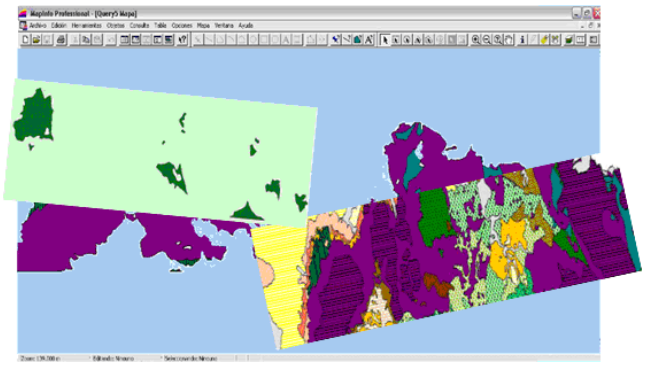

Geographic Information System to generate geological data on the northeast of Cuba*

Liuska Fernández Diéguez

Specialty: Geology.

Mining and Metallurgical Higher Institute (Cuba).

Abstrac: This investigation was carried out in order to generate a Geographic Information System (GIS) for the management of geological and geophysical data. The results included developing thematic maps; such as, maps of ophiolitic rocks, of laterite crust on peridodites and gabbros, of sedimentary and volcanic rocks present in the northeast of Cuba.

Key words: Northeast of Cuba; geologic map; Geographic Information System.

Sistema de información geográfica para la gestión de la información geológica de Cuba nororiental*

Resumen: Este trabajo se desarrolló con el objetivo de crear un Sistema de Información Geográfica (SIG) que permita la gestión de la información geológica y geofísica. Como resultado se confeccionaron mapas temáticos como el de rocas ofiolíticas, de cortezas lateríticas sobre peridotitas y gabros, de rocas sedimentarias y de rocas volcánicas del norte de Cuba oriental.

Palabras clave: Cuba nororiental; mapa geológico; Sistema de información geográfica.

Introduction

A Geologic Information System constitutes a very valuable tool which has been increasingly used in the field of research, geosciences and environmental management projects. In geologic investigations, the GIS allows the organization and interrelation of geological data of different origins and types as well as the solution of diverse tasks associated with geological cartography, prospecting for ore bodies, geological risks, environmental studies, territorial ordering and location of engineering works.

In this investigation, a Geographic Information System (GIS) was developed to generate geological data on the northeast of Cuba using version 6.5 of Mapinfo software and a 1:250 000-scale geological map.

Various geological and geophysical investigations on the northeastern region of Cuba have been directed toward cartography and mineral prospecting. Much of the information is scattered, lacks organization and sometimes unavailable in electronic format, thus limiting the information that may be necessary for future investigations.

Based on the above, it is required to have a GIS available to generate the geological and geophysical information of the Northeast of Cuba.

Methodology

This investigation was carried out in 5 stages:

Stage 1: Design of a Geographic Information System based on the project objective

and scope.

Stage 2: Collecting and analyzing the information taking into account the aspects stated in the GIS design.

Stage 3: Preparation and digitization of the information gathered. The process of converting the information into a digital format was carried out using the methodology proposed by other researchers (Batista, 2000).

Stage 4: Installing GIS on v 6.5 of Mapinfo software.

Stage 5: GIS Handling and Management.

A 1:250 000-scale geological map (Albear et al., 1988), information available in the *Stratigraphic Lexicon* (Franco-Álvarez et al., 1994), various articles and theses as well as other scientific documents were taken as a basis. A series of attributes which characterize, describe and identify the objects of study were taken into account.

Table 1. Relationship between the main attributes that characterize the objects of study and the sources from which the information is taken.

Objects	Classification of the objects	Attributes	Types of field	Source of information
Geological formations and degrees of ophiolitic association	Areals	Name	Character	Geologic Maps
		Synonymy	Character	Lexicon, geologic maps
		Age	Descriptive	Geologic maps
		Formation code	Character	Stratigraphic lexicon
		Author	Character	Stratigraphic lexicon
		Original reference	Character	Stratigraphic lexicon
		Area type	Character	Stratigraphic lexicon
		Types of rocks	Descriptive	Geologic maps
		Ophiolites	Logical	Geologic maps
		Mineralization	Logical	Field work, reports and Publications
		Mineralization	Descriptive	Field work, reports and Publications
		Fossil	Logical	Field work, reports and Publications
		Types of fossils	Descriptive	Field work, reports and Publications
		Average thickness	Decimal	Field work, reports and Publications
		Description	Descriptive	Geologic maps lexicon

Examples of maps generated based on the information collected:

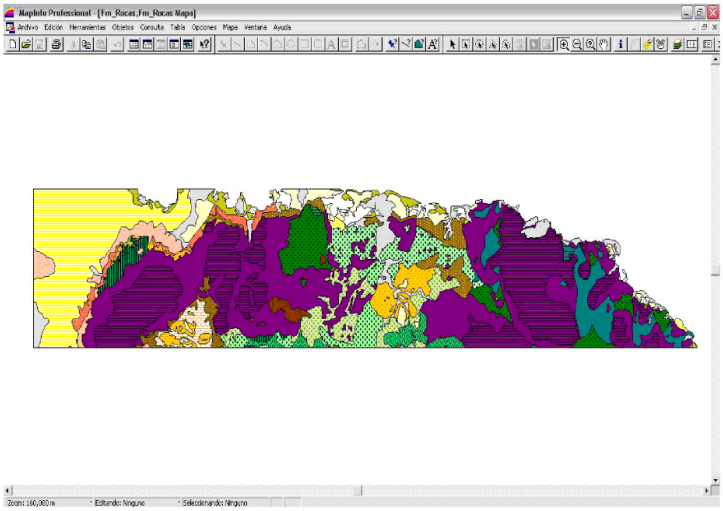

Figure 1. Graphic representation in GIS (Geologic map of the Northeast of Cuba).

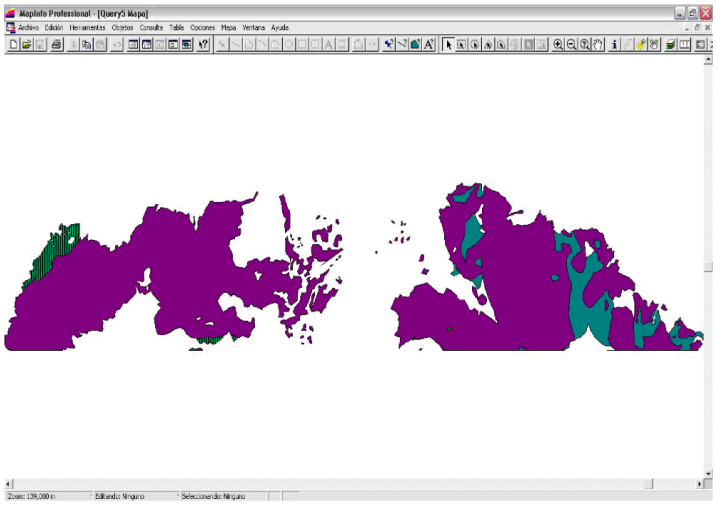

Figure 2. Map of the ophiolitic rocks present in the Northeast of Cuba.

Figure 2 shows a map of existing ophiolitic rocks in the region. This includes serpentinized peridotites, gabbros and parallel dikes. Figure 2 shows the areas of development of laterite crusts over gabbros and peridotites.

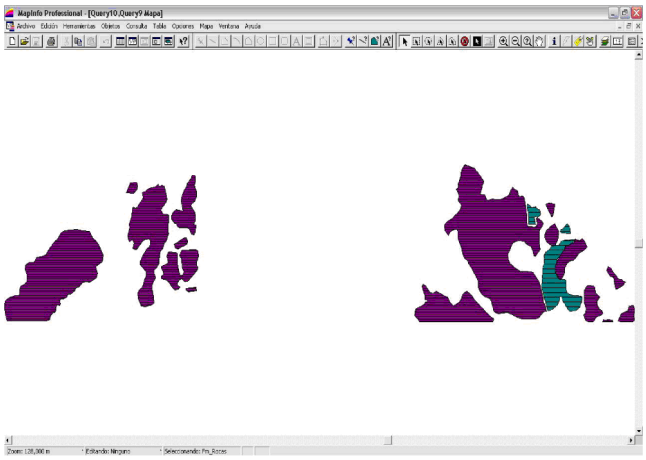

Figure3. Map of laterite crusts on peridotites and grabbos present in the Northeast of Cuba.

Figures 4 and 5 show outcrops in the region, of sedimentary and volcano-sedimentary rocks, respectively. Figure 6 shows an example of rocks of Cretacic age.

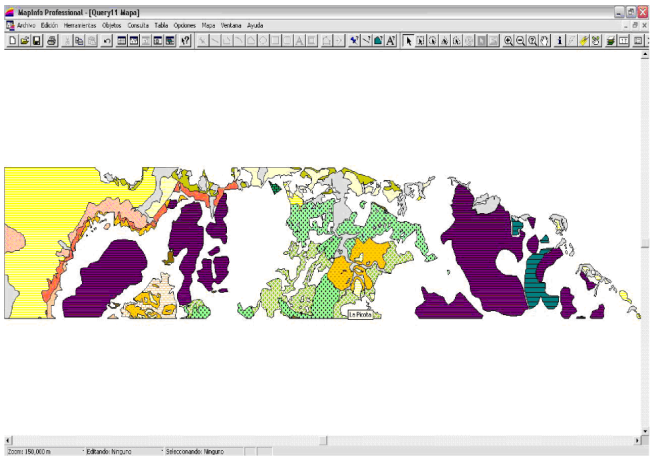

Figure 4. Map of sedimentary rocks present in the Northeast of Cuba.

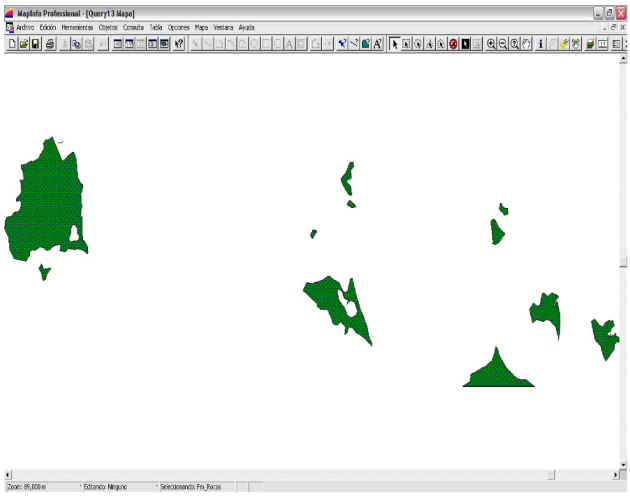

Figure 5. Map of volcanic rocks present in the northeast of Cuba.

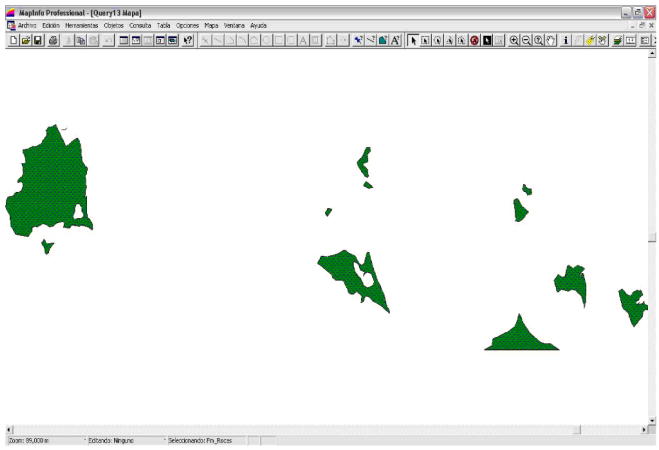

Figure 6. Map of Cretacic rocks.

Technical, economic and social analysis

A qualitative economic evaluation was carried out considering that this tool contributes to substantial time and resource savings while conducting geological investigations. The following are some elements supporting the above:

- Investigations on large areas and management of large amount of information.

- Computer-aided generation of new maps (materials of construction, types of rocks, danger and risks, type of soils, etc.).
- Accurate and automated connection between different types of information (geographical and numerical).
- It provides effective solutions to issues related to geologic cartography, mineral prospecting, geological risks, environmental studies, territorial ordering and location of engineering works.

Conclusions

The creation of a database allows managing geological data in the most accurate and fastest way.

It allows relating the data of different sources and types and providing a satisfactory solution to meet the investigator's needs.

Different maps (lithologic, age, crusts, etc) may be generated from a GIS geologic map in accordance to the investigator's requirements.

The geographic information system is a valuable tool to be used in geological and geophysical investigations.

Recommendations

To carry the geographical database creation to full completion.

To incorporate other geological, tectonic and geophysical maps into the GIS.

Bibliographic references

ALBEAR, J.; I. et all. 1988: Geological Map of Cuba, Scale 1:250 000, Academia de Ciencias de Cuba e Instituto de Geología y Paleontología, Cuba.

BATISTA, J. 2000: Metodología para la recuperación de la matriz digital de las observaciones de un levantamiento geofísico. Minería y Geología, XVII, 2,23-26.

FRANCO-ÁLVAREZ, G. et all. 1994: Léxico Estratigráfico de Cuba. Instituto de Geología y Paleontología. La Habana.

* Research presented in the XIX National Scientific Forum of University Students of Technical Sciences. Cienfuegos 2011. Tutored by PhD. Roberto Díaz Martínez.