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GEOCAD-Geological Computer Aided Description Software for Sedimentary Rocks

TARIK I. GOZOREN, SALIH SANER and HAMZA K. ASAR
Research Institute, Petroleum Engineering Section,
King Fahd University of Petroleum and Minerals,
Dhahran, Saudi Arabia

ABSTRACT. GEOCAD is an interactive IBM PC and compatible software for geological description and reporting of sedimentary rocks. The system consists of one control procedure and 37 transaction procedures for the complete sequence of standard stratigraphic description. It follows two different paths for detrital and carbonate sediments. GEOCAD is a useful tool for geologists who are describing rock characteristics by using microscopes and computerized references of a description sequence. The system was developed in-house using local expertises and dBASE IV database management system capabilities.

Rock type, mineralogical composition, texture, fossil, depositional and diagenetic environments, and other parameters are recorded by selecting given options from the computer screen. These codes are validated against a built-in dictionary, and a complete translation of the description is stored in the database. There are over 600 description codes which can be entered with commonly accepted abbreviations into the dictionary. An abbreviated or a full description text can be obtained through any printer. Identification of the sedimentary rocks in this system is based on standard terminology with full description sequence, which replaces most referrals to reference manuals during the description, and works as a reminder as well. The numerous sorting, selecting, and grouping combinations may be established for single and/or multiwell studies. The system is developed with menu driven windows, so it is user friendly, eliminating the necessity for previous computer experience.

Introduction

An in-house personal-computer-based database system was developed for use by geologists involved in rock description. This paper describes its system components and general remarks. The system was developed by using local expertise, and dBASE IV PLUS database management system. An internationally accepted standard description sequence and terminology were taken from literature. The system incorporates database files and program library which contains 50 program modules and 40 menus and screen layouts to make it user friendly as much as possible.

The objectives of the GEOCAD development are :

1. To establish means for direct geological data entry to the computer database for storage, by placing computer and microscope side by side,
2. To attain comprehensive descriptions by displaying interactive screen layouts and menus in the order of a rock sample description manual. Thus, all description parameters are brought to the attention of the geologist and reminder screens are provided to show possible options for each description parameter, and
3. To establish description standards and direct all geologists to follow the same standard terminology, although given latitude for adding personal remarks.

System Design Essentials

Prior to beginning GEOCAD system design, objectives of the geologist were analyzed and system specifications were outlined. The parameters considered were :

1. The system has to be implemented on the most common personal computers to minimize equipment costs and to increase the availability,
2. Professional system design standards should be applied during all phases of the project,
3. The system has to be organized to emphasize ease of data retrieval, search and update, using a rela-

tional data manipulation methodology,

4. User manipulation has to accommodate minimal computer experience,

5. The system should provide linkage to other available softwares for post processing considerations at later stages, and

6. The system should be able to establish a standard and a commonly acceptable description terminology.

System Structure

The GEOCAD system includes two types of files :

1. database files, and
2. program file.

The first type is further subdivided into groups containing raw data, code translation, temporary files or tables, and menu or screen layouts. Description of the GEOCAD files are given in the following.

Database Files

1. Sample Identification File

The sample identification file contains one record for each sample entered to the system. A total of ten fields (or columns) are used. This file contains basic sample information (sample number, sample type, location, ... etc.).

2. Code Table File

In the GEOCAD system all geological descriptions are coded. These are translated into the abbreviated or full description text through the code table file.

3. Description Data File

The description data file is used to hold the description codes of all rock characteristics which one record for each description. The user's initials can be used for multiple descriptions of the same sample. This file comprises 40 fields which contain an access key field and a single alphanumeric information field which correspond to the single description parameter (rock color, porosity type, ... etc.). Forty description parameters are defined.

Program File

The system is controlled by four procedures. One is the main control program and the other three are menus for selection of the desired application. These are referred to as system maintenance, standard reports, and geological rock description procedures. These procedures are relatively small programs, averaging about 40 dBASE IV user language statements each. The system maintenance procedure is build around the main program to access all files for maintenance. Standard report procedures are used to retrieve predefined information and report them in a predefined format. Depending upon the report classification, the standard report procedure requires certain information (sample number, report code, ... etc.), and routs the output to an attached printer or displays them on the computer screen. Geological rock description procedure is designed to keep the description sequence in order, and follow the basic actions functions of **add, change, exhibit, delete, copy,** and **quit** which will be performed separately. This procedure has its own subprocedures library which contains over 40 subprocedures. A summary of procedure is given in Fig. 1 to assist in following the system flow diagram. The GEO 100 series are used for carbonate rocks. They are also used for detrital rocks except four GEO200 series procedures which replace their counterparts in detrital rock description sequence. All of the dBASE IV user language programs or procedures that manipulate the database files are created, edited, and stored as a document file of word processor software (MicroSoft WORD).

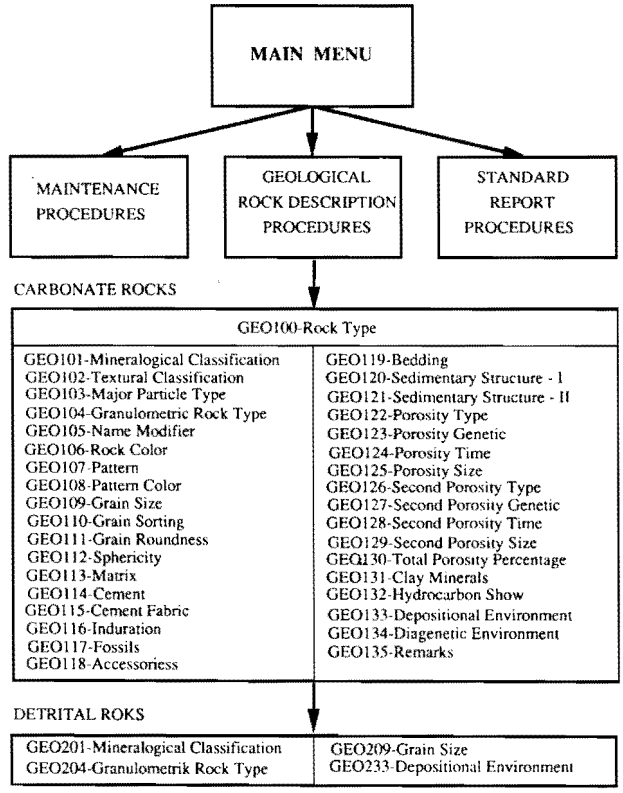

FIG. 1. GEOCAD procedures and their functions.

System Flow Diagram

Rock type, mineralogical composition, texture, fossils, accessories, physical characteristics, and structural and depositional environment characteristics of

the rock are recorded by selecting the given options from the computer screen. These codes are validated against a built-in dictionary which is stored in the database. Identification of the sedimentary rocks in the GEOCAD system is based on standard terminology with full description sequence. This replaces most of the referrals to the reference manuals during the description, and works as a reminder as well. The standard description flow diagram is given in Fig. 2. Each box refers to a single definition of a rock sample. Most common description standards and terminology have been combined in GEOCAD system. Rock name (Folk 1954 and 1959, Dunham 1962, Leighton and Pendexter 1963), rock color (Geological Society of America 1970), grain size (Wenthworth 1922), sorting and roundness (Powers 1953), bedding and sedimentary structures (Pettijohn and Potters 1964), porosity (Choquette and Pray 1970), diagenetic environments (Longman 1980), fossil contents, accessories, cement and matrix were all included, and the Drill Cuttings and Core Description Manual (Petroleum Engineering Section, KFUPM Research Institute 1985) and the Sample Examination Manual (Swanson 1981) were followed for full sequence of description and standard terminology.

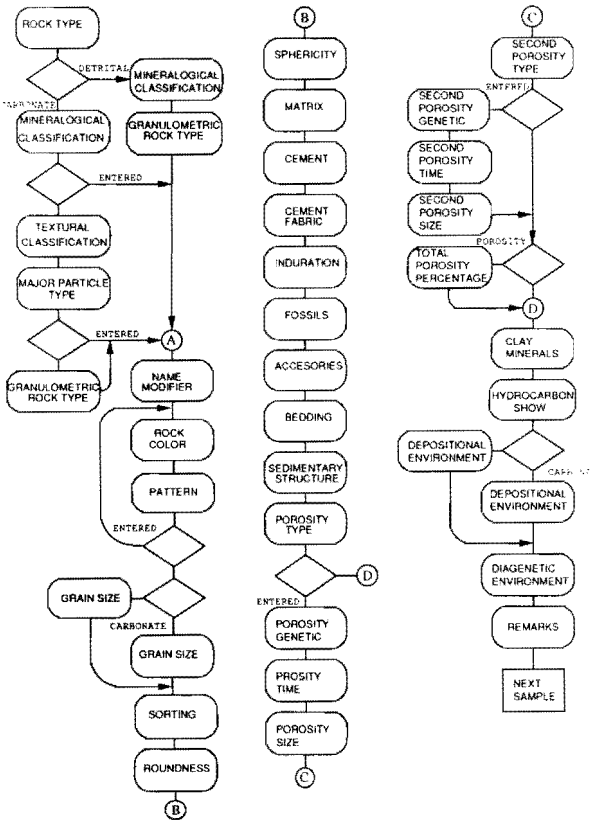

FIG. 2. Geological description flow diagram.

Procedure Outline

The initial step in the process involves system initialization, screen preparation, and start. Since the GEOCAD system is designed as an interactive on-line system, a large number of formatted displays were prepared. These displays are used as menus or screen layouts for data entry and retrieval. Following the system initialization the GEO100 screen (Fig. 3) is displayed for user input. After this, the system runs continuously through the action functions and combination of other input fields. For clarity, the system flow diagram is described here with action functions.

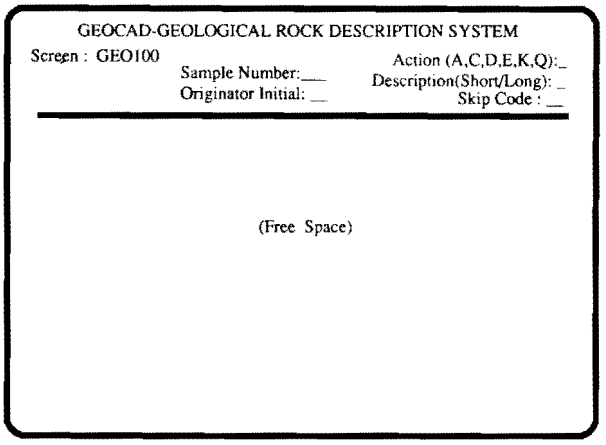

FIG. 3. GEO100 screen layout.

When (A) is selected for **add** function, sample number, and originator initial, are required to complete the action. These fields form the access key to make the description record unique for multiple entries. The system validates the input fields until a complete record defined and added to the database.

When (C) is selected for **change** function, the system requires a sample number to check whether a description exists and to request a skip-code for definition of the parameter to be modified. It is designed to access to the required description item at once rather than following the same sequence as in the add function. The system displays the previous definition and allows the user to replace it with the new choices. The description items will be continuously displayed one by one until escape **ESC** key is pressed to discontinue change action function.

When (E) is used for **exhibit** function, the GEOCAD system requires only the sample number to exhibit the entire record with the abbreviated or long description alternatives. The processing of exhibit action is to access the description record, retrieve the description single codes, and form a text adding neces-

sary punctuation. There are over 600 description codes which can be entered with commonly accepted abbreviations and full description terms. Thirty characters per code have been allocated in the code table file. Using a standard code table file is the major advantage for unified and correct description display.

When (D) is selected for **delete** function, the system requires key fields to be filled. It then verifies the record existence and confirms with the user deletion of the displayed record forever. Once the record deleted, it can not be recovered.

When (K) is selected for **copy** function, the system requires key fields to be copied from and the new key information to be copied to. This feature is particularly useful for entering similar information for the same specifications without going through normal description sequence. User may then modify the description items one by one using change action function.

When (Q) is selected for **quit** function, the GEOCAD returns to the PC/DOS environment following the safe closing and backup procedures.

Description Reporting

There are two standard reporting options which are designed and implemented at this time into the GEOCAD. Both can be either displayed on the computer screen or routed to the attached printer, with an abbreviated or full description text for all samples including depth and sorted by sample number. The first report is for full description including user added remarks, while the second just lists sample number, depth and rock type. The rock type is a combination of basic rock name and the proper compositional or textural classification terms. Two sample reports are given in Fig. 4 showing complete description items, punctuation, and report format.

Conclusion

The GEOCAD system was developed locally as an additional tool for geologists to use in the description of rock samples. The results of efforts to date have been successful, and the good reception by users has been most gratifying to the system developers. Future efforts will be directed towards :

1. incorporation of other easy input options,
2. linkage to the other geological or statistical softwares, and
3. establishment of a connection with other laboratory experimental data which usually follows the rock description.

GEOCAD-GEOLOGICAL ROCK DESCRIPTION SYSTEM

Screen : GEO100 Action (A,C,D,E,K,Q): E
Sample Number: 999 Description(Short/Long): L
Originator Initial: ZZ

Depth : 9999.9
Type : Horizontal Plug

Dolomitic Bioclast Intraclast Packstone:
olive gray - 5Y6/1, yellowish gray - 5Y7/2 banding; particle size .5-.25 mm, moderately sorted, subrounded, elongated, carbonaceous matrix; medium hard; foraminifera, algea; echinoids; very thin bedding (.1-.3 cm); solution enlarged, small mesopore (.062-.5 mm), interparticle porosity, and solution enlarged; micropore (<.062 mm), intraparticle porosity; fair porosity (10-15%); oil stain; shallow shelf; Milioid, Textularia, Clypeina, part of the thin section is Carbonate Mudstone.

GEOCAD-GEOLOGICAL ROCK DESCRIPTION SYSTEM

******** PROJECT

SAMPLE DESCRIPTION REPORT

Sample No.	Depth(ft)	Rock Type
995	9995.1	Bioclast Wackestone
996	9996.2	Bioclast Intraclast Grainstone
997	9997.3	Bioclast Intraclast Grainstone
998	9998.4	Dolomitic Bioclast Intraclast Packstone
999	9999.5	Dolomitic Bioclast Intraclast Packstone
1001	9999.6	Calcareous Dolomite
1002	9999.7	Dolomitic Oolite Grainstone
1003	9999.8	Bioclast Wackestone

FIG. 4. Example of standard geological description reports.

Acknowledgement

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جيـــوكاد : برنامـــج الوصف الجيـــولوجي للصخـــور الرسوبـــية بمساعـــدة الحـــاسب

طارق عصمت غزورين ، صالح سانر و حمزة خضر عصر

قسم هندسة البترول بمعهد البحوث ، جامعة الملك فهد للبترول والمعادن ، الظهران ، المملكة العربية السعودية

المستخلص . جيوكاد هو برنامج للحاسب الآلي الشخصي من طراز آي بي إم والبرامج المتوافقة معه ، ويختص بوصف الصخور الرسوبية . يتكون هذا النظام من وسيلة للتحكم في الأداء ، إضافة إلى ٣٧ عملية إجرائية أُخرى لإعطاء الوصف الطبقي القياسي الكامل . ويتبع هذا البرنامج منحيان مختلفان فيما يتعلق بالرواسب الحتية والكربونية . ويعتبر برنامج جيوكاد مفيدًا جدًا للجيولوجين الذين يهتمون بوصف الصخور عن طريق استخدام المجهر بمساعدة الحاسب الآلي . وقد تم تطوير هذا النظام داخليًا بالاستفادة من الخبرات المحلية ، إضافة إلى استخدام dBase IV وإمكانات نظام إدارة قاعدة المعلومات .

إن نوعية الصخور والتركيب المعدني والتكوينات والأحافير والبيئة الترسبية ، إضافة إلى المكونات الترسبية الأقل أهمية يتم تسجيلها عن طريق الاختيار من الخيارات المتاحة من شاشة الحاسب الآلي . ويتم تنقيح تلك الرموز عن طريق القاموس المضمن في الجهاز ، وتُعطى ترجمة كاملة للوصف يتم حفظها في قاعدة المعلومات . وهناك ما يفوق ٦٠٠ رمز وصفي كامل أو مختصر في الموقع من أي طابعة . ويبني تحديد الصخور الرسوبية في هذا النظام على اصطلاحات قياسية مع إعطاء وصفها الكامل . ويعوض هذا غالبية المراجعين للدلائل أثناء عملية الوصف ويكون مُذَكِّرا لهم في ذات الوقت . ويمكن أن تتم عمليات التصنيف العديدة والاختيار والتجميع للدراسات المتعلقة ببئر واحدة أو عدة دراسات خاصة بالعديد من الآبار .

هذا وقد تم تطوير هذا النظام مع التزود بقائمة الاختيار وعليه يمكن الاستغناء عن الخبرات السابقة في مجال الحاسب الآلي .