

## **GEOTECHNOLOGY IN THE INCORPORATION OF THE NEW LOOK OF THE LANDSCAPE**

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**ABSTRACT** - This work is a collection for the Quadrilátero Ferrífero (QF), generated through the techniques of geoprocessing. The QF was chosen because it is a significant cultural heritage, landscape reference of Minas Gerais, and has several other sums that this region is, not only to the state, but also for the whole Brazil. The region is already been used like a laboratory of practices in the majors of geography, geology, engineering, architecture and others of Federal University of Minas Gerais (UFMG) and for researches and scientists' studies of the whole world. So, at first, the idea is to spread the collection of QF's digital cartography in the scientific community of UFMG, due to the easiness of communication with this group and due to the advantages that this one will provide for this public. Subsequently it is interesting that the collection spreads through other communities. The purpose is to provide the spread and availability of new technologies of digital mapping, with emphasis on the degree of communication products generated in the attempt to bring the perception of space and space represented to the real area, at the same time that awakens a new look to the landscape of the QF. Encouraging this new look at the landscape becomes necessary for there to be changes in the way of action and interfere in space. Before any intervention, need to knowledge. Once the digital mapping plays an important role in the face of this new look, since it is a feature that allows represent, interpret and contemplate the space by various forms. The resources of geoprocessing are technological important tools for the characterization of spaces. What justified in the present work, the usage of them for the composition of a rich base of data on Quadrilátero Ferrífero. The collection of the QF region will consist of the next elements: Map of the main roads / highways, paved and not paved; Map of the main dams; Map of the main hills; Map of the geological aspects; Map of the hydrospeeling; Map of the municipal divisions with its main headquarters; Map with the urbane stains; virtual navigation of several notable points (main mountain ranges and landmarks referential systems); Images 3D of the MDE of the QF, of several sights; Movie of the MDE; Set of current photos on the scenery of the QF; ancient Drawings carried out by explorers on points referential systems of the QF; The archive of the MDE in the extension MXD; The present article, like conceptual basis. The relevance of the collection consists in the fact that it was well-founded in the reflections about the search results that we have recently developed, which aims to optimize the

resources of digital cartographic and topographic representations, from the spatial perception of the user. The preparation of the Collection for the Quadrilátero Ferrífero, through techniques of the geoprocessing, became a challenge in the application of a new glance in mapping, which involves the very and appropriate recognition of what its scenery represents like cultural value for its people, and in the diffusion of a product that has a better interface with its user. It is hoped to have contributed with this work, for the diffusion and improvement of the representative cartographical/topographical techniques produced through the geoprocessing, besides providing the necessary stimulus to wake a new look for the topographical scenery of QF, in such a way that this one is better understood and consequently better preserved.

## 1 NEW LOOK AND NEW PROPOSALS

Since the twentieth century, the man started to lose the purely economic view and began to adopt a new posture of acting in the spaces fewer angrily and more harmonious. The man saw the necessity to break the logic of intervening without knowing, as after each interference, he was discovering the destructive impacts that he was causing in the space. This logic will only be modified when the man adopts a new posture before the look at the scenery. When he inserts a worthy glance of the real perception of the space necessities. It is necessary to know previously and then recognize, in each space, the values that each one represents, before taking any decision. It is necessary to stimulate this new look that sees the scenery under the concept of a quite cultural property of a people, which gives them identity and recognition of community, that is part of the history and culture of these people. According to the IEPHA (State Institute Historical and Cultural Inheritance of the State of Minas Gerais, 2008):

*“Cultural inheritance is the sum of the cultural goods of a people, which are valuable bearers that can be bequeathed to future generations. It is what gives it identity and direction, basic presuppositions so that it is recognized as community, inspiring values connected with the homeland, with the ethics and with the solidarity and stimulating the practice of citizenship, through a deep sense of place and of historical continuity.”*

Through this concept, it elucidates the necessity of realizing the landscape under this new optics, a new look. Especially because, without this optics and without the knowledge of the space, it will hardly be possible to preserve. To preserve a cultural good, according to IEPHA(2008), is to provide better quality of life and to guarantee the memory of a community that is recognized in these values. Therefore, the geoprocessing, as a set of techniques of abridgement importance among the sciences that deal with space data, develops an important paper in this sense. Although the digital cartography doesn't replace the man's straight surviving in the space, it contributes significantly to its understanding and analysis. It allows different forms of looking and of realizing a space or scenery. Before this, the present work prepared a proposal of topographical representation with emphasis in the area of the Quadrilátero Ferrífero (QF), a collection of maps, digital models of virtual elevation and reality of notable

points from the QF. The topographical landscape of the QF was chosen, for representing an invaluable value for the whole community involved. It's inserted in the mental image of its inhabitants, loaded of symbols and meanings for each one of them. It is an important cultural inheritance for its people and it's part of its cultural and historical identity.

Recently, we develop a research entitled “Perception of the topographical Landscape and graphic communication in geoprocessing ”. It's purpose was to discover the potentialities and deficiencies of geoprocessing's resources concerning its degree of communicability with the user, because it's known there are significant differences between the represented space and the perceived space, and that they do not always coincide with the real space. So, it was necessary to understand more about the resignation of human perception, how it varies throughout the time and if there are factors that makes it easy. For that, a long bibliographical revision was carried out about the subject of space perception. After this study, several tests were applied in different groups of users to evaluate the relation of geoprocessing's techniques with its users. For the first group the ones who need spatial representations were chosen: geographers, architects, tourismologist and geologists. For the second group people from other areas were selected, but with college graduation. And in the third and in the last group people from any area or activity were chosen, but without college graduation. For the execution of the tests, several digital models of elevation were produced, generate in the program ArcView, from expressive points of the natural and urbane environment of the city of Belo Horizonte and its region, and in different scales (local, municipal and regional). From the same places virtual navigation were also produced. At the first phase the perception of each individual was evaluated through the digital models without the virtual navigation. In the second phase, besides the models, virtual navigation was also used. Next, the results were analyzed. Briefly, they were:

- Models of cartographical / topographical 3D representation, promote higher understanding levels of the topography for the most of people, lay or not in this subject;
- The models 3D are great for understanding the relief, however they wake in some individuals lack of notion of scale, in other words, the notion of what it is being represented in the dimension is lost when the landscape open to question is not known;
- For who knows prior the subject, the preference is the sight of top (as well as the maps), because, besides having notion of all, synthetic, the individual understands better the topography;
- For the ones who were not used to look and to observe the topographical landscape, difficulties were observed in order to identify and understand the represented place;
- There were cases of altimetry inversion in the sights of top regarding the hypsometric classification. One checked that this fact can be tied to the difficulty of a user in realizing depth;

- The virtual navigation wakes stimuli that makes the topographical perception easy and it helps in the formation of the mental image;
- To have prior knowledge about the subject makes the individual acquire a bigger degree of perception between represented space and real space;
- The type of professional activity stipulates certain types of behaviors;
- Different groups realize in different manners.

A fact that attracted us attention was that the contemporary man, in his majority, is not used to look at the scenery. The ones that do not have the habit of realizing the scenery, did not manage to understand the cartographical representations, couldn't even identify which was the scenery represented in the model, even due to the fact of them being notable points of the scenery of their own city and region. Before the foregoing results the necessity of continuing with this study was seen through new proposals that should provide the diffusion and availability of new representation of data and the land surface technologies , with adjustments that optimize the resources of geoprocessing, at the same time that create instruments to wake the curiosity and the glance for Quadrilátero Ferrífero. In this case the preparation of the collection.

At first, the idea is to spread the collection of QF's digital cartography in the scientific community of UFMG, due to the easiness of communication with this group and due to the advantages that this one will provide for this public. Subsequently it is interesting that the collection spreads through other communities. The region is already been used like a laboratory of practices in the majors of geography, geology, engineerings, architecture and others of Federal University of Minas Gerais and for researches and scientists' studies of the whole world. The creation of this collection will make possible for the students to have several interpretations and analyses of the area before going to field- what will increase the degree of perception and learning of them during the practice, since when there is not the unexpected factor; the human being explores more the theoretical knowledge in the practical field. One knows that prior knowledge about the subject helps in the perception and understanding on it. So if the students have a collection of maps, 3D models and virtual reality of QF, they will obtain higher level of learning and success in their practice in field. So knowledge manages to get “from on tip” to “the other tip”.

## **2 SHORT CHARACTERIZATION AND IMPORTANCE OF QUADRILÁTERO FERRÍFERO**

The Quadrilátero Ferrífero (QF) is located in the state of Minas Gerais, in the southeast-center portion. In a more precise way its area has as limit the apexes: in northeast, the city of Itabira, in the northwest of Itaúna, south-east Mariana and in south-west the city of Congonhas. In this limit, the QF involves important cities like the capital of the state (Belo Horizonte), Nova Lima, Ouro Preto, Sabará, Itabirito and others. Its limit through the hills is in the north for Serra do Curral, in the east for Serra do Caraça, and for the

south tip of Serra do Espinhaço, in the west for Serra da Moeda and in the south for Ouro Branco's Hill.

Quadrilátero Ferrífero occupies an area of approximately 7000 Km<sup>2</sup>. It is characterized as a region of the Ancient Massif of Minas Gerais. It is a geomorphological structure that presents advanced levels of metamorphism. Its altitudes are quite elevated comparing to its boundaries, which have approximately 400/500m. The lowest parts of Quadrilátero Ferrífero, in the south-west of Ouro Preto, have altitudes of about 600m, while the highest parts located in the Massif Quartzítico of Caraça; have altitudes of about 2000m.

According to Fonseca *et al.* (2006), the QF is outlined by four regional topographically elevated structures, whose reliefs are supported principally by ferriferous formations and quartzites of the Supergroup Minas, besides hardened layer of oxides from iron and aluminium of tertiary age. This layers are rare formations and they represent high indicative of iron ore. It has 3 unities predominant litostratigraphics that go from Arqueano to Tertiary: Supergroup Rio das Velhas, Complex granite-gneiss and Proterozoico Metasediments of Supergroup Minas, Espinhaço and Itacolomi Group.

Quadrilátero Ferrífero has several important points that are worthsaying. It has geological importance because it's a region with geological resignations of Pre-Cambrian period. So it acquires relevance in this aspect because it preserves and tells the history of this period of the Earth's evolution.

It has economical importance for Brazil since the colonial period, when extraction activities of mineral resources were developed in this area, especially the gold. After the extraction from iron and manganese. Currently, the history of mining in QF has great economical value not only for Minas Gerais, but also for the whole country, since it's from QF, according to Spier (2005, apud Ruchkys, 2007:65), that comes about 60 % of the Brazilian iron ore production, one of the main products of Brazil's exportation. On the other hand, many mining companies have done explorations that do not consider the cultural, historical and natural inheritance that QF represents. So the landscape of QF is extremely marked by the mineral extraction along the years.

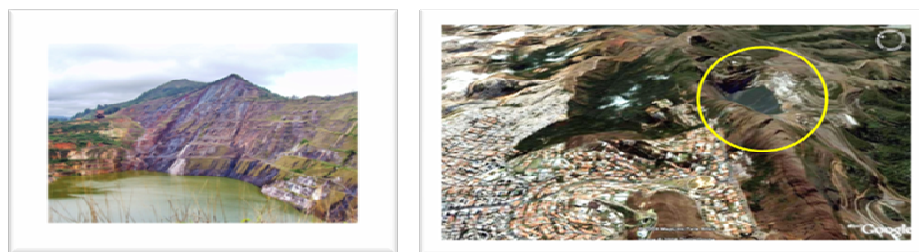


Figure 1: Environmental Impacts – Águas Claras Mining established in the Serra do Curral – Quadrilátero Ferrífero. On the left: photo of authorship of Breno Cota; on the right: source: Google Earth – 3D.

The touristic importance of the region is tied to several factors. One of them is due to the great natural, present inheritance in several protected areas of parks, like caves, waterfalls, rivers, rocky formations, vegetation of the scrubland, rock-painted fields and others. They are also inserted in QF, the Circuito do Ouro and the Estrada Real, important cultural inheritances that keep registers of relevant facts of the history. According to Barbosa and Rodrigues (1967 apud Ruchkys, 2007:65), the great quantity of cities and historical villages, the small agricultural areas, the railroad stations, the ancient iron and steel factories, the touristic attractions, among others, are factors that confirm the great historical and cultural value of QF. The QF is part of the life and memory of the ones who are inserted in it. It's a cultural property that is loaded of values and meaning for its inhabitants, it is extreme important to preserve it then.

The geoscientific value of QF is expressed in the quantity of studies carried out by important scholars of the whole world, since the nineteenth century, because it is owner of several riches and special resignations of this region. Up to these days, it wakes investigators' interest in varied kinds of subject. For this same reason, and for the easiness of access and location, the region has also got great educationally / educative importance. It is a laboratory for several disciplines of the geoscience like Geology, Geography, Mining Engineering and others, once the students can carry out works in field and observe countless phenomena that learnt in theory, in practice.

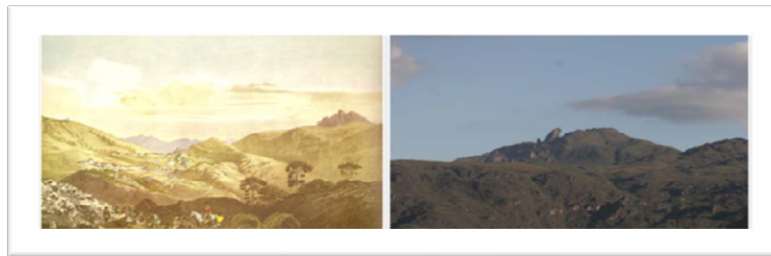


Figure 2: On the left: Villa Rica (in the back, Peak of Itacolomi) – Drawing of J.M. Rugendas, 1824; on the right: Current sight of Peak of Itacolomi. (RUCHKYS, 2007:117)

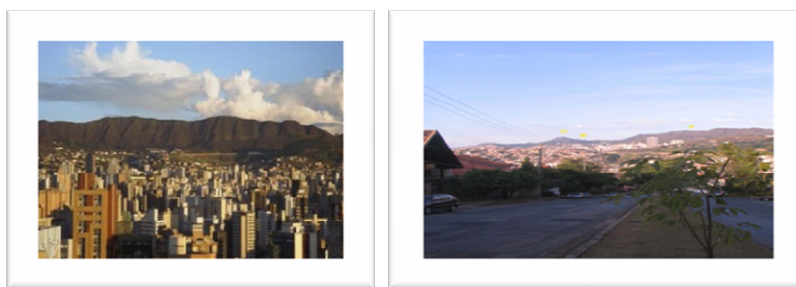


Figure 3: On the left: In the first plan the city of Belo Horizonte and in the back the special Serra do Curral, sight of front. On the right: first plan the city of Belo Horizonte and in the back the side sight of Serra do Curral- Photo of authorship of Débora Brier.

### **3 GEOPROCESSING AND THE CREATION OF QUADRILÁTERO FERRÍFERO'S COLLECTION**

The appearance of geoprocessing in the end of the twentieth century propitiated a revolution in the way of negotiating and analysing the space data. According to Moura (2005:8), the geoprocessing involves basically digital processing of images, digital cartography and the systems of geographical information (SIG). The SIGs are information spatially located, in other words, it allows the “management, analysis and automated representation of georeferenced data”. The author still adds:

*“The term Geoprocessing, came from the meaning of georeferenced data processing, means to introduce a process that swallows a progress, a floor forward, in the spelling or representation of the Land. It is not only to represent, but it's to associate this act into a new look on the space, a profit of knowledge, which is the information.”* (Moura, 2005:8)

This way, the relevance of geoprocessing is the fantastic capacity of management, storage and handling of georeferenced data and in the possibility of associations and different interpretations of the space in analysis, with an unable agility up to that time.

The Digital Models of land or digital models of elevation (MDE) are mathematical computational representations of a certain continuous phenomenon that takes place in a space especially located, produced in digital format. The MDE's allow more efficient and more complex analyses and with quick access for taking decision. They allow analyses of several visual points and without the necessity from the observer of working straightly in the place. Through the MDE, it is also possible to produce a series of maps (thematic, shady), to calculate areas, to draw profiles, to analyse different visual and environmental, and different impacts. Finally, it applies the analysis of any geophysical and geochemical fact, meteorological information, etc.

The resources of geoprocessing are technological important tools for the characterization of spaces. What justified in the present work, the usage of them for the composition of a rich base of data on Quadrilátero Ferrífero.

#### **3.1 Information about the collection**

The collection of the QF region will consist of the next elements:

- Map of the main roads / highways, paved and not paved; Map of the main dams; Map of the main hills; Map of the geological aspects; Map of the hydrospeiling; Map of the municipal divisions with its main headquarters; Map with the urbane stains; virtual navigation of several notable points (main mountain ranges and landmarks referential systems); Images 3D of the MDE of the QF, of several sights; Movie of the MDE; Set of current photos on the scenery of the QF; ancient Drawings carried out by explorers on points referential systems of the QF; The archive of the MDE in the extension MXD; The present article, like conceptual basis.





Figure 4: Map of Quadrilátero Ferrífero's collection.

The creation of the MDE from Quadrilátero Ferrífero has the purpose of each user using it according to his objectives of work and even to produce and to associate new information to the existent material, since the archive will be also available in the extension MXD, which is susceptible of being published, just for this purpose. From the archive MXD, the extension of the program ArcView, the user will be able to select the layers of each subject, as well as to do and add data on top of them.

The base of data, with which the maps were produced, made use of the image SRTM of the state of Minas Gerais, obtained by EMBRAPA, whose primary source is original from the mission of mapping from the land relief SRTM (Shuttle Radar Topography Mission), developed by the NASA (National Aeronautics and Space Administration) and NGA (National Geospatial-Intelligence Agency) of the United States in the 2000 year. The space resolution belongs to approximately 90 meters. Next there was done a cutting out of the region of the QF through the municipal limits that this region involves.

The coordinates used for the collection are in the projection in UTM (Universal Translator Mercator) and the used datum is the SAD 69, with 23rd South spindle / zone.

Besides the layers of information in shapefile format, for handling by those ones who dominate the tools, all the maps will be available, in PDF archive, with ready layout and



scales of 1:300.000 for aims of plot, justified by the format A1, aiming to facilitate the accessibility of them, since it will not demand technical specific demand in geoprocessing for part of the users, and to guarantee higher agility of consultation. These maps present the proper conventional and necessary elements to the cartography, like subtitles, graphic scale, northern, UTM network, fountain, authorship, date of its preparation, scale of the map etc. It's important to say that, besides these basic elements of layout, these products were produced by cares of the interface improvement between represented object, perceived object and real object.

Virtual navigation was done of notable points of the topographical landscape of QF, because these are important of space information. In spite of not reproducing the sensations and sensorial stimuli, only perceptible in loco, they are representations that have significant approximation with the reality.

Another important resource was the realization of flights on the MDE available in the form of a short movie. It is an additional resource that allows several types of uses for space analysis. According to the EMBRAPA (2008), there are some areas of applications of the resources of flights on the MDE: Analysis of agricultural production; Geological exploration; Environmental monitoring; Meteorological analysis; Hydrological modeling; Archaeological visualization and mapping; Modeling of forest; Architecture of condominiums and cities; Marketing.

To end, the set of detached images of the MDE, several drawings done by the first explorers of the region, besides several photos of important mountain ranges and notable points of the scenery of the QF, all with their proper reference, it is necessary to complement and to enrich the collection.

#### **4 FINAL CONSIDERATIONS**

When the man to wake a new look for the scenery and realize it in the correct way, he will not destroy it, since he will have developed the real conscience of what it represents for the humanity. In this sense, the importance that the digital cartography represents in front of new East looks at the scenery was seen.

The preparation of the Collection for the Quadrilátero Ferrífero, through techniques of the geoprocessing, became a challenge in the application of a new glance in mapping, which involves the very and appropriate recognition of what its scenery represents like cultural value for its people, and in the diffusion of a product that has a better interface with its user.

It is hoped to have contributed with this work, for the diffusion and improvement of the representative cartographical/topographical techniques produced through the geoprocessing, besides providing the necessary stimulus to wake a new look for the topographical scenery of QF, in such a way that this one is better understood and consequently better preserved.

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