of data in order to determine the existing relationships between the various subterranean water bodies and their reappearance at the surface, and the identification of the presence of animal species which indicate water quality;
- 4- ecological analyses of the subterranean ecosystems and their interaction with the external environments;
- 5- analyses of the water quality by chemical, microbiological and biological analysis; comparative analyses of the karstic aquifers and the identified deep and superficial water bodies;
- 6- identification, study and description of the specific elements new to Science.

### **2. Training**

1. training of both Chinese and Italian technical personnel for collecting, analysing and processing data;
2. training of both Chinese and Italian scientific personnel for collecting, analysing and processing data;
3. Lectures for university students both in China and in Italy.

### **3. Data processing**

- 1- identification or creation of software specific to the research requirements;
- 2- realisation of a georeferenced environment data base;
- 3- evaluation of the biodiversity of the hypogean environments;
- 4- publication of various thematic maps and a thematic map of the research syntheses;
- 5- proposals for the conservation and evaluation of the hypogean environments and the surface and subterranean water resources;
- 6- proposals for planning the management of the local environmental and economic resources

### **4. Communication and publication**

- 1- distribution of data by using both traditional and information means.

## **Objectives and Methodology**

The main aim of the project is the detailed study of some karstic aquifers in the area of Guizhou by monitoring the principal chemico-physical parameters. It is intended to assess the pollution level by utilising macro indicators, in accordance with legislation 152/99: ammoniacal nitrogen, nitric nitrogen, dissolved oxygen, BOD5, COD, total phosphorus and escherichia Coli.

Other parameters will also be assessed such as air and water temperature, conductivity, pH, hardness, iron, organohalogenates, total coliforms, etc.

Regarding the biological monitoring it will be attempted to calibrate an Extensive Biotic Index (E.B.I.) by utilising the presence of aquatic macrovertebrates, modelled on that applied in Italy on the basis of current material standards (legislation 152/99 and its modifications). This methodology of analysis will allow information and a synthetic judgement of quality to be given about the state of "health" of the hypogean and surface fluvial environments. The terrestrial hypogean environments may also be taken into consideration by a numeric value: the E.B.I. value. In the E.B.I. method the biological community of benthonic macroinvertebrates is utilised, that is all the invertebrates visible to the naked eye, which normally live in subterranean and surface waters: larvae and adult insects, molluscs, crustaceans, triclads, oligochaetes and *irudinei*

This method, which includes the collection and study of the organisms which live within the subterranean and surface waters, is based on the principle that the benthonic animal community reacts to variations in the degree of pollution and environmental change, according to a determinate succession of events. In addition, all the vertebrates present in the karstic caves which have a biological significance of particular importance within the environmental balance of the area under investigation will be taken into consideration. In order to monitor the complete state of health of the external and subterranean ecosystems samples will be taken with the aim of mapping the animal biodiversity of the study area.

The specimens collected will subsequently be sorted and studied by Chinese and Italian experts. The research will be carried out in accordance with the local meteorological conditions and at different times of the year (spring, autumn) so as to highlight the eventual seasonal variations in the environmental parameters.

## **Implications from results**

The information obtained will be of great importance in outlining the conservation interventions most suitable for surface and subterranean fluvial environments. For example, a knowledge of

the structure of the biotic community is the basis for monitoring the biological quality of the aquifers being investigated and this may be obtained by applying the "Biotic indexes". The identification of the species which comprise the terrestrial fauna and the description of the taxonomic elements new to Science will allow the knowledge of evolutive history and biodiversity to be enriched for the area under investigation.

The elaboration of the data collected together with the charts produced during the research will provide a useful tool in the conservation and evaluation of hypogean environments and of the subterranean and surface water resources. The planning of a correct management of the local environmental and economic resources can also be achieved. These are in fact the basic principals of the concept of "sustainable development".

Throughout the various phases of the research training courses will be held both in China and in Italy for the training of the scientific and technical personnel. Lectures will be given to the students of Guizhou Normal University on the progress of the research project.