国土资源部
中国地质调查局
China Geological Survey

IUGS/IAGC Task Group on
"Global Geochemical Baselines"
Mapping the Geochemistry of the Earth's Land Surface

A Proposal for CCOP Geochemical Mapping

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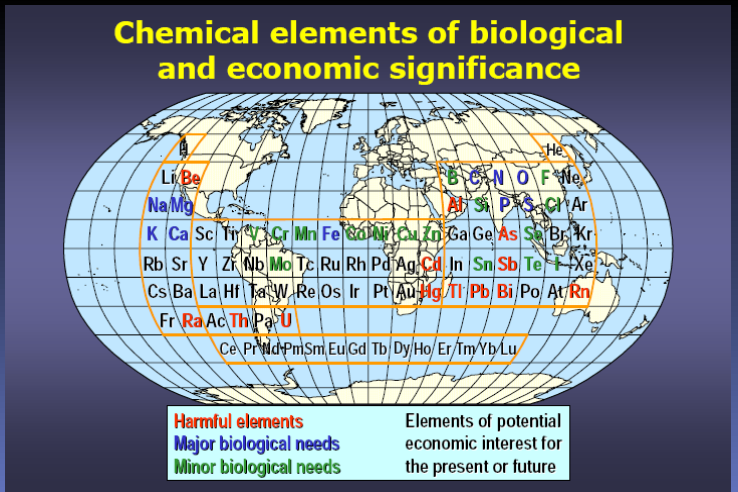
IGGE

Importance of Global Geochemical Data

- Everything in and on the Earth is made from the chemical elements listed in the periodic table.
- 90 elements have been found in nature, but we know a little of their background and spatial distribution of these elements on Earth.
- A global geochemical database is critically needed for solving resources and environmental problems facing challenges of global change and sustainable development.



What's Geochemical Mapping?

Geochemical Mapping involves the systematic measurement of elements or compounds by recognized methods and the results are expressed on geochemical maps.

Its purpose is to provide data for basic geology, mineral resources, environments, agriculture and many other disciplines.

Objectives of the CCOP geochemical mapping Project

- Capacity building: to improve the technology and knowledge on geochemical mapping and its application in mineral exploration, environmental assessment and global chemical change through training courses in CCOP member countries,
- Data documentation: to develop harmonized high-quality geochemical baselines data for understanding the past and predicting the future changes induced by natural processes and human activities, and for mineral resource assessment.
- to develop a bridge between the scientific community, decision makers and the general public in the field of global-scale geochemistry.

Scales of Geochemical Mapping

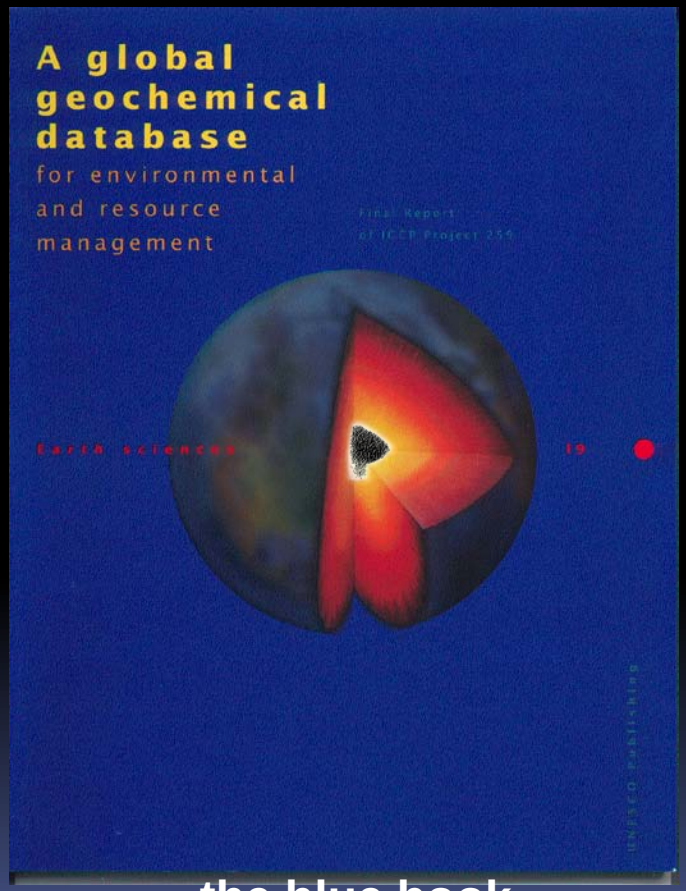
- **Global-scale:** global wide-spaced sampling to document global abundance and distribution of all chemical elements on the Earth's surface for global change and sustaining natural resources.
- **Regional-scale:** low-density sampling to delineate areas of interest for mineral resources, environments, agriculture and so on.
- **Local–scale:** high-density sampling to explore mineral resources and to evaluate environments.

An implementation proposal in CCOP Countries

- **Stage 1:** Global-scale Geochemical Baselines
- **Stage 2:** National/regional-scale Geochemical Mapping
- **Stage 3:** Local-scale geochemical mapping

Stage 1 Global-scale

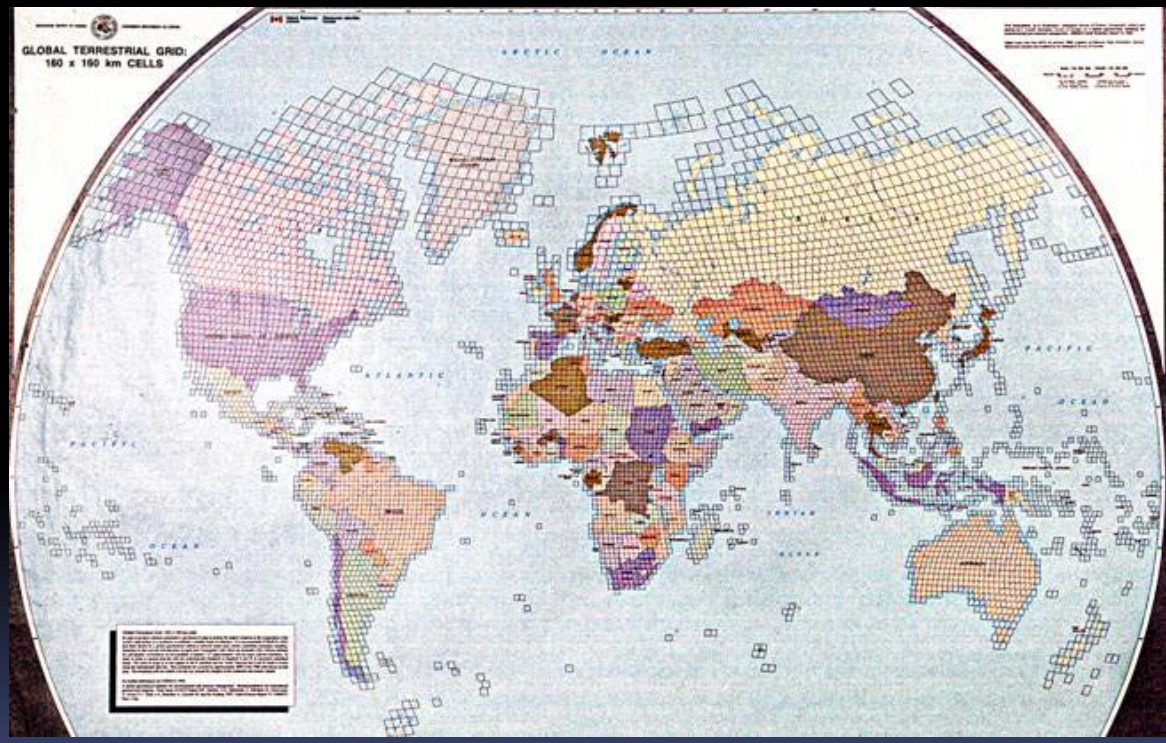
IGCP 259: International Geochemical Mapping (1988 – 1992)
IGCP 360: Global Geochemical Baselines (1993 – 1995)
IUGS/IAG Task Group on Global Geochemical Baselines (1995 –)



the blue book

UNESCO publication volume 19

Global Reference Networks

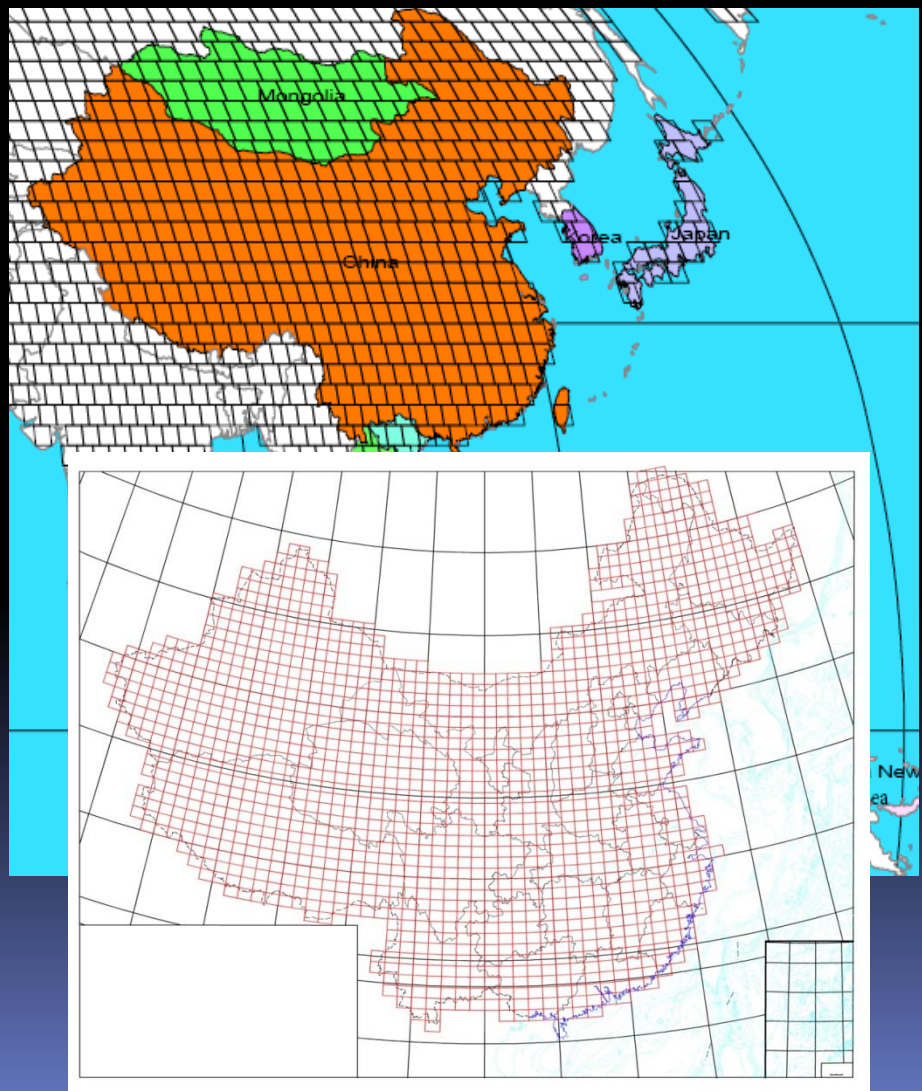


A global geochemical reference networks to cover the whole land surface of the Earth with 5000 GRN grids (each: 160 by 160 km).

Stage 1: Global-scale Geochemical Baselines

- 580 GRN cells (subdivided into 4 sub-cells)
  - 2400 CCOP sub-cells
- Sample media
  - Overbank/floodplain sediments in mountains and hills
  - Soils in plain terrains
  - Catchment basin sediments in desert terrains
- Elements analyzed
  - 76 elements
- Objectives
  - Document geochemical baselines
    - Geogenic background used to determine anomalies for mineral resource assessment
    - Anthropogenic baselines used to predict future environmental changes

Global Networks Cells Covering CCOP countries



Number of samples to be taken

国家 Countries	No. of Global grids	No. of samples	国家面积country area km^2
柬埔寨Cambodia	10(6)	30	15916
中国China	400(355)	1400	9600000
东帝汶East Timor	1(1)	4	14874
印度尼西亚Indonesia	116(69)	300	1904443
日本Japan	27(16)	80	377835
老挝Los	16(9)	40	236800
马来西亚Malaysia	19(12)	50	330000
蒙古Mongolia	69(62)	260	1564116
巴比亚新圭亚纳Papua New Guinea	21(12)	60	462840
菲律宾Philippines	30(9)	60	299700
新加坡Singapore	1(1)	4	707
韩国Korea	6(3)	20	99600
泰国Thailand	23(16)	80	513115
越南Vietnam	21(12)	50	331688
全部Total	760(583)	2438	15916753

Global sampling media

- **Global sampling media used**
  - **floodplain/overbank sediments in mountainous terrains**
  - **soils in plain terrains**
  - **catchment basin sediments in desert terrains**

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Global sampling:

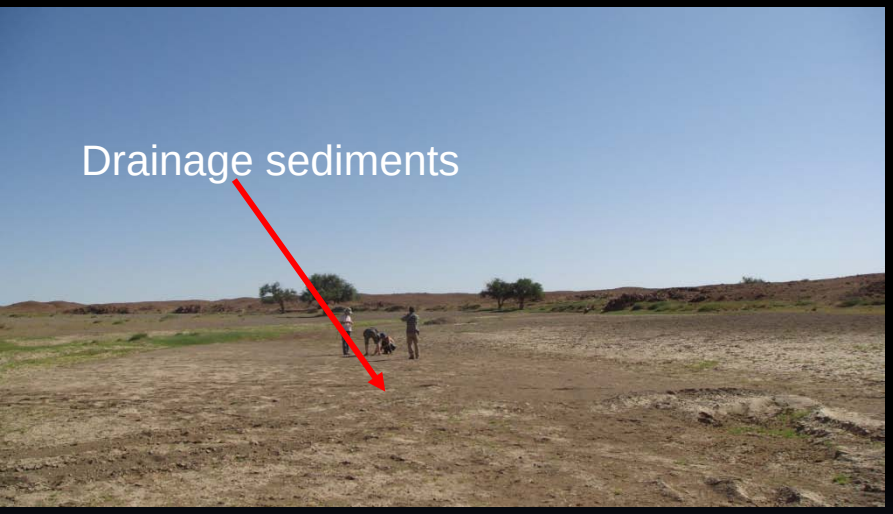
Overbank/floodplain sediments in mountain and hill terrains

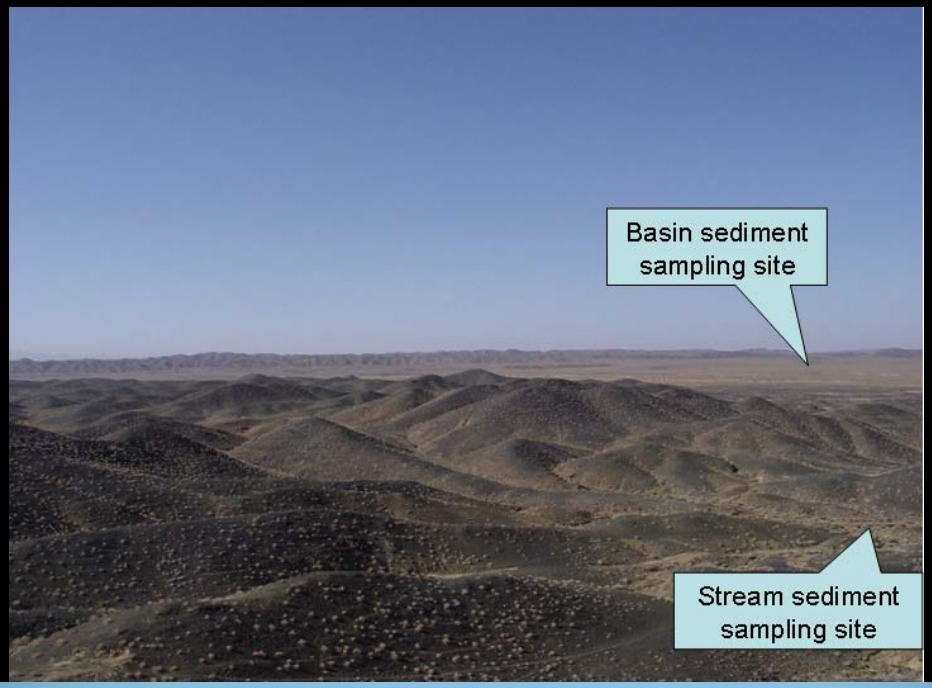
Global sampling

Soils in plain terrains

Global Sampling

Desert areas: inter-basin or drainage catchment sediments

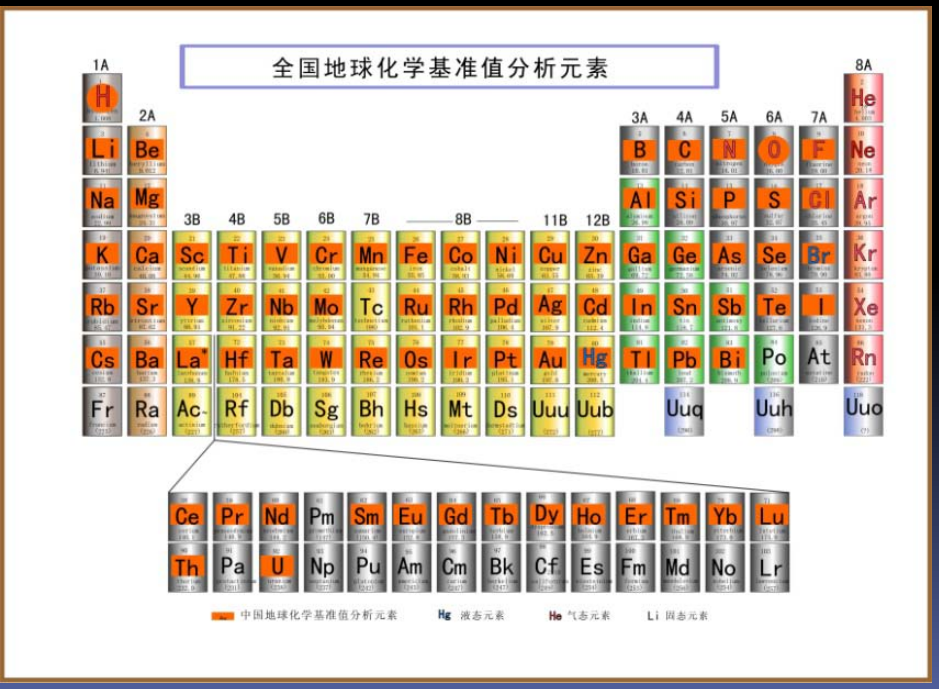




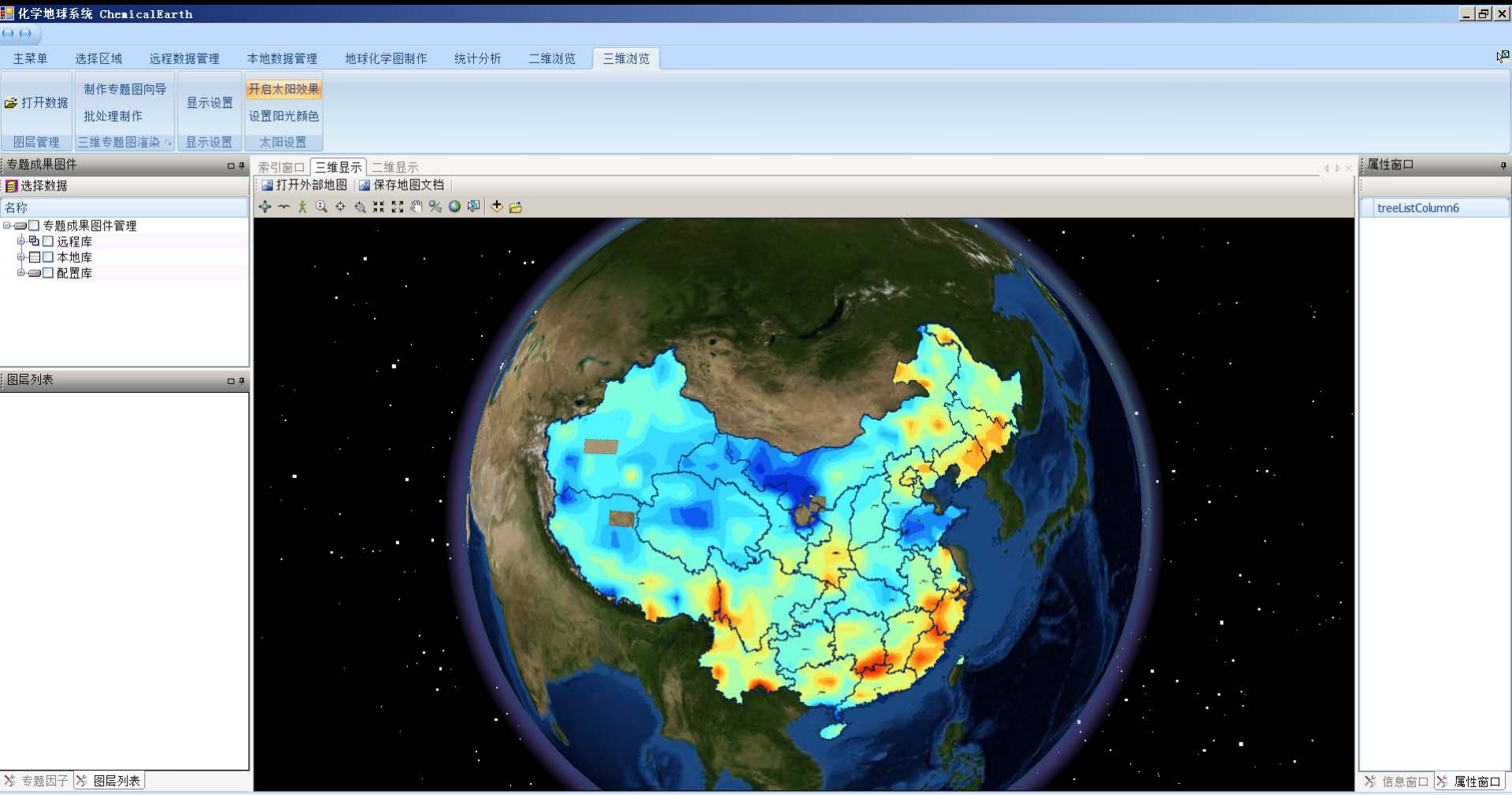
Global Sample Archieves

Sample analysis and quality control

- 76 elements are recommended to be determined according to the IGCP 259/360 specifications.
- Quality control by using China and Canada standard reference materials

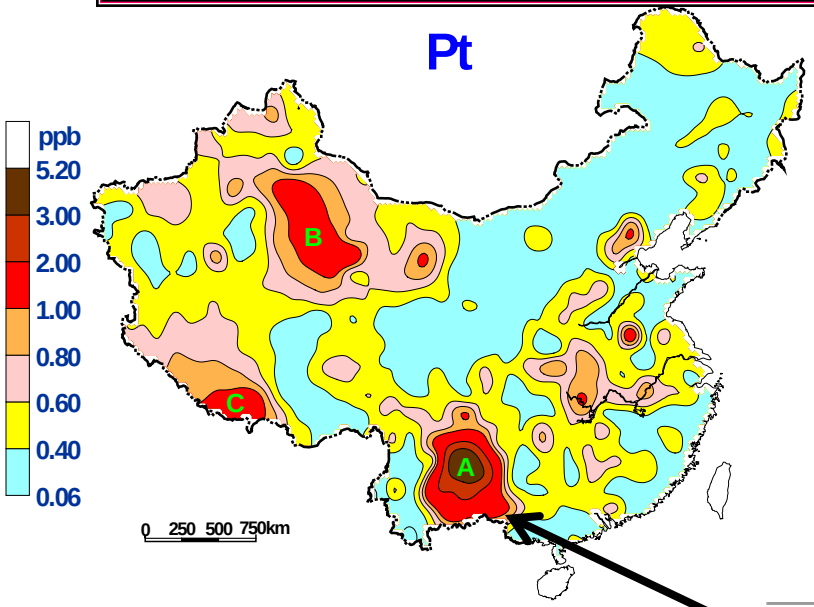


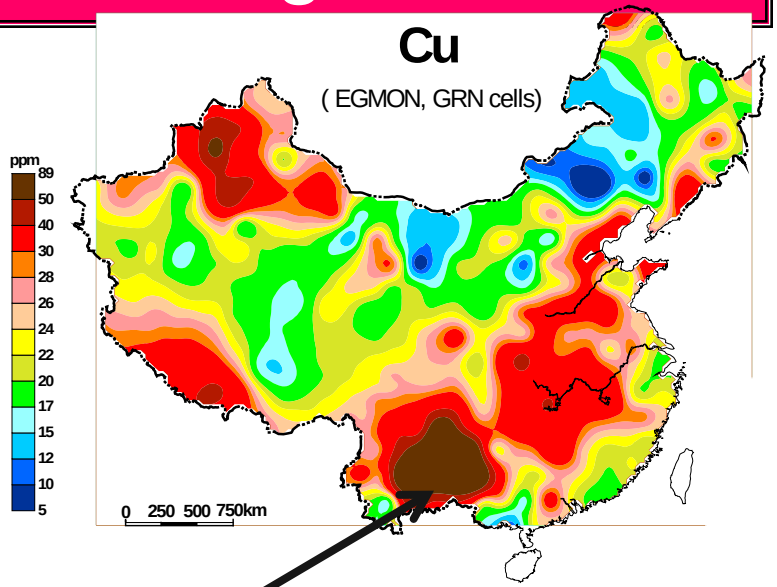
Data Management: ChemicalEarth Software



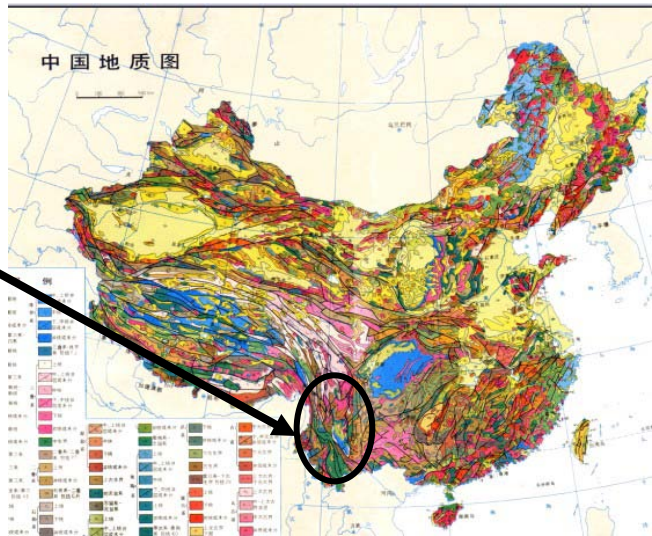
Geochemical patterns

Determine geogenic background



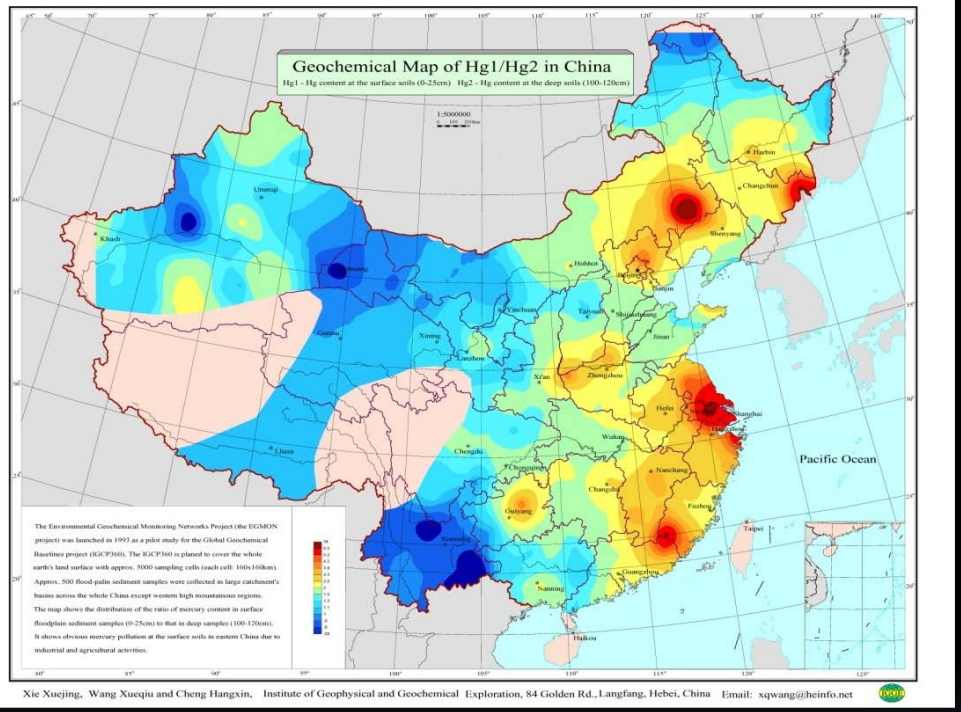


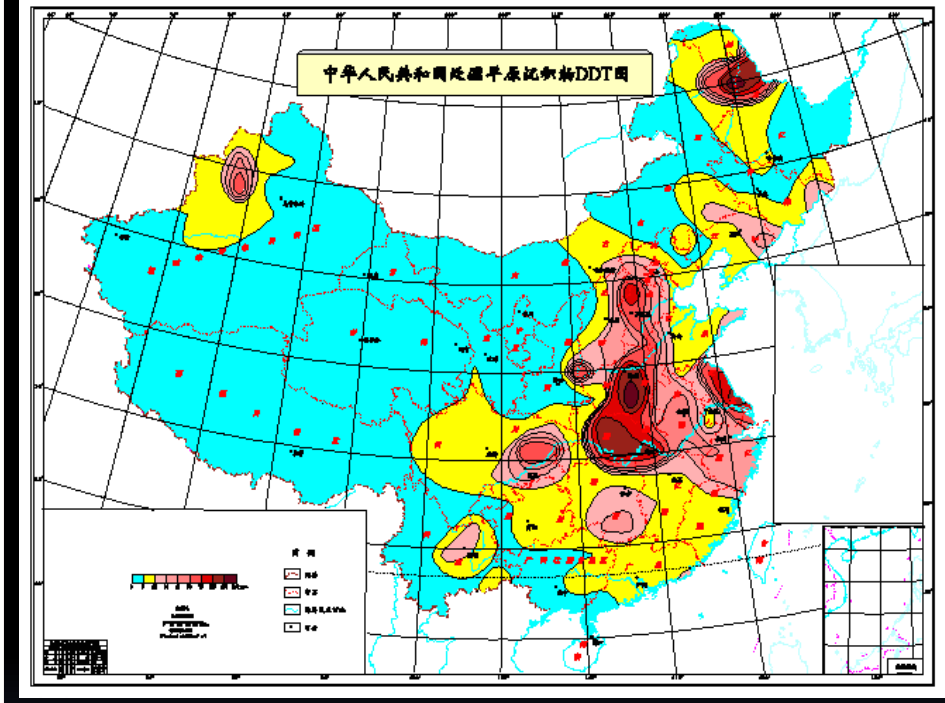
Basalt rocks
Mental plume



Environment:

Environmental Contamination by human activities

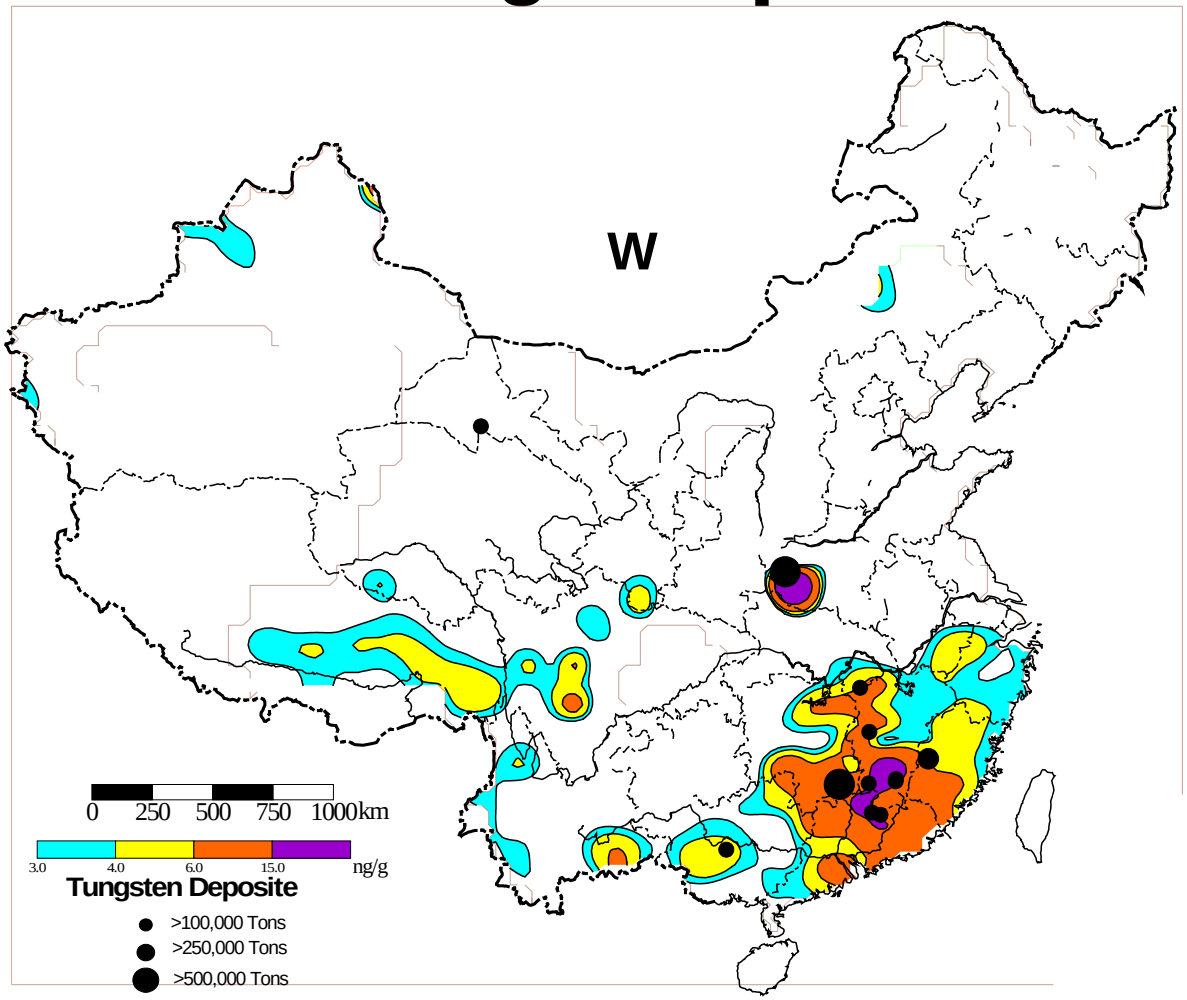




Mercury contamination by mining, coal burning and industrial activities

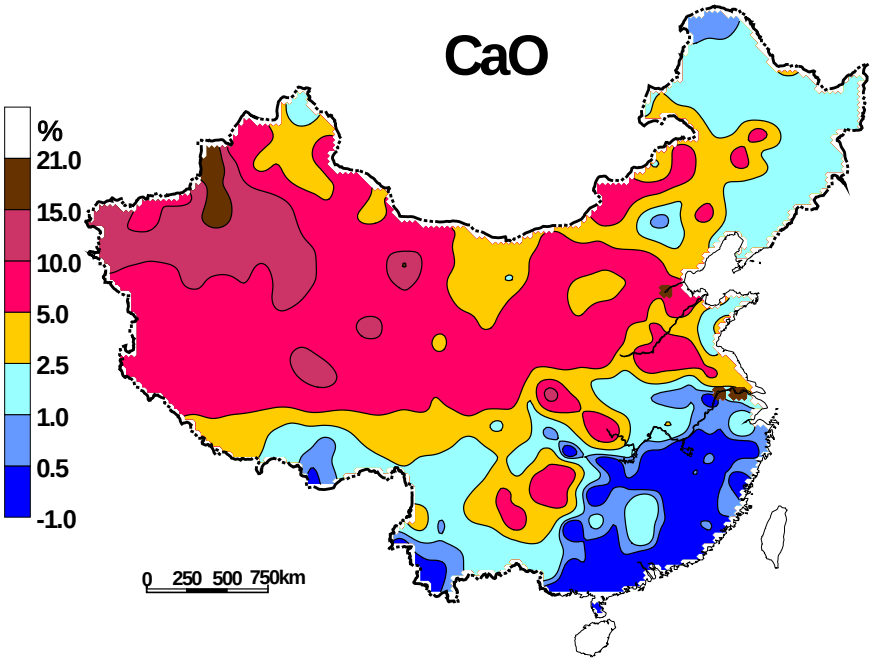
DDT contamination by insecticide

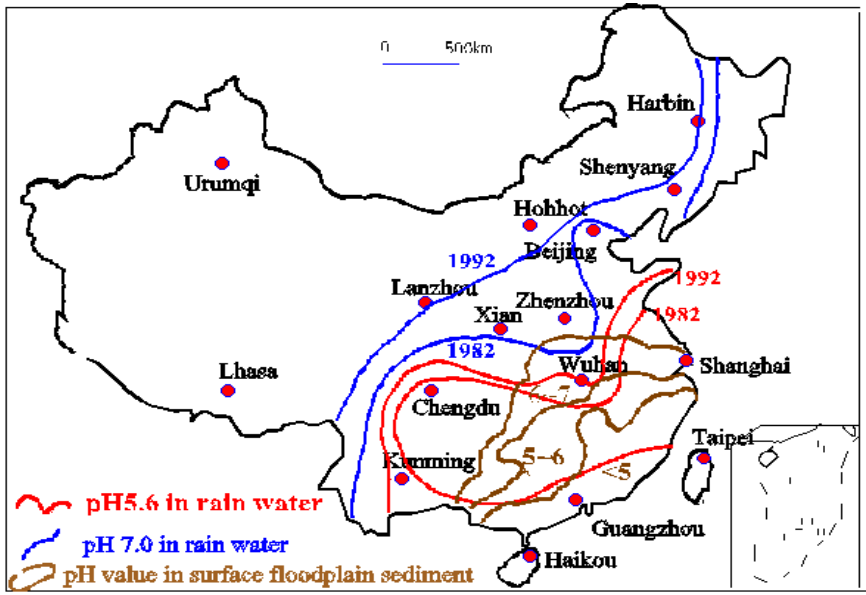
Geochemical patterns
related to metallogenic provinces



Geochemical province containing the world's largest tungsten ore deposit cluster

Geochemical patterns related to climate changes





Distribution of acid rain in 1982 and 1992,
as well as pH in surface floodplain sediment(SFS) in 1994

Stage 2: National/regional-scale Geochemical Mapping in CCOP countries

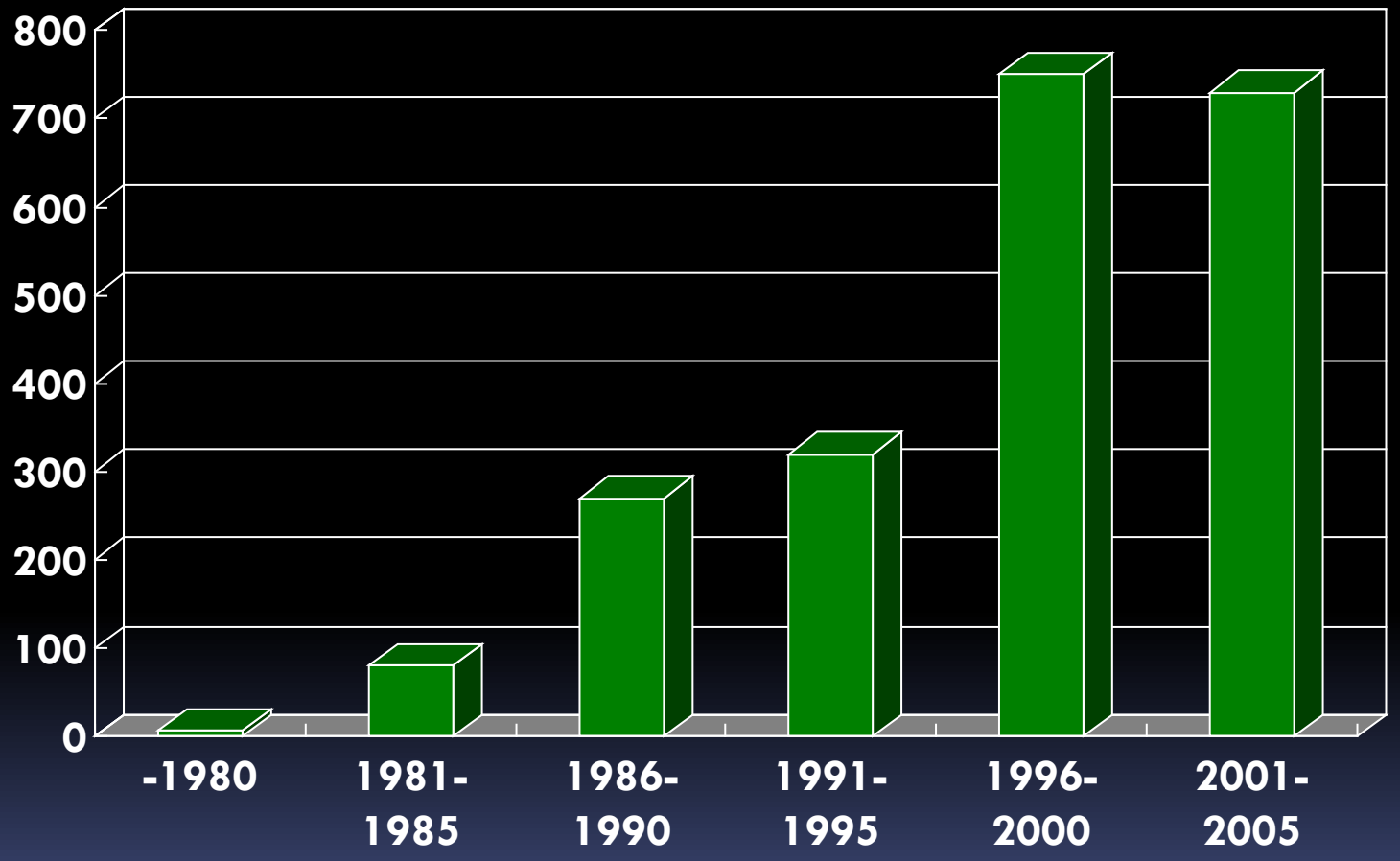
- **Objective: To delineate regional geochemical patterns related to mineral resources and environments.**
- **Sample media: Stream sediments and soils**
- **Elements determined: 30 to 76 elements**

Sampling densities for National/regional-scale Geochemical Mapping in CCOP countries

Sampling density	Country area km^2	Map scale
1 km x 1 km 2 km x 2 km	<100 000	1:100 000 1:250 000
4 km x 4 km 5 km x 5 km	100 000-1 000 000	1:500 000
10 km x 10 km	>1 000 000	1: 1 000 000

1 data point per sq. cm on the map

Regional geochemical mapping made great contribution to mineral ore discoveries



Number of ore deposits by geochemical surveys by years

Stage 3: Local-scale geochemical mapping

- **Objective: To delineate areas of interest for mineral deposits or specific environments.**
- **Sample media: Stream sediments, soils, rock debris, vegetation, water, gas.**
- **Elements determined: elements related to mineral deposits or environments and agriculture.**
- **High density sampling.**

Road map and Cooperation ways

- **Step 1 (1 year)**
- **1. Preparation of sampling instructions suitable for various landscapes from Tropical to Tundra and from Forestry to Desert**
- **2. Training courses for sampling, and (chemical analysis, map generation and data interpretation).**

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Road map and Cooperation ways

- **Step 2 (2-3 years)**
- **Global-scale:**
  - **Sampling by CCOP countries respectively**
  - **Chemical Analysis by China**

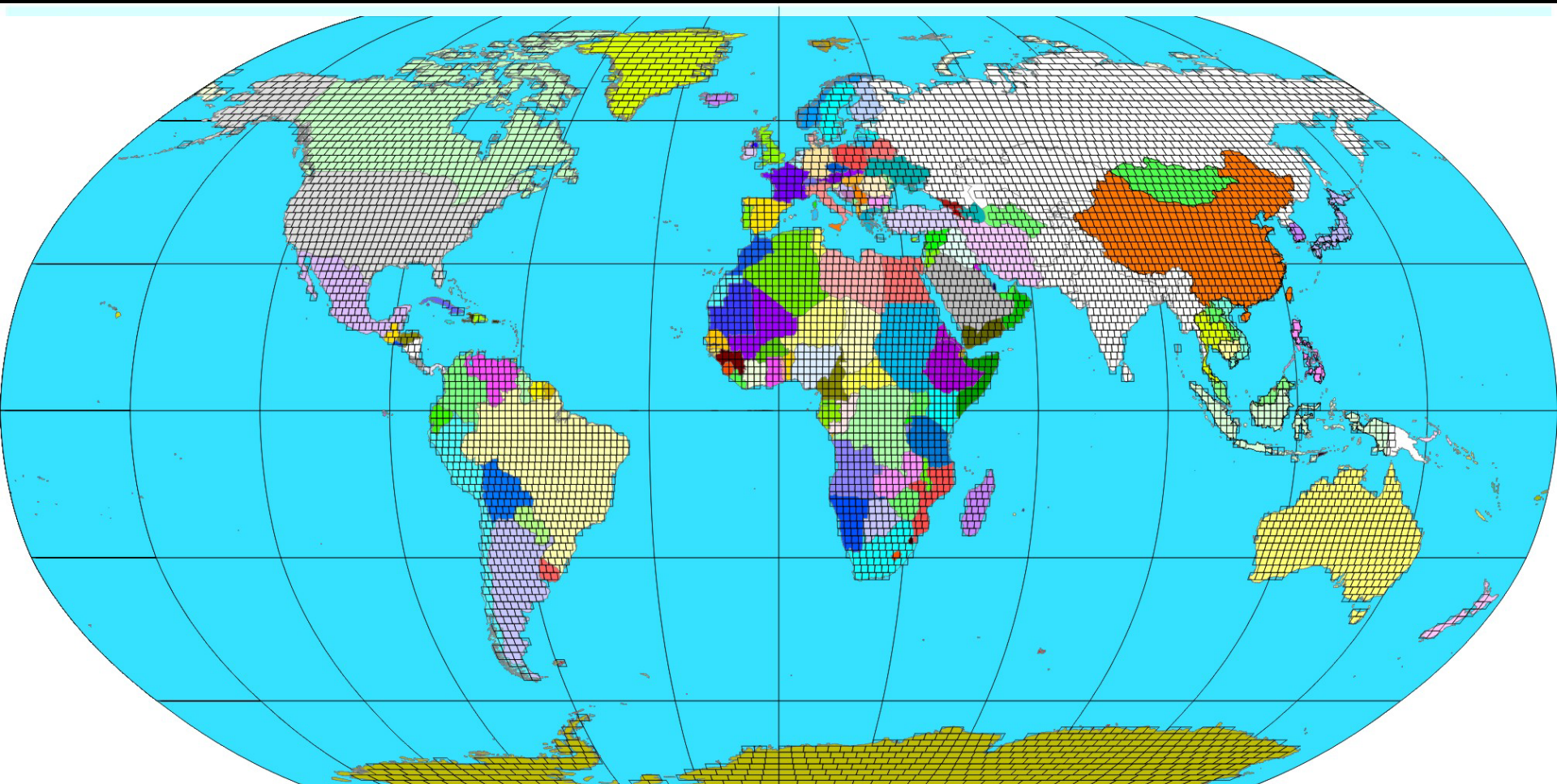
Road map and Cooperation ways

- **Step 3 (2 years)**
- **Regional-scale demonstration: sampling by CCOP countries and technically supported by China.**
- **Local-scale demonstration: CCOP countries technically supported by China.**

Your participations will make great **contributions** for Global Sustainability.

Development of natural resources and environments.

You r country will **benefit** considerably, such as capacity building, knowledge/ technology-sharing, environment monitoring, mineral discovery, agriculture efficiency, health effects, etc.



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You are welcome to participate in the CCOP Geochemical Mapping Seminar on 29th March, 2012.

Thank you !

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