THE ESTABLISHMENT AND ANALYSIS OF
DIGITAL HYDROGEOLOGY MAP SPATIAL DATABASE

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ABSTRACT:

Digital hydrogeological map spatial data base is the most important components of "digital China ". According to uniform standard, primary hydrogeological materials were converted into numeric format to form spatial data base by means of MAPGIS as the flat roof. Digital hydrogeological map spatial data base will be important materials for establishing the model of database and spatial analysis. In this paper, the process of establishing digital hydrogeological map spatial data base was discussed at length. Firstly, the model of database was constructed. Secondly, the vector basic data was inputted, the graphic elements (such as points, lines, and so on.) were edited, errors were corrected, and the layer file was established. In the end, the attributes were connected, the projection conversion was carried, and numeric format were converted in order to forming Arc/Info and Arcview format. So the digital hydrogeological map spatial database was established. The important basic data for spatial analysis and all-purpose development can be obtained from this database. Technological puzzles that came forth frequently in the work were put forward and their resolvents were gave accordingly.

1. INTRODUCTION

As a basic material for hydrogeology, hydrogeological map exerts the important actions, and plays the important roles in the study on hydrogeology and during the developing of economy of China. The top-quality materials are needed with the develop of the society and the advance of study level. Therefore, some primitive materials, including hydrogeological papery map and its records, can not meet the need. The developing of the information science makes the application of computer a necessary means in the field of hydrogeology. Hydrogeological map must be adapted to this developing trend and to meet the actual need, namely, hydrogeological map must be digital and information.

Digital hydrogeological map spatial data base is the important part of digital land engineering of China, it takes 1:200000 scale digital hydrogeological standard map of China as a unit and 1:200000 scale digital hydrogeological report as base. According to series of standards enacted by the Ministry of Land and Resource of China, digital hydrogeological map spatial data base is established by means of MAPGIS as the flat roof. The database is provided with many characteristics, such as uniform projection, uniform format, uniform standard and easiness for query. Then the primitive papery materials, that are relatively unskillful, were converted into an intelligent and visual system. The spatial analysis can be carried in this system. The system can provide important basic materials for "digital China", it will form base for effectively development and application in future.

2. ESTABLISHMENT OF DIGITAL HYDROGEOLOGY MAP SPATIAL DATEBASE

2.1 Procedure of work

The procedure of work is shown as fig.1.

2.2 Analysis of the procedure of establishing base

2.2.1 Establishment of layers: According to primitive materials and format standards of layers and attribute files of 1:200000 digital hydrogeological map spatial data base, the contents of spatial data base about the district that is studied were classified as layers (shown as Table1.).

2.2.2 Establishment of attribute date bases: According to the scheme for establishing layers and format of attribute data, the attribute tables were filled in, namely, the attribute of every graph element is endowed according to the contents come from primitive materials. Then attribute data base is established on the base of date base microware FoxPro or Access.

2.2.3 Digitization of graphics: After primitive materials were analyzed, base dictionary (sub-graphs base, color base, line style base, fill graphic base and parameter table of all kind of objects) were established according to the actual situation of hydrogeology.The graphics should be inputted in scanning mode to form grid files(*.tif). The grey scanning mode is a better one than others.
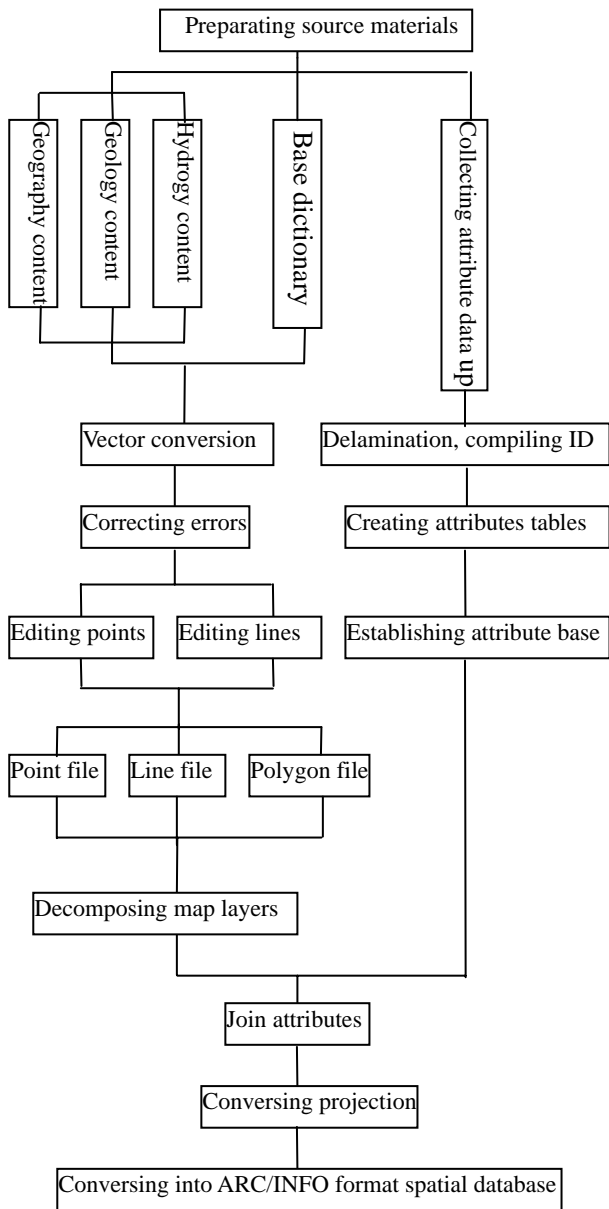
Figure 1. Operating flow chart

Sort	Content of layer
Basal information	Frame
	Special note layer
	Legend
Geographical layer	River layer
	Traffic layer
	Residential area layer

	Ambit layer
	Lake or water system layer
	Counter line layer
	Height point layer
	Town layer
	Relief type layer
Foundational geology	Stratum
	Stratum borderline
	Fault
	Attitude of stratum
Hydrogeology	Underground water type
	Underground water yield property
	Modulus of ground water flow
	Grounder water quality
	Hydrogeology features point
	Hydrogeology features borderline
	Grounder water using layout
Certain hydrogelogical map	Composite hydrogeology columnar
	Stratum distributing
	Stratum describing
	Hydrogeology section chart

Tab. 1 The description and layer of the hydrology geology map spatial data base

2.2.4 Importing and editing graphics file: After the graph is digital, it will be imported and edited. Importing graph is a process that graph is conversed into vector. During editing graph, map elements- points are edited, then point file (*.wt) is formed and saved. So do map elements-lines and polygon (File*.wl and *.wp are formed). In order to avoid getting into trouble in future work, insuring map elements against losing and repeating is necessary during importing, and importing of map elements must be in order.

2.2.5 Correcting error: During scanning the primitive graph and conversing the primitive graph into vectorgraph, errors will be caused at any moment. Therefore, it is important to correct errors of all-points and line-file. Firstly, the standard frame of every map is built in a sub-system for projection conversion. Then, intersection points of square grid were taken equably as points of theoretic values for correcting errors. It must be remembered that four corner points of map should be selected and more than twenty points of theoretic values should be selected. Finally, the corresponding points in files that had been vectors were selected as points of actual values, error-correction was carried by error-correction system, all files were saved.

2.2.6 Forming layer file: After file that had been corrected was disposed by Topo method, all parameter were edited and different factor layers were formed. Different factors were picked up separately according to delamination standard to form layer file.

2.2.7 Connecting attributes with graph elements: After attribute database was set up, it was connected with map database, in this way, every map element was with attribute accordingly.

2.2.8 Conversing projection: In order to meet all needs, all files, that had been connected with attributes anteriorly, were conversed into Xi'an coordinate system format and geographical coordinate system format.

2.2.9 Conversing MAPGIS format into ARC/INFO format: For sake of developing and internationalizing system in future, every layer file of geographical coordinate system format was conversed into *.e00 format by means of conversing function of MAPGIS file. Then *.e00 format was conversed into ARC/INFO format and file was saved in certain directory(Chen Weigong ,2000).

When all above works were finished, the intact digital hydrogeological map spatial database of Gauss-Kriiger projection file was established successfully by means of MAPGIS as the flat roof. The database can meet all kinds of needs.

3. SEVERAL DIFFICULTIES IN WORKING

3.1 Data precision

The quality of database is affected by data precision directly. Despite a handsome database, it is no useful if its data precision of is very low. The data precision of 1:200000 scale digital hydrogeological map spatial data base depends on mainly spatial data precision and attribute data precision. When establishing database, every step must be controlled strictly to attain maximal spatial data precision. For example, scanning differentiate rate of image must been controlled above300dpi when importing data, windows of screen must been magnified above 25 times when conversing the primitive graph into vectorgraph(Chen Weigong ,2002), parameters of projection should be set up properly, and precision must be controlled strictly during data format conversion. For sake of maximal attribute data precision, attributes should be filled in by hydrogeological experts who know database very well. Furthermore, people who take charge of establishing database should be expert and earnest.

3.2 Stratum code name in the primitive geological graph

Because of some causes, the code names of the congener stratum are different sometimes. This is the principle problem during establishing database. Therefore, errors in the primitive graph must be corrected and the uniform stratum code name must be established by a group of experts who are constituted.

3.3 Map interlinking

It will affect the quality of the spatial database directly that if maps can be interlinked very well. Because the primitive maps were fulfilled in by different departments in different age, it is a familiar sight that different standard maps can not be interlinked very well. Accordingly, maps must be edited by experts who know hydrogeological status of maps properly to ensure interlinking maps.

3.4 File format conversion

The last work during establishing database is format conversion of files. In this step, all kinds of problems will come forth easily. To avoid the problems, some measures should be taken:

(1) To correct Topo errors before conversing MAPGIS format into ARC/INFO format, then, compress data and save.

(2) To set up an intact system for saving files to avoid overlaying and confusion between files.

(3) To select two limiting parameters modestly when using command "Clean" in ARC/INFO. Generally, select 0.000001 for "Dangle Length", 0.000000001 is advised; select 0.000001 for "Fuzzy Tolerance", 0.000000001 is advised(Chen Weigong ,2002).

3.5 Superposition between hydro-boundary and geology-boundary

To solve such a problem, every step must be handled in earnest by manipulators, including cutting the line during conversing the primitive graph into vectorgraph, differentiating earnestly during delaminating and ensure right Topo relation of layers.

4. CONCLUSION

Hydrogeological map is the most important hydrology materials in China. Digital hydrogeological map spatial database, that was established by means of MAPGIS as the flat roof, was one of important components of "digital land" .Through establishing 1:200000 scale digital hydrogeological map spatial database, hydrogeological materials, that are schemas or Chinese character reports originally, can be managed by computer. The important basic data for spatial analysis and all-purpose development can be obtained from this database. 1:200000 scale digital hydrogeological map spatial database will exerts the important actions, and plays the important roles in the study on hydrogeology and during the developing of economy of China.

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