地质记录数据库系统及其在地球科学中的应用展望

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地质记录是一种地质资料的摘录（全文摘录）、储存与提取的数据库系统。它是在DOS状态下采用Dbase Ⅲ⁺编辑而成的数据库管理系统。该系统由文献目录模块、地质资料模块和标本资料模块三大主要部分组成，具有良好的用户界面，使得用户能够方便地完成输入数据、编辑及综合提取所需信息、图形显示等。地质记录已发展成为能容纳地球科学中不同领域的文献资料，包括发表的和未发表的地质文献、野外记录和标本资料等。它已成为多国合作的数据库系统。英国CASP研究所及加拿大、中国等三个研究组已从事该项研究多年。由于该系统能向用户提供详尽信息，优于一般文献检索系统，加之功能齐备，应用灵活，将会在地球科学中许多领域发挥重要作用。

GEORECORDS DATABASE SYSTEM AND ITS PROSPECT OF APPLICATION TO GEOSCIENCES

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ABSTRACT

Georecords is a system for the abstraction, storage and retrieval of geological data. The Georecords database, which was implemented using the commercial database management system Dbase Ⅲ⁺ and compiled under Nantucket clipper, is a menu-drive system which allows for data entry and editing, retrieval (filter-searcher and browsing and report generation). The system has been developed to facilitate access to a wide range of data derived from many different sources including published and unpublished literature, field notebooks, specimen forms etc., and become an international co-operative database. Three research groups have been engaged in such a big project, they are Cambridge Arctic Shelf Program (head office), the Canada Georecords Office and Chengdu Georecords Centre. As the system is advanced, powerful and flexible, the Georecords database will take a great part in geosciences.

GEORECORDS SYSTEM

The Georecords system was established by W. B. Harland (famous geologist and the former chairman of Cambridge Arctic Shelf Program, Cambridge University, England) in 1984. The basic principles of Georecords is to be devoted to the author(s) of the original geological paper or book and to abstract the whole contents of the paper or the book as far as possible so as to establish a global geological literature database. The present Georecords database system based on PC is a system for the abstraction, storage and retrieval of geological data of different sources (i. e. from different subjects and different countries) such as published literature and field notebooks with a standardized format so that the geologist of different countries can share the database in the future. The system is structurally composed of three main modules: bibliographic data module, geological data module and curation data module.

The bibliographic module provides the reference details relavant to both geological data in the literature data module and the library. In the module, following data are included: source reference number which is a unique identification one assigned by the abstracter; Caspbib id that is assigned to the Georecords form from the bibliographic database so that the references can be accessed in all three systems; type of source that indicates the type of source by entering the appropriate letter such as "P" for published literature; pages abstracted; type of abstract-the amount of data abstracted from the original paper, authors; title (English and other); year of publication; name of journal, periodical, serial etc; key words and graphical data that indicate the presence and nature of geographical data in the source reference by ticking the appropriate box.

The geological data module is the main part in the Georecords database system. The detailed information of a paper or a book can be found in the database. Because the latitude and longitude are global standard and each paper or book can be divided at least one location, which is chosen as a basic clue in Georecords database. General information of one location includes locality number; locality map; drawn section; general locality such as China, northwest; area covered; plate fragment code; detailed locality such as Sichuan, Emei, Longmendong; geographic co-ordinate (latitude and longitude, recorded in decimal degrees); type of locality indicates the type of locality recorded by entering the appropriate letter such as "B" for borehole; Nature of data that indicate the nature of the data recorded by entering the appropriate letter such as "A" for continuos section.

A series of individual modules with the geological data module are designed for special detailed information.

The stratigraphical module is used to store the stratigraphical information. The data in the module include location number; unit number; lithostratigraphical unit (group, formation and member); thickness of each unit; lower contact (conformity, disconformity etc.)

of each unit; published age, range-age, range given by author; age evidence that indicates how the author determined the age; standard age-assigning an age to each unit standardised to the Harland et al (1989); lithological description of each unit (colour, structure, texture, qualitative aspects of crystal or clasts, matrix type, roundness, sorting; sedimentary structures) and genetic environments etc. There are also rooms designed for various codes correlated to the ligthological descriptions and genetic environments. In this way, geologists can easily restore a section with graphics or print output and easily do the regional correlation even global correlations. The automatic translations can easily come true on such a basis. A new stratigraphical module (SM)has been developed recently for quick inputting geological data, displaying and printing output with graphics.

The palaeontology module is used to store palaeontology data; informal group name, such as bivalve; genus; species; citation or description, preservation; position with the unit and the data on biozone.

The structural module is used to store the structural and tectonic information of geological data; regional structural history; regional tectonic history; local structural features or events; structural interpretation, miscellaneous small-scale structural feature (boundins, mullions, pencil cleavage etc.); Occurrence (strike and dip); inverted? folds (fold style, interlimb angle, fold wavelength, axial surface strike and dip); joints; fault and shear-zones (strike and dip, nature of fault or shear-zone, fault or shear name; corrent displacement magnitude, statistical data of joints etc.).

The geophysical and geochemical module is used to store aspects of geophysical and geochemical data: paleomagnetic information, physical properties (density, porosity, permeability and electric data etc.); isotopic age data (the mineral dated, dating method, published age, standardised age and errors etc.)and geochemical data (elements or compound, percentage, the position of the sample in the unit etc.).

The petrological, petrogenetic and sedimentological module is used to store petrographic data pertaining to the actual numerical data (e. g. composition of crystal or clasts, matrix and their percentage, grain or crystal size, degree of roundness or sorting); petrogenesis (source, diagenesis etc.)and sedimentology details not included in the lithological description (such as lateral and vertical variations, repetition information or cyclicity, sedimentary basin type and its code etc.)

The curation module is used to store detailed information about the nature of a geological specimen and its collection and processing history.

Besides the modules mentioned above, there are some accessory software such as Salami and Atlas for diagramming.

PROCEDURE OF GEORECORDS

Although Georecords is a huge project, its procedure is not complicated. Basically, it can

be divided into five steps.

Ⅰ. The accumulation and selection of data. The source of data includes almost of all literature on geoscience: published and unpublished literature (paper on the speciality in the serials, journals, periodical or books etc.), field notebooks, specimen forms, laboratory data and so on. After the selection, source reference number is given to each paper.

Ⅱ. The abstraction. Specialists are expected to abstract the data from the original paper or book into a format (translate non-English paper or book into English as English is the most popular language in the world and associated codes and then fill them into a series of sheets) suitable for computerisation. This step needs the specialists understand the whole paper, translate it correctly and abstract the contents as much as possible.

Ⅲ. The inputting. The reference data, geological data, and curation data are input into bibliographic module, geoligical module and curation module respectively.

Ⅳ. The editing. Printing out the data and checking the data with the sheets and the original paper or book, minimising the errors as far as possible in order to guarantee the quality, this step must be redone several times.

Ⅴ. The output options. A batch (4 — 6 megabytes) is often used in Georecords database on PC, after having edited and corrected, the database can be printed out in different options depending on real needs.

ADVANTAGES AND APPLICATIONS OF GORECORDS SYSTEM

The characteristics of Georecords System is that it not only has the functions of general literature retrieval but also provides the detailed information the users are interested in and can print out in written language and diagram. When Georecords database is large enough, it, in fact, is equal to a international geological super-library which can provide various geological literature all over the world. It is no doubt that its potential application will be a wide range. They are expected to take a great part in following fields or subjects of geosciences:

Ⅰ. The division and regional correlation of strata: numerous stratigraphic sections with the lithostratigraphic, chronostratigraphical, biostratigraphical information make it possible to do multiplex stratigraphical division and correlation in computer.

Ⅱ. Sedimentary facies and palaeogeography studies. The data of genetic environments, sedimentary structures and the degree of strata development etc. can be used to reconstruct the sedimentary facies and palaeogeography of each period in geological time.

Ⅲ. The evolution of extinct animal and plants and palaeoecology. The systematic data on fossils of different ages and different regions can restructure the evolution of extinct animal and plants, the data of fossils' preservation and statistical data can provide a basis for palaeoecology.

Ⅳ. Oil and gas prospecting. Georecords database can provide a lot of useful informa-

tion such as porosity, permeability, degree of saturation, possible source rocks, reservoir and structural backgrounds, the horizon and depth of the reservoirs for oil and gas prospecting. That is why the foreign oil companies continuously subscribed CASP for Georecords.

V. Regional geology. The collection and analysis of regional geological literatures are bases for regional geology; the Georecords database can make such a hard work to be done in the computer. The simulation of a basin will become much easier and more convenient with Georecords database.

GEORECORDS IN CHINA

China Georecords began in 1989. It is a joint project between Chengdu Institute of Technology, the Ministry of Geology and Mineral Resources of the People's Republic of China and CASP, Cambridge. Its aim is to build a comprehensive database of Chinese geology. The current China Georecords database has recorded more than 40 Mb of checked records, including about 800 stratigraphic sections which cover almost the whole county. Most of these georecords have been sent to some international oil companies via CASP as a service for their subscriptions.

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