GIS AND DATABASES TOOLS IN DOING THE DATA MORE EFFECTIVE APPLICATION IN THE GEO-SCIENCE FIELD

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Abstract. The "GIS and Databases tools in doing the data more effective – application in the geo-science field" paper are presented the main reasons and objectives for carring out integrated systems in specific data managemnet. It is also sugested a general scheme in data structuring that could be used as starting point in projecting an integrated system GIS – Database. It is stressed the great importance of a good co-operation and co-ordination of the GIS and Database designer and the data owners and final users.

Key-words: database, metadata, software, hardware, GIS.

INTRODUCTION

In the last few decades the explosive development of the hardware and software computing capabilities, have offered the opportunity to appear new specific and powerful tools in data management.

It is well known the huge amount of data, both in quantity and variability, that are using in geo-sciences field.

There are thousands of parameters that are measured and stored in differed forms (samples, images, tables in digital form or on hardcopies, graphs, geophysical recordings, a.s.o.) and each of these generic type of data is measured in thousands of samples.

The complexity of geological medium in general and the necessity of obtaining more and more accurate interpretations of geological and geophysical researches, corroborated with the quantity and diversity of data, gave birth to the will of using all the available data in more effective manner.

GIS CONCEPT

All the data produced and managed in geo-sciences, have spatial co-ordinates. This characteristics is an advantage, because allow to be synthetically represented on maps, but sometimes this property could be a major drawback.

The representing of all the data (type and sample or measuring points) could produce maps enclosing too much, and thus confusing, information.

Many times we need to know what data are available in a specific area, and this is not so simple if we are using conventional databases and if this zone is not squared. The technique of modelling the geological and geophysical phenomena it is used frequently in last years, and these methods require to previously carry out a spatial analysis of some related parameters.

The tool named Geographic Information System is that which can manage the complex tasks mentioned above.

The term GIS, is very much used in the last few years, especially in the field of geo-sciences, but not only. Unfortunately the frequent using of this term not produced a very clear image of what exactly is and imply GIS.

Function of what is doing, GIS can be understood as a complex tool that allow us to store, maintain and efficiently exploit a collection of data spatially distributed. Function of what is comprising, GIS is a collection of personnel, data, hardware and software (Fig.1).

HARDWARE:

- DIGITIZERS
- SCANNERS
- POWERFUL COMPUTERS
- SPECIALISED DATA STORAGE DEVICES
- PRINTERS
- PLOTTERS

SOFTWARE

- PROPER GIS SOFTWARES
- DATA BASE SOFTWARES
- SOFTWARE UTILITIES FOR: DATA EXCHANGE, COMPRESSION, OPTICAL STORAGE AN RETRIEVAL, ETC.

PROPER GIS SOFTWARE: FUNCTION

- data input
  - digitising
  - scanning
- raster to vector conversion utilities
- data editing
- building the topology

- attribute to each element an unique ID label
- building a minimum data structure (tabels)
- spatial analysis
- producing of maps and graphs
- minimum data exchange capabilities
- programming and integrating other softwares capabilities

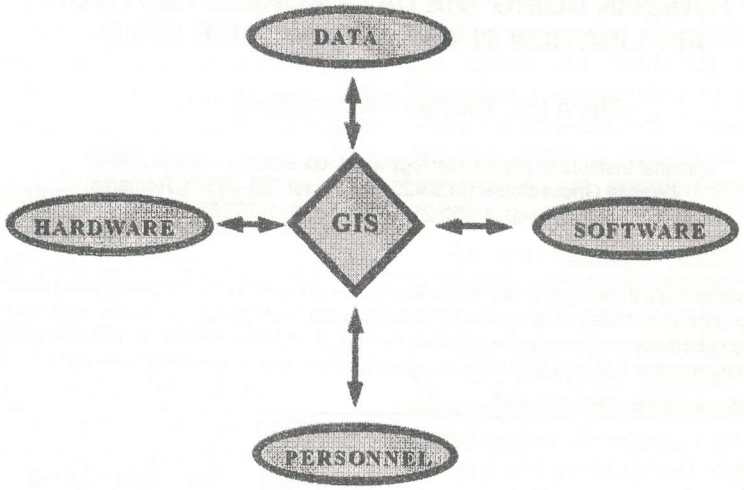

Fig.1 Components of a GIS

DATABASES AND GIS - APPLICATION IN GEO-SCIENCES

These tools, databases and GIS, used together, form the most efficient way to capitalise the owned data.

In general the users of the GIS tool wish that all already done of data processing to be included in the system in order to display and print them any-time when they need.

This approach is an ideal one, because theoretically there are an infinite number of way of data processing, the results being graphics images - features that request large spaces to be stored. Storing different results of data processing has the tendency to produce too big and redundant databases. The exploitation of such a databases could produce unpredictable results.

The designers and the administrator of a GIS, always have to keep in mind, the necessity to store in the system only those data that describe and characterise most completely the studied area. Usually the GIS software has programming capability and also the possibility to execute other specialised softwares in data processing. In this way can be obtained in real time the needed processing.

The GIS must to have a digital database working behind the scene, these two specialised tools having to be able to co-operate in the most convenient and efficient manner, in order to produce the expected results.

These generalities are very important to be very clear settled before to start the designing process of a GIS.

DATA STRUCTURING

The data can be split in two general categories:

- metadata;
- proper data (data themselves).

Metadata are about the content, quality, condition, and other characteristics of data; the major uses of metadata are:

- to maintain an organisation's internal investment in geospatial data;
- to provide information about an organisation's data holdings;
- to provide information needed to process and interpret data to be received through a transfer from an external source.

The roles of metadata are:

- availability - data needed to determine the sets of data that exist for a geographic location;
- fitness for use - data needed to determine if a set of data meets a specific need;
- data needed to acquire an identified set of data;
- transfer - data needed to process and use a set of data;
- these roles form a continuum in which a user cascades through a pyramid of choices; the exact order in which data elements are evaluated, and relative importance of data elements, will not be the same for all users.

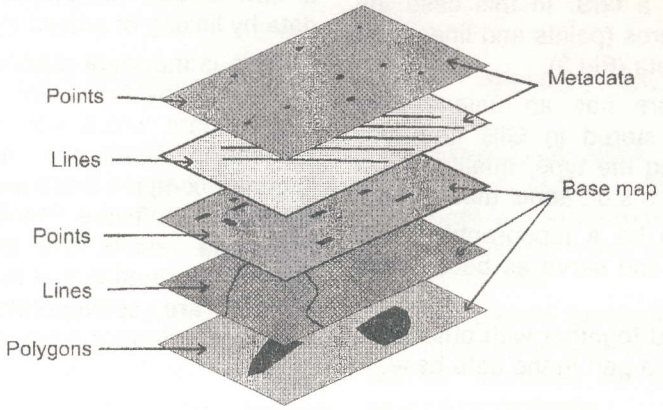

Fig.2 Layering the informations as function of geometric features

METALS IN WATERS

Sample no.	Cr µg/l	Al µg/l	Co µg/l	Cu µg/l	As µg/l	Hg µg/l	Se µg/l	Zn µg/l	Pb µg/l	Cd µg/l
DD 7529	0.12	397	1.20	8.6	17.9	< 1.0	33.0	55.7	9.0	0.64
DD 7531	0.12	177	0.82	2.5	21.3	< 1.0	34.2	13.2	8.5	0.53
DD 7532	0.17	289	1.25	9.9	18.9	< 1.0	37.4	15.7	10.0	0.71

METADATA TABLE

Sample No.	Location	Latitude	Longitude	Sample_ type	Table_ connectivity	Accuracy_of positioning	Date
DD7529	L. Fortuna	45°12,5833'	29°07,7000'	WS,ST, OO	AA,AB,AC, BA,BB,BD, BE	B	8.1.1996
DD7530	L. Fortuna	45°12,6167'	29°08,3333'	WS,ST, OO	AA,AB,AC, BA,BB,BD, BE	B	8.1.1996
DD7532	L. Tataru	45°12,8000'	28°55,8667'	WS,ST, OO	AA,AB,AC, BA,BB,BD, BE	B	8.1.1996

Fig.3 Linking of metadata and proper data tables

As it can be seen the metadata are very suitable to be stored in a GIS. In this case the metadata are these features (points and lines) that show us where are the data (Fig.2).

Each of these feature has an unique user identification label (ID) stored in GIS and also other attributes describing the type, quality, exact co-ordinates, availability, a.s.o., about these data.

The base map could be a topographical one and/or a geological one and serve as background for spatial referencing.

The ID must be stored together with other data in a table of metadata as a part in the data base.

This ID or another kind of data (sample ID) that is also unique can be used to obtain the proper data by linking or adjoining tables (Fig.3).

This is the ideal manner of storing information in GIS. Many times we have to include in the system data which are not primary - results of processing. This is the case when the processing is a very complex issue and when there are not yet available software tools to produce these requested results. As an example of such a derived information that are stored as primary data in GIS are sedimentological, tectonic, paleo-geographical maps,a.s.o. (Fig.4).

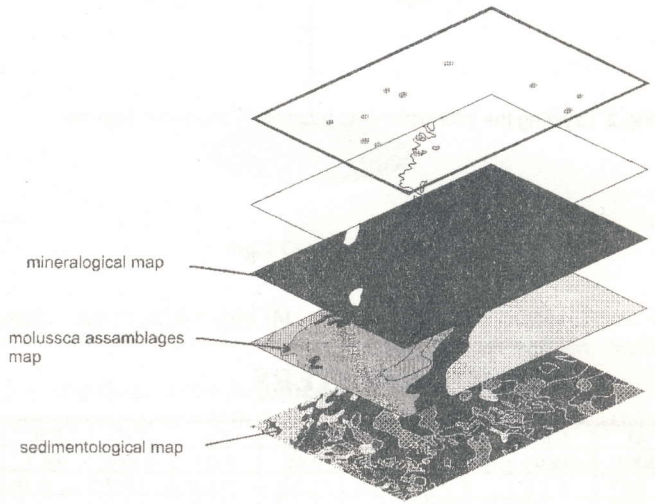

Fig.4 Theme layering in GIS project

CONCLUSIONS

To carry out of a functional GIS with a powerful data base behind it, is a very complex issue that require a detailed analysis carried out before the designing the systems.

The choose of software and hardware is also important having to allow future scaling of the systems by adding data and new processing and modelling capabilities.

As in many other cases in geo-science, it is necessary to use the art of compromising between the needs and present capabilities. It is necessary a continuos co-operation of users, software designers and the administrator of the systems.

GEO-ECO-MARINA

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Manuscrisele vor fi prezentate în limba engleză sau limba franceză. Ele vor fi însoțite de **abstracte** de maximum 20 rânduri în limbile engleză și franceză care să prezinte pe scurt principalele rezultate și concluzii (nu o simplă enumerare a subiectelor abordate). Lucrarea va fi predată pe dischetă de 3,5", cu caractere ARIAL, în programul Microsoft Word 7.0 pentru Windows, însoțită de un exemplar printat.

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Ilustrațiile fotografice (numai alb/negru) trebuie să fie clare, cu contrast bun și grupate pe planșe de maximum 16/24 cm. În cadrul fiecărei planșe numărătoarea fotografiilor se repetă (ex. Pl. I, fig.1; Pl. II, fig.1).

Tabelele vor fi numerotate (cifre arabe) și vor avea titlu. Dimensiunea tabelelor va corespunde dimensiunilor tipografice menționate mai sus.

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Only papers presenting concisely and clearly new information shall be accepted. The manuscript will be submitted for critical lecture to one or several consultants.

Manuscript should be submitted in English or French. They should also be accompanied by **abstracts** (maximum 20 lines in English and French) presenting the main results and conclusions in brief (and not a mere list containing the topics tackled). The paper should be handed in an a 3.5" diskette, in Arial characters, in the Microsoft Word 7.0 programme for Windows, accompanied by a printed copy.

The **key words** (maximum 10) items should be in English or French according to the language used in the text, given in succession from general to specific.

The **references** should be listed alphabetically and chronologically for the authors with more than one reference.

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Tables should be numbered (Arabic figures) and entitled. The size of the tables should correspond to the above mentioned dimensions of the printing area.

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