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PetroChina

Mapping Tool for Base Map of Petroleum Resources Assessment

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Preface

In the National Basic Research Programs of GPRA(Global Petrole-um Resources Assessment), geologists had to spend a lot of time to plot base maps of assessment area which are relatively constant. In order to improve mapping efficiency and standardization, an auto-matic mapping tool was developed based on the ArcPy toolkit.

It can :

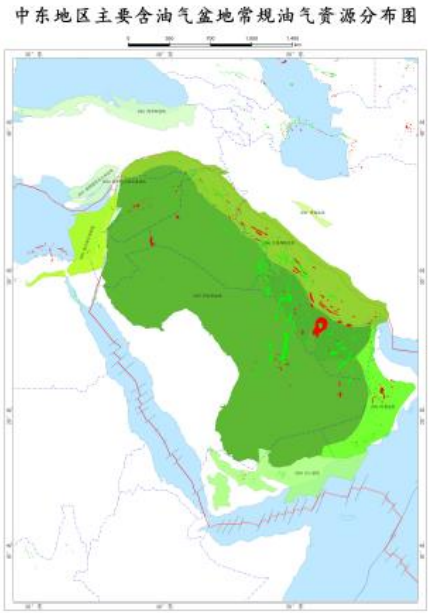
- **automatically get spatial data**
- **invoking appropriate projection method according to the corresponding assessment area**
- **select corresponding spatial data automatically according to different scales**
- **be used in the mapping and updating for the base map of petro-leum resources assessment area**

Outline

- **Introduction**
- **Workflow and procedures**
- **Conclusions**

Requires of program GPRA

- **In the GPRA program, there are 468 petroliferous basins be evaluated worldwide.**
- **Many types of geological maps for the 468 basins are needed, such as the petroleum distribution map of petroleum resources.**
- **These maps require uniform standards and format.**



Problems and Challenges

- **In order to realize the standardization of the basin maps, the unified standard base map of 468 basins is required**
- **This is a large quantity and the same type mapping task**
- **By hand-drawing, geologists have to spend much time on base maps drawing.**

Can we do anything with the help of ArcMap system?

We can developing an automatic GIS mapping tool to realize the base map drawing!

What is an automatic mapping tool?

An automatic mapping tool is a software which can automatic realize map production, update and output , through developing computer program according to the principles and methods of computer graphics.

What can it do?

- **Batch map production**
- **Automated map output and printin**
- **Automatically modify the map by updating the source data**
- **Map layers display control**
- **……**

It can replace manual operation to a great extent

Outline

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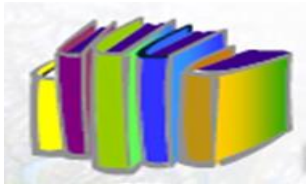
- **Conclusions**

Workflow



Designing Map

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Collecting data, processing data and establishing geodatabase

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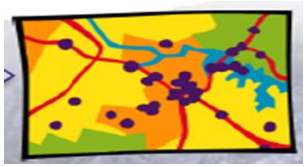

Designing map symbol, map template and layer template

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developing and running programs

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Inspecting and outputting result maps

Procedure 1-Base Map Designing

Paper Size	A3
paper Orientation	According to the ratio of the length to width of the outer border of the basin
Map Projection	according to the location and scope of the basin, setting the projection coordinate system
Layers	A total of 7 layers, including cities, rivers, lakes, oil and gas fields, basins, countries, land and oceans, etc.
Map Scale	Unfixed scale, according to the size of the paper and the range of the basin.
Map Legend	There is no legend in the single map, and it is illustrated in the atlas.
Map Orientation	Map orientation is identified by the longitude and latitude grid line. In one map, there are 6-8 grid lines on the long side, and 3-4 lines on the short side.

Procedure 2-Data Collecting and Processing

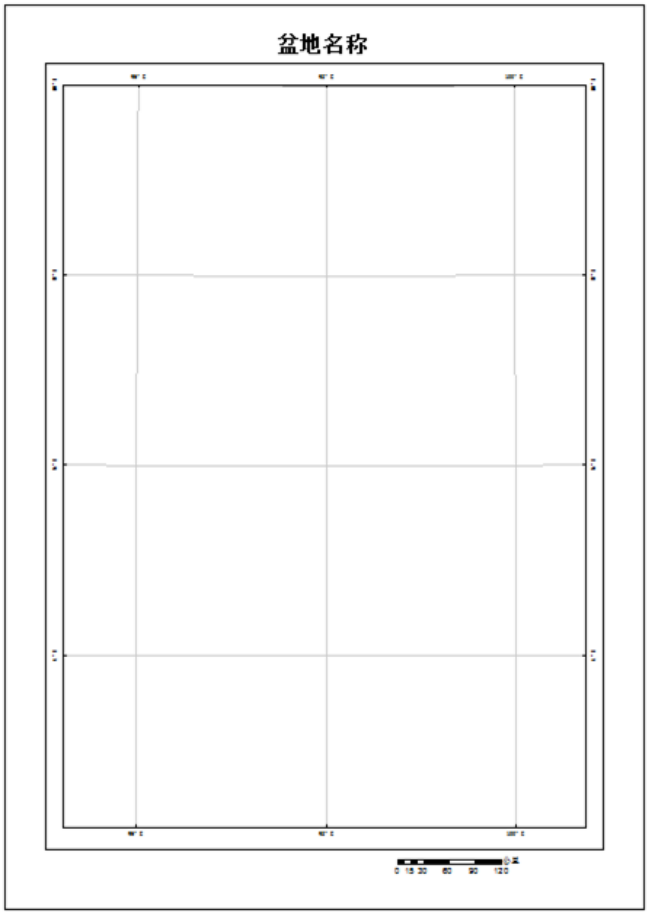
- Coordinate transformation for spatial data, unifying coordinate system
- Preparing multiple sets of different scale data in order to adapt to different basins
- Field data loading and integration
- Establishing geodatabase

Procedure 3- Designing map symbols

Designing the symbols of each layer according to the specification of cartography:

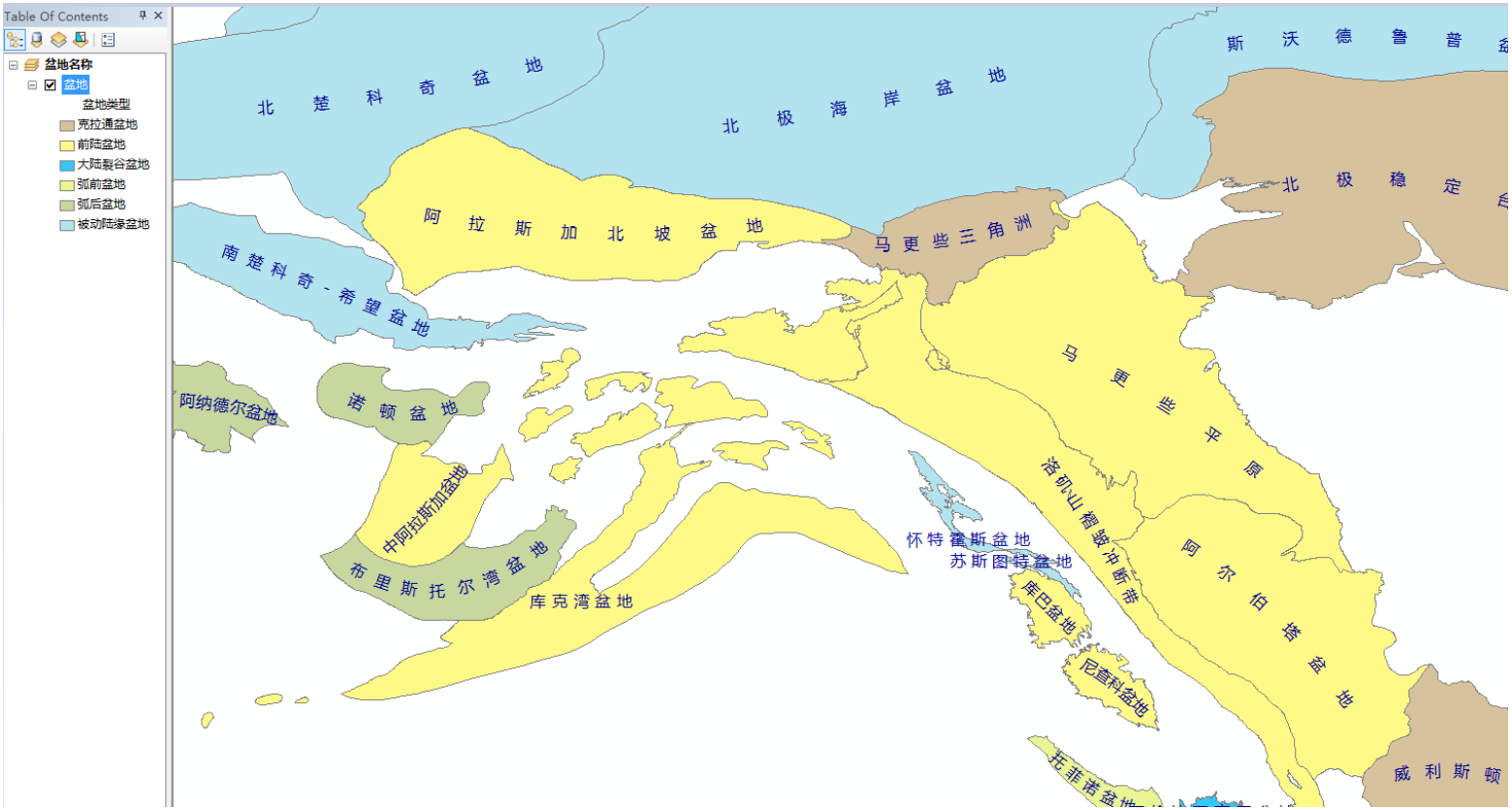
Procedure 4- Defining map templates

The map template contains the map frame, the title, the scale and the latitude and longitude grid lines.



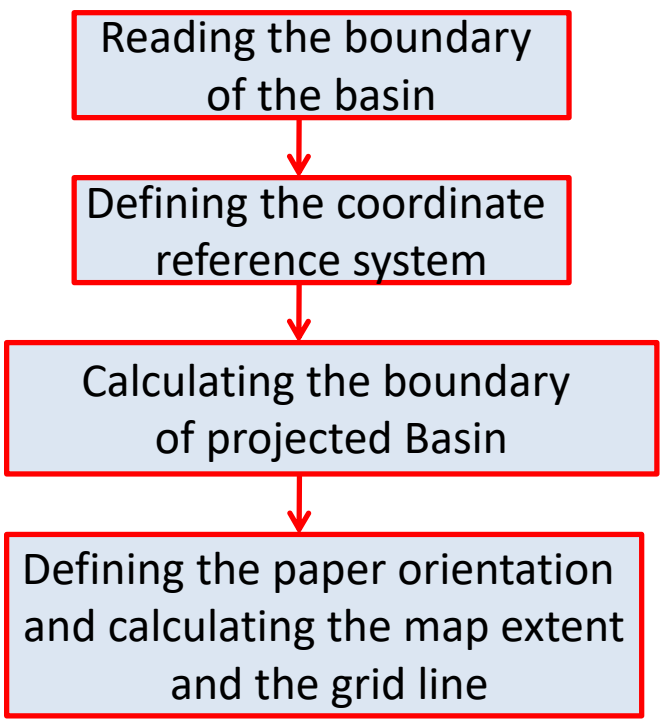
Procedure 5- Setting the layer style for each layer

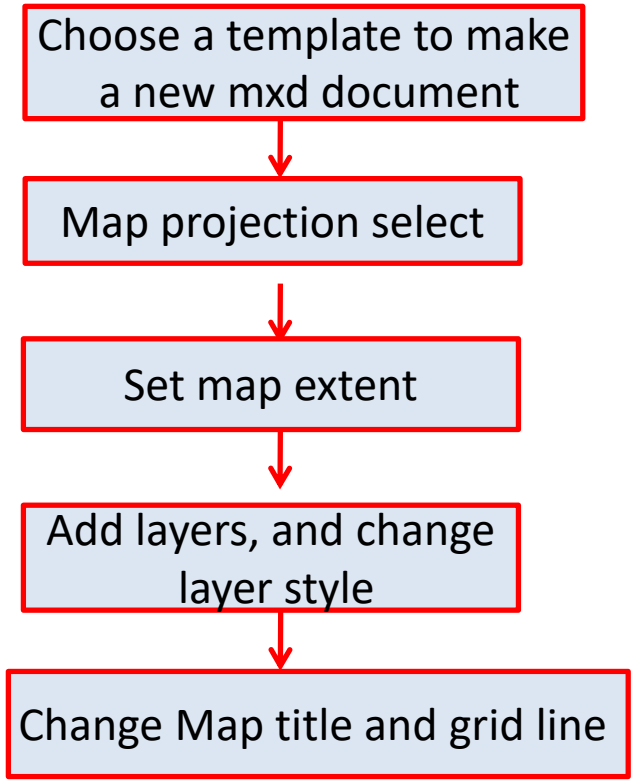
Set up symbols, labels, display scales for each layer, and then save them as layers in ArcMap.

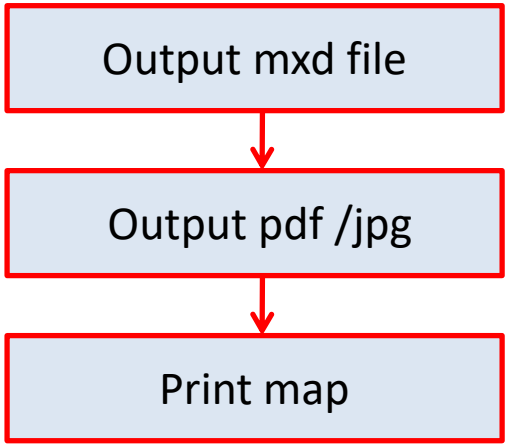


Procedure 6- Developing Automatic Mapping Programs

Used Python script based on ArcPy Toolkit







Key problems solutions

1. How to define projected coordinate systems?

Deciding Criterion:

- **UTM Projection**

  Low latitudes area or the difference between longitude and latitude is less than 12 degrees

- **Lambert Conformal Conic**

  middle latitudes area or the difference between latitude and longitude is greater than 12 degrees

- **Lamber Azimuthal Equal Area**

  High Latitudes area

Key problems solutions

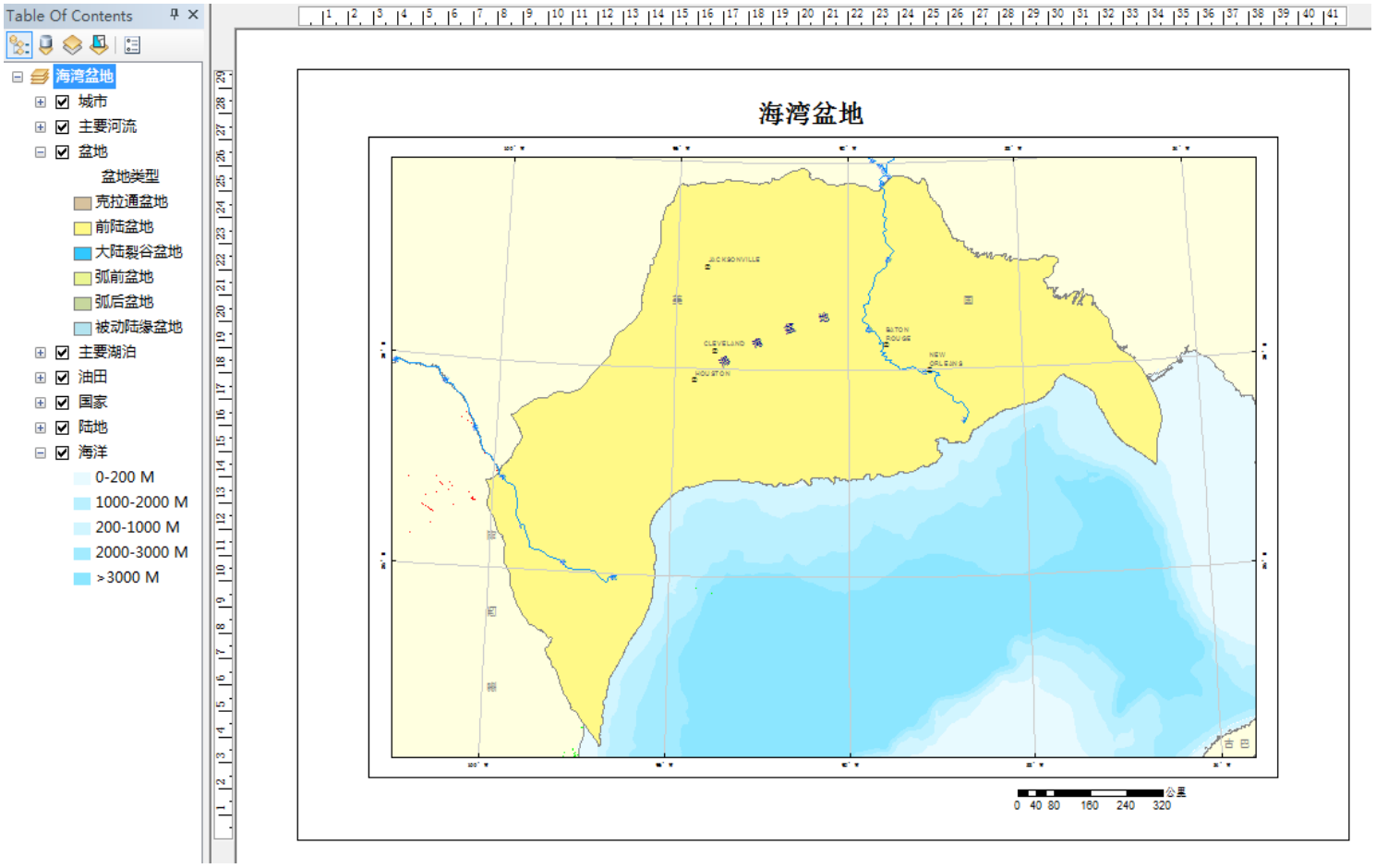
2. How to select spatial data automatically according to different scales?

This is a problem about map generation. Usually, spatial data can be processed into different scale data sets. But in some cases, it can't work, take cities data as an example.

There are millions of city points, which may have different administrative levels. For one base map, only several cities needs to be identified. Through special processing, it is easy to select several of the largest or the most populated cities in the basin area.

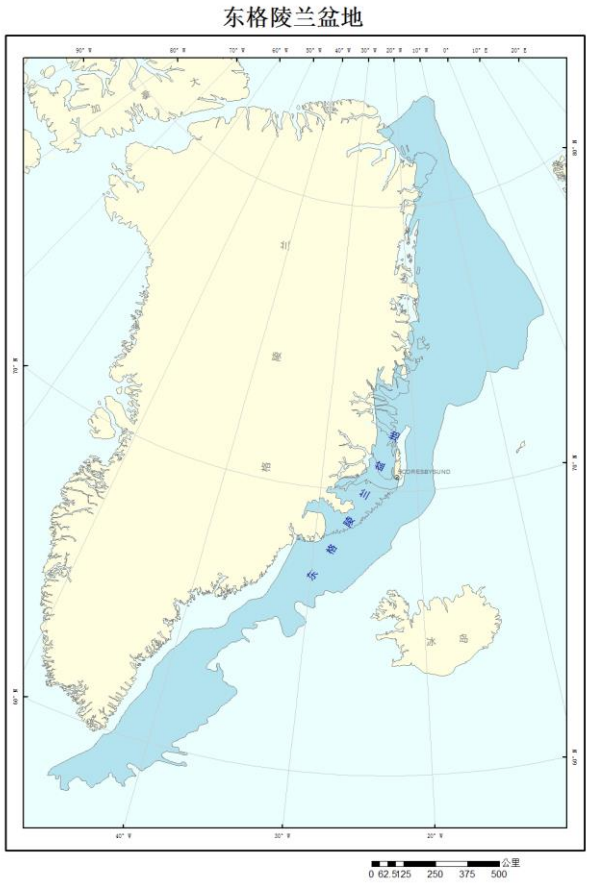
Procedure 7- Running programs to generate base maps

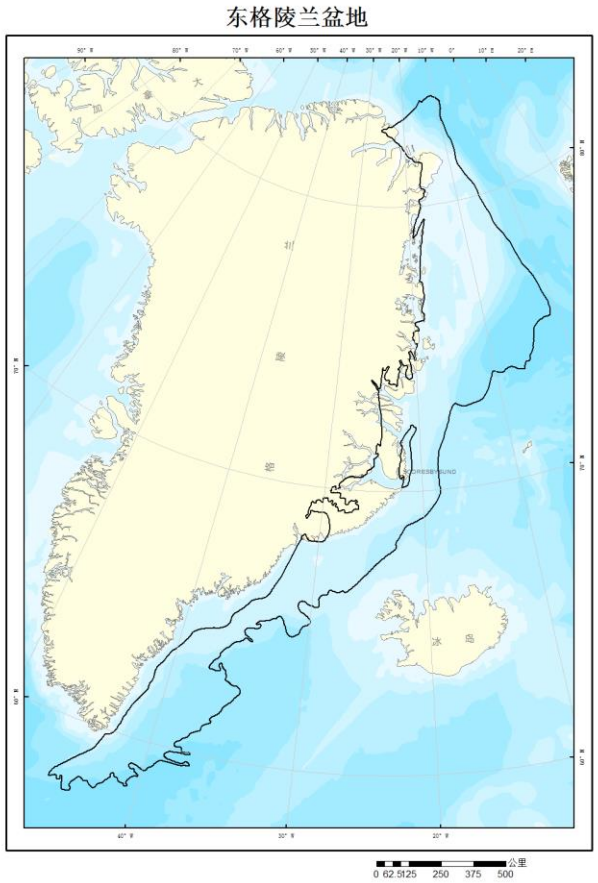
It takes only 90 minutes to generate base maps for 468 basins.



Automatically modify the map by updating the source data

The python program can also be used to update maps automatically. This is an example of modifying symbols and annotations of basins and marine layers.





Conclusions

1. Automatic mapping tool saved a lot of manpower and time.
2. The application of base maps can unifies cartographic specifications.
3. The application of base maps improves the efficiency of geological analysts by only concentrating on thematic layers.
4. Mapping on GIS software, will benefit to the storage, management and sharing of maps.

Future Work Probably

1. Using ArcGIS Representation technology to visualize map layers
2. Add interactive interface for the automatic mapping program based on ArcMap tool
3. Improve the oil and gas industry mapping database

Questions?

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