SEDBA扩展与应用
——以石油地质综合勘探开发为例

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本文以油气综合勘探数据库结构为例，探索SEDBA数据库结构的调整和功能扩展的可能性。新的SEDBA是将现行SEDBA结构的第二层次中的煤及褐煤专用数据库及含金属质沉积岩专用数据库改为煤炭专业数据库和金属与非金属矿藏专业数据库，与新增加的石油地质专业数据库一并置于第二结构层之下，构成新的第三层结构-专业数据库结构层。并将原来第三结构层中的14种实验表作为各专业数据库的一个子数据库，组成新的SEDBA数据库结构。显然，新的SEDBA不仅包含了所有的沉积岩石学信息，还容纳了各种沉积岩矿产资源（如石油地质等）的数据库系统，拓宽了SEDBA的应用前景。石油地质工作者应用新的SEDBA能系统地进行盆地分析、油藏描述和油藏数值模拟等地质问题研究，以及模拟地质过程，检验地质现象，揭示动态演变，预测未知区域；还可与全球SEDBA联网，进行区域和洲际比较研究，促进信息的交流和共享。

EXPANSION AND APPLICATION OF SEDBA

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ABSTRACT

In this paper, a case on the structure of oil-gas exploration and development database was proposed so as to discuss the possibility for adjusting structure and functions of existing SEDBA database. The characteristics of new SEDBA database is that the specialized data sheets for coal/lignite, and metalliferous deposits in SEDBA are replaced by Coal Specialized Database and Metal/Nonmetal Specialized Database, and a new specialized database for petroleum geology is supplemented. The new SEDBA will contain the information not only about sedimentary petrology, but also about oil-gas and mineral resources, which can be used for basin analysis, pool description, pool numeral simulation, etc.

INTRODUCTION

The establishment of a global database in sedimentary petrology (SEDBA) is of great significance in realizing the global correlation of sedimentary rocks, promoting the international exchange of information and the development of sedimentology and related geosciences.

Due to the lack of the data on prospecting and resource evaluation of sedimentary deposits in SEDBA, it is necessary to expand its scope of infomation.

CHARACTERISTICS OF DATA STRUCTURE IN SEDBA

The present SEDBA provided a model of relevant data structure, which is composed of 26 subdatabases and divided into three layers.

The first layer is composed of Header Sheet, Collective Sheets for Bibliography and Graphic documents, Cover 1 and Cover 2.

The second layer consists of 7 Specialized Sheets for clastics, pyroclastics, carbonates & evaporites, cherts, metalliferous deposits, phosphates, coal and lignite, respectively. Each specialzed sheet corresponds to a genetic type of sedimentary rocks.

The third layer is composed of 14 data sheets, which record the data on chemical analysis, carbonaceous material, hydrocarbons, microprobe, isotopes, fossils, sporopollens, granulometry, various fluids and sedimentary grain size for inclusions, modal analysis and components analysis, physical and engineering properties, heavy minerals, X-ray diffration and information for samples and sampling processes.

PROBLEMS

At present, geology has become a comprehensive displine interacted with multisubjects. In the exploration and development of oil-gas, following 4 respects are mainly involved: primary basin evaluation, basin modeling, trap evaluation, pool description and numeral simulation, which reveal the whole process of oil-gas generation, migration and pooling. The Data Sheet for Hydrocarbon Occurence in SEDBA can't cover all of information used for above research. Besides, various techniques, such as seismics, logging, drilling and well testing, have not been included in SEDBA.

So far a great number of data on underground sedimentary rocks and deposits have been accumulated in many departments on coals, minerals and petroleum. Especially in the well explored oil-gas fields, the research achievement on sedimentary rocks in depth are much more than in outcrop area. Almost in all of oil fields the databases have been set up. However, due to the limitation of structure and content in SEDBA, it can hardly be at-

tached on line with SEDBA. Therefore, only by expanding and adjusting the structure and function can SEDBA be attached on line quickly. For this reason, a new model of expanded database structure for comprehensive oil-gas exploration and development is proposed and its feasibility of expanding function is discussed in this paper.

EXPANSION OF SEDBA DATA STRUCTURE

To expand the structure of SEDBA, the petroleum geology specialized database (PGSDB) will be supplemented. The multiple specialized databases (SDB) will be substituted for the former 2 specialized databases which will become the new third layer——the SDB structure layer.

The 14 data sheets in former third layer will be the subdatabases of each SDB. Each SDB is composed of many subdatabases (as shown in Fig. 1).

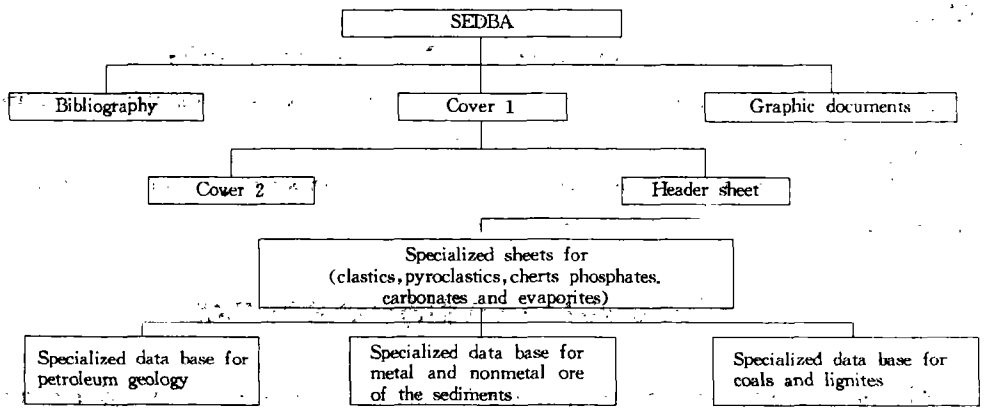

Fig. 1　Concept chart of data structure of expanded SEDBA

A case of petroleum geological SDB is given as follows. On the basis of the characteristics of petroleum geology, the structure of oil-gas exploration and development database will be composed of 7 databases (see Fig. 2).

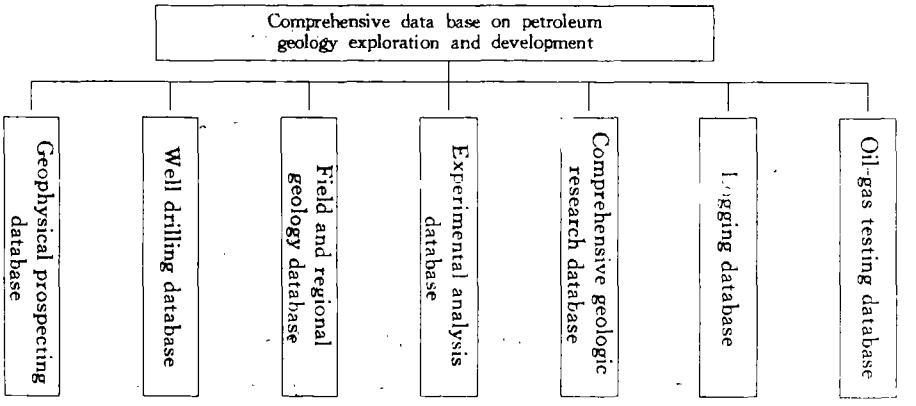

Fig. 2　Structure chart of petroleum specialized database

1. Geophysical prospecting database includes the original data of remote sensing, geochemical prospecting, magnetic method, electrical survey, gravity survey and seismic exploration, etc.

2. Databases on field geology, regional geology and well drilling are used to store the new parameters for lithology and the information about well drilling time and gastesting.

3. Logging database is composed of various lithologic parameters from hydrocarbon logging curve, such as: porosity, permeability, saturation of water/oil/gas, mud content, sand-mud ratio, rock framework composition, stratum dip angle, property, content and flow velocity of fluids, etc.

4. Experimental analysis database. Based on the former 14 intrinsic data sheets, the important parameter values for petroleum geology, such as the reservoir property (porosity, permeability and saturation) and organic geochemistry for source rocks, maturation, oil-source correlation, hydrocarbon migration, environmental analysis index, etc., must be added.

5. Oil-gas testing and recovery database. The data on production, pressure, water/oil/gas property, physical properties under high pressure, production management during well testing and prospecting of oil-gas fields must be added.

6. Comperhensive geological research database contains all contents of documents, contents index and major achievement comments.

APPLICATION OF IMPROVED SEDBA

The improved SEDBA not only provides the means for storing, retrieving and applying original data, but also solve the important problem in petroleum research. Therefore, the petroleum geologists can use the improved SEDBA to simulate geological process, examine geological concept, reveal dynamic evolution and predict unknown oil-gas fields.

To realize the aims, the application of "Petroleum Geology Exploration and Development Database" should involve following respects (shown as Fig. 3).

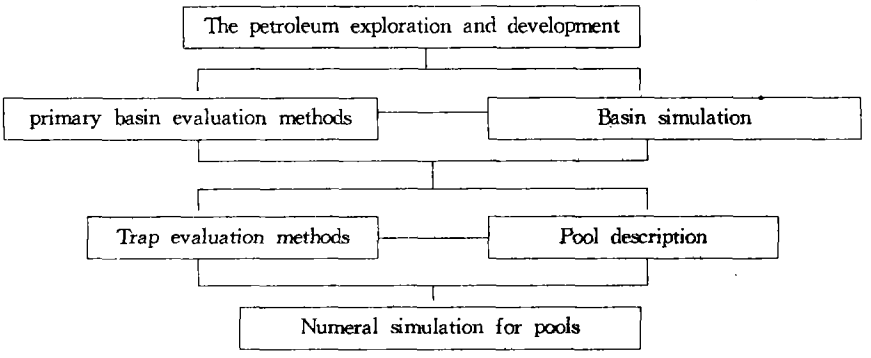

Fig. 3 Flow chart of oil-gas exploration and development comprehensive evaluation system

To research petroliferous basin, the advanced computer techniques must be used to make physical and mathematical modeling. At first, the single parameter, such as oil-gas generation and migration, sedimentary model, structure style, etc., is involved. Then it can be expanded to whole basin. At last, various information will be gathered to predict oil-gas resoures (Zhu Xia, 1982). The programme could be summarized into four steps: (1) using the primary basin evaluation methods, PRASS 1, FASPUM, to predict the prospects of oil-gas resources (segs and depressions); (2) simulating the basin evolution histories, such as geological history, thermal history, hydrocarbon generation history and hydrocarbon discharge history, on the basis of physicochemical mechanism; (3) using the 3-D mixed phases (multi-composition) vadose mechanism to simulate the second migration of oil-gas and find the trap location and pool amount. (4) studying the pooling mechanism and acucumulation regularity of oil-gas field under the conduct of 2-D and 3-D simulation. Through above procedures, the evaluation concept on whole basin could be obtained.

The pool description is another important respect on the application of improved SEDBA. At first, the petroliferous province and favourable traps are evaluated by multifactor comprehensive evaluation model and trap evaluation method, on the basis of which the oil pools can be described. The pool description includes reservoir description and structure interpretation in detail. The key of reservoir description is to set up a 3-D architextrue of reservoir. According to the principles of sedimentology, tectonics and petroleum geology, the sedimentary structure, texture and rock assemblage of sand body are amply described, together with the information about analysis of paleontology, grain size, heavy mineral, lithology, geochemistry (organic/inorganic), isotopes, seismic facies, well-testing facies, logging facies of sedimentary facies patterns to discriminate the type of sedimentary environment and microfacies. Then, according to the logging curves of key well, the grain size and sorting of sediments, hydrodynamic regime and supplement condition of sediments can be qualitatively determined. The lithological parameter values, such as the porosity, permeability, saturation, mud content, sand-mud ratio, composition of rock framework and property, content and wave impedance of fluids and quantitatively obtained. After that, the characteristics of logging curves of microfacies under various sedimentary environment are discriminated. Finally, a model on the relationship between seismic cross-hole sections and logging-sections is set up so as to predict the unknown lithofacies by using seismic pattern recognition and seismic lithologic modeling. In addition, a concept on pool geometry and distribution of homogeneous/nonhomogeneous fluids in reservoir can be obtained.

On the basis of geological condition in the field and the vadose mechanism of water-oil-gas in various pore system, the vadose process is described and the pool boundary condition is also determined. Then, the original geological model and vadose mathematical model can be determined.

The study on oil displacement and oil-control mechanism in pay beds can be carried out by means of computer numerical modeling method (2-D or 3-D multiphase numerical

modeling). The mechanisms contain the vadose capacity in pore system of pay beds, capillary interstice systems, reservoir interface condition (oil-wet or water-wet), hydrodynamic condition and every driven ways (gas-driven or bottom water and boundary water-driven). The behavior of parameters and fluid occurence in reservoir may vary with the change of field pressure and recovery. Therefore, the behavioral forecast can be performed. Finally, a rational exploration and development will be proposed to enhance oil-gas recovery and recovery extension.

In the procedures mentioned above, various information on petroleum exploration and development can be stored in the improved SEDBA. Conseguently, the improved SEDBA will be an important tool to be used for the prospecting and prediction of oil-gas resources.

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