

THE ESTABLISHMENT AND APPLICATION OF GEOGRAPHY INFORMATION TECHNOLOGY IN THE EXPLORATION AND DEVELOPMENT AREA OF SHENGLI OIL FIELD

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1. Introduction

As a newly established industry, information industry is being paid more and more attention by people. Information technology revolution is changing the whole society of human beings. In this revolution, geography information technology is a newly developed borderline subject, which is the integration of computer science, geography, surveying and mapping remote sensing science, aerial science, information science, environment science and management science. It gradually deepens its use in economy and society. In the recent 2 decades, with the rapid development of computer science, geography information technology was quickly disseminated in a variety of areas, such as environment, resource, remote sensing, transportation, city development, military, police and geology. It has become the multi-area high technology industry in the western countries and become the effective supplementary support of rapid development of society.

The application of geography information technology in the area of geology is no more than 15 years. At the beginning, the principal application is mainly focus on remote sensing geology, ecological environment geology and seismic geology etc. Although the application in petroleum exploration and development is not very long, its development is rather fast, almost involved in every research area of petroleum exploration and development. As we know, American association of petroleum geology (AAPG) will hold a world's largest petroleum geology academic conference ---annual meeting. Special seminar site was designated to discuss the application achievements of geography information technology on annual meetings in recent years, and other geological mapping software has claimed that they have interface with geography information technology. It shows that geography information technology has become a standard technology and the research direction of petroleum exploration and development.

In recent years, the development of geography information technology in Shengli oil field is very fast. In 1998, the 1:50,000 mapping database was established. In 1999, the development information system and exploration database of Shengli oil field was established. In 2000, surface construction information system was established. Geography information system is being built in each special working unit of Shengli oil field with its own characteristics. For an instance: basic construction planning and management information system, the establishment of this system provides a large amount of information for basic construction, and it is also helpful for the planner, manager and designer. In the meanwhile, it has the unparalleled preponderance in the area of data maintenance and up date. We also set up real estate management information system and oil production engineering information system. With the establishment of these systems, we can not only store a large amount of data, but also continuously load more information at any time, thus keeping the data up date and integrated. Given the abundant content of information system, we can get what we need with different choice. We can also inquire formation at certain point. In summary, the preponderance of these systems is to keep information up date and well maintained.

2. The development of system and running environment of soft and hard ware

- 1). Software allocation
 - a. Tool software: ARC/INFO7.2.1For NT
Microstation 95
I/RASB
I/RASC
Autocad Map 2000
MapGuide 4.0
 - b. Operation system: WinNT 4.0
Win 95
- 2). Hardware allocation
Intergraph TDZ 2000 3 sets
Compaq server
Compaq Pentium 166Hz serial computers
HP 3500CP colorful ink spray graph plotter
Calcomp A0 Digital desk
Anatec A0 colorful scanner

ARC/INFO software can be run on Compaq sever and its serial computers. Basic data are stored in Intergraph TDZ 2000, Autocad software, Microstation 95, I/RASB, I/RASC and MapGuide software are used to input, edit data and publish on Internet.

3. Organization of system data

- 1). Layer-built design of system data

According to Gis data organization principle, system data should be divided into files horizontally and into layers vertically. So we draft the principle to divide data layer as follow:

- a. Put same kind data into same layer.
- b. Try to put relevant data into same layer.
- c. Put frequently used data into main layer, others into secondary layer.
- d. Put data of auxiliary point, line and plane that show the plot or control location names into auxiliary layer.

After coverage file builds topology, it becomes vector data file that have relationship with topology. The entity type of file can be divided into point, line and plane. Dbf file and info file record property data correspondence with graph data. Graph data have one-to-one correspondence with property data. Combined with the practical application of exploration and development in Shengli oil field we divide key element into 22 coverages. We name and descript each layer as follow:

- Mathematics base (kilometer net, longitude and latitude net)
- Official border (coastal line, province, area, city, county)
- Water system (river, surface waters, ditch, canal)
- Railway and its subsidiary
- Road and its subsidiary
- Resident area
- Pipeline

Independent surface item
Seismic survey line
Oil well
Fault
Hydroisobath
Gravity line
Magnetic line
Electrical line
Isopach
Mining registered line
Geological border
Oil and gas bearing range line
Geological structure line
Lithologic line
3-D seismic exploration block range

Abundant information is contained in these coverages. In particular, specialty information does a lot of good to our jobs. For an instance, in the layer of 3-D seismic exploration block range, it contain the management of 3-D seismic exploration of Shengli exploration area, including information collection, information treatment and information interpretation. Four kinds of coordinate database file are formed: 3-D seismic exploration information range, full-times overlying range, information treatment range and interpretation and mapping range, which contain over 4,000 records. It facilitates customers not only inquire 3-D block distribution map in this system, but can find the original coordinate data for 3-D block distribution map as well. Thus it provides information for science research and production, and it also helps directors to make determination.

2). Data organization

a. Property data organization

According to “the classification and code of basic information data of national territory” GB/T 13929-91 and “the classification and code of basic information data of petroleum geology”, we load each element with a code. Property data are adopted by junctive phase, which connects property table in exploration database of Shengli oil field with relevant graph element. Thus it realizes the joint of property and graph. For example, the coverage of oil well contains oil wells and gas wells, among which, gas wells have properties such as pressure, ownership of gas gathering station, practical gas production capacity, type of pumping jack etc. each gas well is one point in database, the joint of data in each property phase with point is realized by adding a code to gas well, and code=5100.

b. Graph data organization

Graph data are digitalized and edited into layers, changed to coverage and stored in separate layer. Various graphs can be transferred and invoked in MapGuide 4.0.

3). The establishment of system aerial database

a. The establishment of grating graph figure base

Base establishment content: aerial picture, seismic profile, lithic profile, well drilling and logging curve graph, interpretation construction map, reported achievement figure.

Base establishment standard: graphs are index encoded according to “the classification and

code of exploration graph in graph base” Q/SL1269-1997. The save format of grating file was all regulated as: BMP, TIFF.

Base establishment accuracy: the key problem is grating graph locating accuracy. Here we determine that correcting points are 4-6, and locating accuracy is less than 0.005 inches. To improve the accuracy of graphs input into base, we try our best to use large-scale graphs of same area.

Base establishment procedure: first adjust the scan parameter of scanner according to the graphs which want to input into base, then after scan was finished, graph location correcting must be done. When it reaches the locating accuracy, save it as base establishment standard.

c. The establishment of aerial vector graph database

Base establishment content: achievement graph of physical survey, chemical survey, gravity, and magnetic and electrical exploration.

Base establishment standard: the locating accuracy of base establishment has the same requirement as grating database.

Vector potential: when we change each element to vector in layers, to keep the vector accurate, catch vector along centerline.

Database construction: since Library in ARC/INFO soft is adopted to manage, the management and usage is rather convenient.

4. Function of system

1). Function of inquire and searching: given the abundant content of information system, you can choose differently as different requirement, thus each takes what he wants. You can inquire information of certain point. For example, if you want to inquire exploration well drilling, click certain exploration well, it shows the information of logging, drilling basic parameter, logging and drilling curve and geological logging curve of this well. Through logical condition inquiry we can search qualified location of exploration well. Thus we realize the interaction from graph to property information and from property information to graph.

2). Function of auxiliary analysis and determination: comprehensive treatment and analysis can be made on this system, so we can draft more reasonable plan. Scientific management and comprehensive geological analysis of oil and gas resource area can be fulfilled on this system according to 2-D and 3-D seismic exploration collecting information, treatment information, drilling, logging and oil production information. Thus it provide optimum project for fine exploration and development of Shengli oil field, searching new oil and gas reserve and benefiting drilling target.

3). The compile of graph brochure: this system has advantages over graph compiling. “The exploration situation figure of Shengli oil field”, “The exploration course graph brochure of Shengli oil field” and “The exploration and development graph brochure of Shengli oil field” were integrated, modified and put together with the aerial vector plot base.

4). The maintenance and up date of data: this system has much preponderance on the maintenance and up date of data. It can satisfy the requirement of people at its best. With the rapid development of Shengli oil field, each piece of information is changing continuously. With this system, new information can be input into computer rapidly, and research personnel can get latest information at any time.

5). Function of publishing on Internet: with the Mapguide technology, it realizes data publishing

on Internet. Thus it provides information service for each unit of Shengli oil field. After customer establishes his net account and set his jurisdiction, he can browse data file under his jurisdiction and download file through net.

5. CONCLUSION

The application of geography information technology in the area of petroleum exploration and development in Shengli oil field is still in its initial stage. With its application going deeper, it will realize the scientific management of oil and gas exploration and development. It will provide auxiliary determination on secondary exploration and development of oil field and fine block exploration and development. It will also lay the foundation for scientific auxiliary determination of searching back up reserve.