

## PROGRAM OF MINERAL RESOURCE ATLASES OF CHINA

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### Abstract

This paper reports on the origin of program of Mineral Resources Atlas of China. And who manages and designs and compiles the series of Atlases. The paper also describes the organization, the composition, the content of the Atlas and he methods of compilation. The author explains that the Atlas uses the electronic cartographic publishing system of MAPCAD which is researched and developed by China itself and the procedure of publishing system. Finally the author gives her problems or ideas on the computer compilation of maps or atlas of geology and mineral resources.

### 1. Introduction

The Mineral Resource Atlases of China, which is an important kind of map in the midst of the economic map, will come out both at home and abroad for the first time. The task given by the State Planning Commission and the Ministry of Geology and Mineral Resources in 1987, was officially launched in 1989. The aim of compiling the Atlas is to serve the construction of the national economy, help various government departments in their programme-making for the development of the resource, agriculture, city, travel, education, sciences research, production, and market, etc. And the Atlases also the achievement of geology and mineral study over fort years as well.

The work of compiling the Atlases is a large-scale systems engineering. The unit

in charge of the compiling work is Institute of geology, Chinese Academy of Geological Sciences. The editorial Board of Atlases composed of experts of mineral and cartography who is the chief editor and the vice editors, have been responsible for the designing, direction, advising, organizing an exchange of experience, dealing with all kinds of professional work during compiling the Atlases, unifying and coordination all maps as a whole, and being in charge of all the work of check on the quality of the Atlases during the publishing work and so on. There are over 200 people who are from about 40 different departments to do the compiling work. The compiling members consist of two parts. The experts who are from provinces of all of the country and possess plentiful experience of practice work in the field and know their provinces' geology and mineral resources, compiled provincial maps. The other experts compiled the world map, nation-wide maps and regional maps, they have been serving at Institute of Geology, Chinese Academy of Geological Sciences. It spends over 7 years for the whole work of the Atlas, including gathering data, analyzing and researching, designing, compiling, editing and publishing and printing, etc.

## **2. The composition**

The readers maybe question how the Atlases to be composed of? In fact, the Mineral Resource Atlases of China are main Atlases among a series of 7 volumes which are of large format in octavo with hardcover. It includes: (1) Atlas of Geology of China; (2) Atlas of Ferrous Metal and Nonferrous Metal Resource of China; (3) Atlas of Solid Fuel and Nonmetal Resource of China; (4) Atlas of Noble Metal and Rare and Rare-earth Metal Resource of China. Except for (4), the other Atlases will be printed in Chinese and In English.

## **3. The content ( here only the Atlas of Ferrous Metal and Nonferrous Metal Resource of China and the Atlas of Solid Fuel and Nonmetal Resource of China.)**

### **3.1 The data**

The geological and mineral data ended by the end of 80' to early 90' and the geographical data ended by the end of 1994. The Atlases also represented new data of major regions, such as North China region, Qingling-Daba region, Jingsha-

Nujiang-Lanchuang region, middle-lower reaches of Yangtze region, Nangling region and so on. On these maps the new achievements in scientific research of geology and mineral resources have been represented.

### **3.2 Arrangement of the content**

A series of 5 parts have been represented on these Atlases, each part has its characters.

- (1) World map on the scale of 1:65 m, showed the distribution of mineral resources of the whole world, and the mineral resource position of China in the world.
- (2) Some national maps with scale of 1:12m, showed the situation of mineral resources of China in different aspects.
- (3) Some regional maps on the scale of 1:1m - 3.5m, showed the character of main metallurgic zones or provinces of China.
- (4) Provincial maps on the scales of 1:0.5m- 4m ( most of them are 1:1.5m ), this is the principal part of these Atlases. Each provincial map represented its characters of distribution and metallurgic factors in their own province.

(5) Others

In the Atlas of Ferrous Metal and Nonferrous Metal Resource of China, contains 48 maps and about 400,000 words explanation and about 350 attached charts and maps. And in the Atlas of Solid Fuel and Nonmetal contains 67 maps and about 550,000 words explanation and about 400 attached charts and maps. The back of every map not only the world, nation or province map, is a brief explanation with some pictures and tables, such as geological sections, columns, geological maps of mining areas, forms of ore body, lithological maps, metallurgic models, galaeogeographical maps, etc. Enlarged maps of crowded area of mineral resources also showed at the free spaces of every map. Otherwise, in the front of each Atlas there are 4 pages colour photographs of

mineral, ore, natural landscapes of well-known and typical mine in the world. That is for readers to learn the mineral resources in China and to have interest in it.

### ***3.3 Basic maps of geography***

A series of basic maps of geography have been compiled specially as the common basic maps of Atlases. Except for the world and nation maps, all basic maps of geography adopt the conical equal-angle projection with two standard parallels. And the main elements of geography such as cities, counties, villages, sea-short line, islands, rivers, lakes and boundaries of nation and province have been represent on these maps.

### ***3.4 Simplified geological maps***

For expressing the relation between the mineral resources and the stratum, tectonic, igneous, the simplified maps of geology in common for the Mineral Resources Atlases have been compiled specially. Before beginning the work, the principle of compiling the maps laid down by the geological experts. For showing the distribution of tectonics, stratum, igneous and its ages the different width lines for faults, boundaries of stratum and igneous, the patterns and the colours have designed in accordance with international general rules.

### ***3.5 The mineral content***

On the basis of actual data the Mineral Resource Atlases have represented the distribution of mineral resources, the scales of proved reserves, shorts of all kinds of mineral resources and the metallurgic factors.

#### ***3.5.1 Atlas of Ferrous Metal and Nonferrous Metal Resources of China.***

There are 17 shorts Ferrous Metal and Nonferrous Metal Resources have been represented in the Atlas such as iron, manganese, chromium, vanadium, titanium, copper, lead, zinc, aluminium, nickel, cobalt, tungsten, tin, molybdenum, bismuth, mercury, antimony by different colours (See Table 1.). And according to the scales of proved reserved, all these Ferrous Metal Resources and Nonferrous Metal Resources are classified large, middle and small scales in different sizes of

symbol. And also represented the metallurgic types of twelve in different shapes of geometric symbol.

Table 1. Symbols, colours of Metal and Nonmetal Mineral Resources' Sorts

Sorts of Mineral Resource	Colours
iron; fertilizer minerals, Sypsum, potash salt, etc.	Red
maganese; raw material for optical use, luorite, crocidolite-asbestos, asbestos, attapulgit elay. etc.	Purple
chromium; raw material for buiding and construction, raw material for moulding. etc.	Brown
vanadium	Light Purple
titanium	Dull Red
Copper; jade and nephrite, kaolin, ceramic material, talc, boron, etc.	Grass Green
lead-zine; garnet, raw material for cement industry, salt. etc.	Blue
aluminium	Grey
nickel; alunite, dolomite, sepiolite clay. etc.	Green
cobalt	Drab
tungsten; piezoelectric quartz, raw material for glass industery, mica, barite. etc.	Rose Red
tin	Light Rose Red
molybdenum	Dark Blue
bismuth	Dark Green
mercury; mineral material of artware, prophyllite, bentonite, diatomite, phosphoras. etc.	Orange
antimony	Dary Blue-Green

### *3.5.2 Atlas of Solid Fuel and Nonmetal Resources*

It includes solid fuel (represented 6 shorts of coal), all kinds of Nonmetal Resources such as metallurgical supplemental raw materials of 6 shorts, chemical industry raw materials of 23 shorts, building materials of 23 shorts, precious stones and special uses nonmetal of 6 shorts, etc. And total of 67 shorts solid fuel and nonmetal resources have been represented on the Atlas. It is classified by its use. And accordance with its scales of proved reserves, all kinds of solid fuel and nonmetal resources are graded large, middle and small scales, and use the different symbols and colours (some colours of nonmetal ore shorts see Table 1.).

### *4. The compiling process and method*

The special subject maps of mineral resources are the one of most complex maps. A large number of data and work of analyzing, studying, classifying, deciding which to be choose, generalization of elements, the complex contents and process makes the work of compilation more difficult than any other maps. And the computer techniques have not been mastered by the most compiling experts now. Which method should be put to use? Finally the traditional method not the computer have been put to use during the process of compiling the Mineral Resources Atlas. At first the series high precision and high quality basic maps of geography should be compiled for the Atlases which can make the geological and mineral contents have a good mathematic base and have present conditional geographic elements.

Therefore it is necessary to choose suitable project and count the coordinate numerical values and to choose high precision and good present condition geographic data for compiling the basic maps of geography in order to give the accurate location and the correct place names especially the translated names in English for the foreigners. At the English copy of the Atlases the place names divided into two parts: one is the proper names using the Chinese Phonetic Alphabet; the other one is the common names translating into English in accordance with its meaning. Thus the foreigners will learn the maps easily. All these work have been done by the experts of cartography. At the same time, the experts of geology compiled the simplified geological maps in accordance with the design of compilation. On basis of the general geological maps, the stratum, the magmatic rock and the faults have been merged and simplified. After examining it could be drawn on to the basis maps of geography. That is all for the manuscripts of simplified geology. It is the geological setting of the mineral resources. The elements of mineral resources is the major contents on the maps of mineral resources. According to the large number of data available, the metallurgic types and the scales of proved reserves can be determined. It is important to compile mineral resources location contrast tables for each map

before compilation. It shows the geographic position of mineral resources, metallurgic types and the scales of proved reserves. Then put the all mineral shorts on the manuscripts of simplified geology in different symbol and colours. Only now can we say that the mineral resources manuscripts finished. For ensuring the precision and quality of the Atlases, we made strict demands at every stages and examined it from beginning to the end carefully. For the provincial maps, the compiler should examine it by themselves at each step. Then it should be examined by the experts asked by their unit before it is submitted to Editorial Board. Only can qualified map be submitted to the Editorial Board. These maps divided into three parts of Northeast China and North China, Middle-South China and East China, Southwest China and Northwest China, to be examined by stages. Also the regional maps, national maps and worldwide map. Finally the leaders of Ministry of Geology and Mineral Resources invited the experts of cartography, geology and mineral in all parts of the country to check and acceptance the Atlases in 1993. After that the experts of compiling commission of the Atlases spent one and a half years to unify and coordinate and modify all maps of the Atlases. Thus, the Atlases come up to advanced standards after doing that.

## **5. The publishing of Atlases**

Advanced electronic cartographic publishing system have been used by many countries in the world. For following the forward position of nation in the field of geological cartography, we decided to use the electronic cartographic publishing system on the publishing work of Mineral Resources Atlases after several tests. The publishing work of the Mineral Resources Atlases is being undertaken by the Chandi Computer Development Associate, Hai Dian, Beijing. And the designing work for the atlases have been done by the experts of Institute of Geology, Chinese Academy of Geological Sciences. Both of them coordinate each other for fulfilling the arduous task.

### ***5.1 In preparation for coming work***

#### ***5.1.1 Training operatinmg staff***

Before starting operation, the leaders of Changdi Company mange to find time to train the operators for learning the contents of the Atlases and its knowledge, the demands and methods, etc.

#### ***5.1.2 The design of the Atlases***

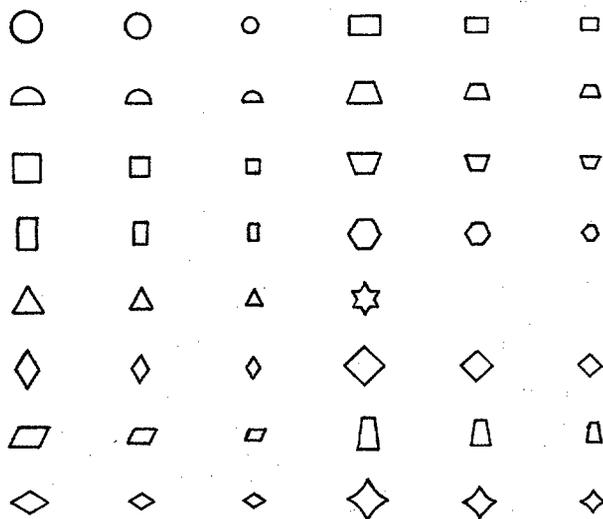
The series designs have been done by the Cartographic experts of Institute of

Geology, Chinese Academy of Geological Sciences, such as the layout and the structure of the Atlases, the specifications of the symbol, the colours, etc. A total of 8 colours for the maps of front pages and 4 basic colours for the back.

### 5.1.3 The library of symbol and colours

For operating easily and unifying the Atlases as a whole, we created the symbol library and colours library for the Atlases. Some of Symbol library are followed (See Fig.1.).

Fig.1. The library of mineral resources symbols



### 5.1.4 The tests

Before putting into production we tested Mineral Resources Map of Hubei, Geological Map of Yunnan, Quaternary Period Geological Map of China with electronic cartographic publishing system. The aim of attempt is to learn from actual, discover problems and solve them, check computer cartographic procedure and program, method, function, quality, etc. The contents of attempt include drawing lines, create areas and colours, fill patterns, primitive cover, hollow out colours, registering precision, etc.

### ***5.2 The electronic cartographic publishing system***

It mainly includes colour scanner: computer of Macintosh Quadre, pc486 and 386, Sun workstation; grating processor Lino type-hell Rip50, Rip60; Laser plotter Lino Type-Hell Recorder 5080dpi; transmission and reflex densimeter X-Rite; and the Mapcad software etc. Here I would like to make mention of Mapcad Geosciences compiling system. It is the software of China itself researched and developed by China University of Geosciences in Wuhan.

### ***5.3 The procedure of cartographic publishing system***

It is represented by block diagram (See Fig.2.).

## **6. Conclusion**

### ***6.1 How we Automatically compile small scale geological maps***

The computer have been used in compiling and publishing all kinds of general maps in the countries of the world and accumulated rich experience, it also be used in larger scale geological maps and have some experience. But it have not been used in small scale geological and mineral resources maps or atlases widely. It mainly have two problems. One is the artificial intelligence of computer. The other one is the computer generalization. When maps' scale reduces to smaller the larger geological areas are getting smaller and smaller even getting together. How the computer thought like experts of cartography or geology and generalizes the geological lines and technical lines and other elements according to the order to be suitable to apply for all small scale maps of geology and mineral resources?

### ***6.2 Geological database***

The base of computer compilation should begin of geological survey in the field. When experts of geology work on the geological mapping or geological sections, the geological database should be created. When it has been finished in this area a variety of geological maps could be compiled easily. The Germany has led the way. How should we make a digital plan of geology and mineral resources on our own country according to its condition then realizes it actually?

Fig. 2. The Procedure for Cartographic Publishing

