ABSTRACT

This paper presents a research, developed by the Laboratory of Cartography, of the Geography Department of Federal University of Rio de Janeiro, which works with the reversal cartographic evolution, i.e., the Rio de Janeiro State cartographic involution, linked to the political-administrative divisions of Rio de Janeiro State as far as time is concerned.

This research aims to establish the reversal digital cartography of Rio de Janeiro State, Brazil, in its municipal divisions on a time basis. This would generate digital and analogical cartographic maps in levels and accuracy, compatible several applications.

The historical names of cities, small towns, villages and others, are been researched too, linked to the real names, establishing a link with the position in time of each one.

A space-time data base structure is developed to permit the implement of the research in a SIG.

The maps of the State, was built between the dates of 1565 and 2003, dates of foundation of the first and the last county. It was developed 47 temporal maps and others 38 linked to the toponimic study.

1) INTRODUCTION

The Laboratory of Cartography, GeoCart, of the Geography Department of the Federal University of Rio de Janeiro, (UFRJ), acting mainly in the researches areas of Digital Cartography, Cartographic support and Thematic Cartography, identified problems and difficulties, not only in works, researches and projects developed by the Laboratory itself, relating to the support of temporal data on the State of Rio de Janeiro demanded, but also by the users them selves, through doubts and consultations made to the Laboratory, on possible political-administrative divisions of the State. These problems, most of the times, comprehend data acquisition as well as the making of maps, which concern and are linked to the temporal data included, mainly when the need of interlinking socio-economic data map and temporality is asked.

Most of the demands are former times maps in digital formats, for associations to Geographical Information Systems (GIS).

The problem above mentioned associated to the State of Rio de Janeiro, one of the 26 States of the Federative Republic of Brazil, presents a picture of political administrative evolution rather interesting: in the year 2001, the last municipality was created totalizing 92 municipalities. From 2001 to 1565, data of foundation of the City of Rio de Janeiro (first municipality), 47 changes took place as it can be seen in graph 1. Thus one can realize that, in principle, 47 maps should exist showing the political administrative evolution of the State. However different names over the same space show new maps, asking for a study on the evolution over the toponymy. As an example The municipality of Nova Iguaçu had the following names: Maxambomba, Yguassu, Iguassu, Nova Iguassu and Nova Iguazu.
Graph 1: Municipalities established between 1565-1810

Graph 2: Municipalities established between 1820 –2001

Illustration 1 - Legend of graphs 1 and 2

Graphs 1 and 2 show the evolution of the municipalities linked to the different political national moments. One can observe facts as the stability of divisions during the military government, f. i., as well as an increase occurred soon after which shows a demand which could be restrained during this period of time. Chart 1 show the years of creation of the different municipalities.

Chart 1 - dates of the creation of the municipalities of the State of Rio de Janeiro
The Research aims at the making of a study of the reverse cartographic evolution, that is, the cartographic involution of the State of Rio de Janeiro, associated to the administrative divisions of the States of Rio de Janeiro.

The word “involution” was created to distinguish from evolution which only took place rebuilding the political divisions. After the involution, it was possible to recreate the evolution related to the State of Rio de Janeiro.

On the other side, the main aim of the research was the establishment of the reverse cartography of the State of Rio de Janeiro in its different political and administrative divisions, at municipal level, creating digital and analogical cartographic bases, in scales and accuracies in agreement with thematic applications.

Figure 2 shows the involution scheme of the work. Figure 3 shows the creation dates of the municipalities of the State of Rio de Janeiro.

Figure 2 – involution scheme of the work – Reverse Cartography

Figure 3 – Dates of the creation of the municipalities of the State of Rio de Janeiro
2 – METHODOLOGY

The project is developed in different phases interlinked among themselves. In several, all research will be synthesize in the following phases, characterizing the methodology which will be applied to the project:

Phase 1 – Bibliographical research and Data Acquisition
Phase 2 – Cataloguing and ordering of the collected material
Phase 3 – Development of the cartographic bases
Phase 4 - Treatment and data cartographic representativeness
Phase 5 – Validation of the final results and “availability” in the net
Phase 6 – Partial reports
Phase 7 – Final report

2.1 - Description of Phases
2.1.1 – Phase 1: Bibliographic Research and Data Acquisition
It means the search of up-dated bibliography, at national and international levels, though contact with universities journals, researches, researchers, libraries, newspapers, specialized magazines and internet. Governmental and no governmental organizations on the subject of the undergoing research subject.

2.1.2 - Phase 2: Cataloging and Ordering of the Collected Material;
This phase comprehends the ordering and cataloging of the selected and acquired material for the research. Due to the amount of material which can appear, a temporal and spatial cataloging of all material must take place.

2.1.3 - Phase 3: Development of the Cartographic Bases
Once the material is temporarily ordered, the period of time to be reached for the establishment of the cartographic bases is defined. True sub-phases are also foreseen in order to respond to the aims of the phases.

2.1.4 – Phase 4: Treatment and Data Cartographic Representativeness
It means the creation and elaboration of charts and associations to the data banks, which will the no-graphic material linked to the thematic data discussed by the project.

2.1.5 - Phase 5: Validation of the Final Results and Availability in the NET
It aims at the final checking of all the material created. Once validated a homepage on the project will be created aiming at is dissemination and its own availability to the users.

2.1.6 - Phases 6 and 7: Partial and Final Reports
They aim at the follow-up of the project, through reports, which allow the establishment of the researches associated to the project, progress achieved, human resources formation, works, thesis and monographies generated and presented.

3 - DESCRIPTION OF SOME PROCEDURES OF ELIMINATION AND CONSTRUCTING OF MUNICIPAL BOUNDARIES

The political administrative maps of the States of Rio de Janeiro shared to be built from the IBGE (Brazilian Institute of Geography and Statistics) 2001 digital base in dxf. shape. In this map the 92 municipalities, which today from the political net of the State are shown, being the most up-dated and complete one.

From 2001 to 1962, the procedure took place only by the elimination of boundaries (the boundary between the municipality and emancipated district was eliminated) making possible in a very simple way a new map.

In the 1956 map there is the specific case of the Paracambi municipality. This municipality, created in 1962, is originated from two other municipalities (Vassouras and Itaguaí) and not only from one as the others. This it was necessary a bibliographic research to discover how much territory was taken from Vassouras and Itaguaí. As the official newspaper of the States is from 1944, and at that time Paracambi didn’t exist, one could find the detailed description between Vassouras and Itaguaí. As the boundary was described through physical features one had to use the digital base of the topographic map of Paracambi in dgn format, to discover the boundary according to obtained date. From the digital map one followed this boundary drawing precisely a line in accordance with the information described at the official newspaper.
However, as the boundaries were taken out of a topographic map, in UTM coordinate system, and in research the maps were produced in the latitude/longitude coordinate system, it was necessary to make a conversion.

After establishing the boundary, and after having transformed it to mentioned coordinate system, this could be integrated to the 1956 map, allowing the progression of the involution procedure of the States of Rio de Janeiro. Figure 4 presents the elimination of the boundaries between Vassouras and Itaguai for the creation of Paracambi.

![Map: 1960 / 1962](image)

**Figure 4 – Period 1960/62 – Municipality of Paracambi**

The same thing also happened with the municipality of Niterói. This municipality had a territory incorporated to São Gonçalo in 1943 that will this year had not exit to the sea as can be seen in figure 5.

![Map: 1939 / 1943 vs Map: Atual](image)

**Figure 5 – Example of Municipalities of Niterói and São Gonçalo**

It was also formed this boundary in documents and as the prevision case it was possible to build it following the same steps.

The big difference between these two cases was that in the first one it was a phenomenon of municipal emancipation and is the other one it was a case of incorporation of territory.

The conclusion of these two case is that the building of lines in map makes the work much more complex once they must be drawn according to the historical documents, or starting of evidences of boundaries old maps.
4 – GENEALOGY OF MUNICIPALITIES

The genealogy of the municipalities of the States of Rio de Janeiro is rather complex due to the fact that several municipalities were created from the fusion of other municipalities. Thus the research work must be very careful in order not to have doubts about the areas taken from each one of there aiming at the creating of the final municipality.

The figures 6, 7 and 8, show below, partial trees of the creation of the municipalities, not only will the spatial division of each one of them. Figure 9 shows an example of what is possible to present for the Nova Iguaçu municipality.

Figure 6 - Municipalities created from Angra dos Reis

Figure 7 Municipalities created from Cabo Frio

Figure 8 – Municipalities created from Nova Iguaçu
Figure 9 - Involution of Nova Iguaçu, according to the presented genealogy

Figures 10, 11 and 12 present some of the maps made till now showing the behavior of the municipal divisions inside each period of time.
Figure 11 – Maps from 1943 to 1874

Figure 12 – Maps from 1850 to 1666
5 – CONCLUSIONS AND PRESENT DAY RESULTS

The project is still in process existing a substantial amount of work to be done mainly in relation to the organization of data which will be incorporated to the database.

In relation to the temporal aspects of the maps three different periods of time are being characterized. The first one of political division assured, defined and determined by the law of the creation of the municipalities of 1943 represents the first series. The second temporal series is defined by the existence of documentation, written or cartographic, which allows the establishment of the non-proved boundaries but very near to reality. This series was called the probable series. It is limited by the publishing of the Atlas of Imperio de C. Mendes, from 1868. The third one, however, will translate a connect temporal information, but under a spatial vision just estimated due to the impossibility of establishing correct boundaries. This series corresponds to the final period of time, from 1868-1565.

This division in series, nevertheless, will not impeach a clear vision of the involution or of the reverse cartography of the administration division of the State.

Till now all data which allow the evaluation of the periods were already gathered and 47 maps of the proposed period of time were created.

The study of the associated toponymy allow the elaboration of new maps from periods in which even when there was no spatial change, there was change in the toponymy of the municipalities, being necessary a new temporal division. Due away mention the case of period 1943-1947 when the municipality of Bom Jardim was called Vergel and afterwards Bom Jardim again. Thus, it is necessary to have three maps which show the changes of toponymies. It is assumed that the amount of maps will increase in at least 85% of the existing maps.

In the end of the work it will be established all the methodology for the treatment of the cartographic involutions which can be applied to the other states of country as well as to specific towns which allow this type of applied research. One must emphasize, however, that for urban states the work will be much bigger once some have more municipalities than the state of Rio de Janeiro.

6 – BIBLIOGRAPHY

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BIOGRAPHY
Name: Paulo Márcio Leal de Menezes
Birth date: 07/ 23/ 1948 Nativeness: Rio de Janeiro, RJ Nationality: Brazilian
Position: Geodesy and Topography Engineer, Academical Professor, Retired Colonel of Engineers Corps of Brazilian Army

PROFESSIONAL FORMATION
Doctor in Sciences in Geography - Federal University of Rio de Janeiro - 2000
Topography and Geodesy Engineer - Military Institute of Engineering - 1977
Official of Engineer Corps - Military Academy of Agulhas Negras - 1969

PUBLISHED PAPERS
64 (sixty four) papers published in Congress, Seminars and several participations.

DIDACTIC ACTIVITIES
- Assistant Professor of Federal University of Rio de Janeiro: undergraduate in Geography: 1994 to 2000;
- Senior Professor of the Federal University of Rio de Janeiro: undergraduation and graduation in Geography
- Head of Cartography Laboratory of Geography Department - UFRJ
- Advisor of 11 (eleven) doctorate theses; 25 (twenty five) master's degree theses; 32 (third three) monographs of undergraduated Geography course

RESEARCH LINES
Digital Cartography; GIS; Historical Cartography; Multimidia and WEB Cartography; Thematic Cartography

PARTICIPATION IN CONGRESS, SEMINARS
- Participation in 41 (forty one) several events

ADMINISTRATIVE POSITIONS
- Engineer – Geographical Army Service
Coordinator of undergraduation course of Cartographic Engineering; Coordinator of graduation course Automated Cartography; Coordinator of graduation course of Computational Systems Military Institute of Engineering
Head of the Laboratory of Cartography; Head of the Laboratory of Computer science; Coordinator of graduation Course of Geography Federal University of Rio de Janeiro
- Brazilian Society of Cartography
President of the Technical Commission of Geographical Information Systems; Member of the Deliberative Council; Vice-president technical scientific affairs
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PRIZES AND DISTINCTIONS
- Military medal of Silver; Medal of the Pacifier; Medal of Cartographic Merit degree of Oficial