THE CLOSE RANGE PHOTOGRAMMETRY IN THE DOCUMENTATION OF THE ROCKS ART. STUDY OF CASE ARCHAEOLOGICAL SITE SANTINHO NORTE I – SC/ BRAZIL.

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ABSTRACT

This work approaches the use of effective techniques of the close range photogrammetry and digital processing of images as documentation tools and analysis of archaeological sites. It was chosen as case study the archaeological site of the beach of Santinho, located in the city of Florianópolis (SC), whose location is the North side of the beach. The option for this area in subject is due to the following factors: the easy access, for its deteriorating state of condition, and for being the third archaeological site in number of rock art. The present work will have as central focus the use of the technique of the close range photogrammetry in the archaeological documentation of the rock art, which enables its necessary image registration. In order to accomplish this work, the researchers used: analogical camera and semi-metric PENTAX-Pams 645, properly gauged; scanner of precision Scai-Zeiss for films; software SSK for the restitution of the typed images; software Microstation for edition of the images.

1. INTRODUCTION

Located in the south of Brazil, in the state of Santa Catarina (SC), the city of Florianópolis is made up by an insular part and other continental one. In the Island of Santa Catarina were found copies of registrations rocks art that are petroglifos, that is, draws executed with aid of an instrument. These petroglifos were executed before Columbus societies that inhabited the Island of Santa Catarina. Those registrations are located in peculiar situation, because the archaeological site where they were inserted are opened sea beaches, in locations of difficult access, on its majority.of cases. The registration rocks art are an example of the archaeological site importance, because they are fundamental in the understanding of our past, as well as a contributive factor for the mechanisms ideological knowledge, psychological and religious persons of the before Columbus populations. Factors as erosion, vandalism and the lack preservation action, place in risk the integrity of the registrations rock art. This work approaches the use of effective techniques of the close range photogrammetry and digital processing of images as documentation tools and analysis of archaeological sites.

2. LOCATION

It was chosen as case study the archaeological site of the beach of Santinho, located in the city of Florianópolis (SC) the site in this analysis is located on the North side of the beach. (Figure 1).

Figure 1 – Archaeological site.

3. ROCK ART

The rock art analyzed were executed polishing technique on a spoilt diabasis. Polishing is an abrasive technique which results from the friction of an instrument against the rock. Orientation South to the side (Figure 2) it is the first registration that we found soon in the ascent of the Costão (rocky shoreline) its is not in good shape. Its form is described by many as log glass, composed by 8 parallel lines, that meets in the extremities superior and inferior. The 4 lines of the left have opposite undulations to the 4 lines of the right. They are found at other archaeological site variations in the format and in the size of this petroglifo.

Figure 2 – Rock art

The other petroglifos analyzed in this paper are in an only diabasis rock in which is made up by two separate registrations. In this rock the first art (Figure 3) is described by many

interprets as a net: four horizontal and ten vertical lines, the junction of those lines form quadrilateral. Ten centimeters below it is found the other rock art (Figure 3). It is made up by a parallel wavy on a vertical, that they form series with undulations of inverse phases, being the empty spaces that are in the middle of the series, they are crossed by horizontal straight line.

Figure 3 – Rock art

4. PHOTOGRAMMETRIC DATA ACQUISITION

4.1 Material:

-Pentax PAMS 645 medium format camera
-ZEISS Scanner SCAI -ZEISS Total station Rec Elta 14C
-Kit SSK - Station Digital Photogrammetric:
-3D Lab' Wildcat 4000 Stereo Frame Buffer
-CrystalEyes – Stereo Kit
-3D mouse

4.2 Data Acquisition

It was necessary to accomplish initial tests in archaeological site to measure the difficulties in the photogrammetric data acquisition, because differently from the architectural constructions, the rock art are in wild and steep lands with little displacement distance between the photographed object and the photographic camera. The software SSK used in this work it is destined for aerial photogrammetric data acquisition, being possible to be used for terrestrial data acquisition from it is inverted the coordinates x,y,z, In the photogrammetric data acquisition a stairway of aluminum of 1.80 m height was used, which enabled the necessary height to obtain the angle of 90° between the pictured object and to focus of the camera, necessary for the processing of the images for the software SSK. (Figure 4)

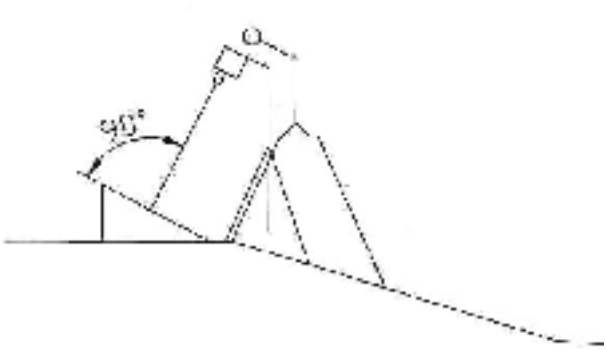

Figure 4 - Data acquisition

Four control points were used for each analyzed petroglifo, fastened in the extremities. There was not needed of the use of more control points. In order to obtain the needed stereoscopy between the taken pictures it is necessary that there is a encompassing of 60% or more between the images, for that, there was a displacement of 0,5 m of the left for right among the taken images. The information of the photogrammetric data acquisition form registered in a protocol, as well as, the accomplishment of an outline of the rising with the measures

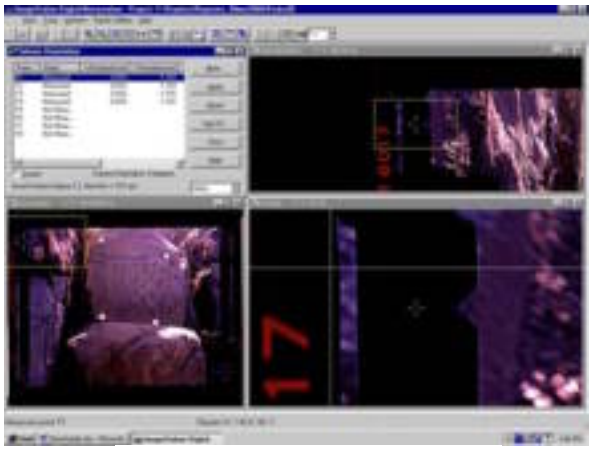

Figure 5 - Orientation Internal.

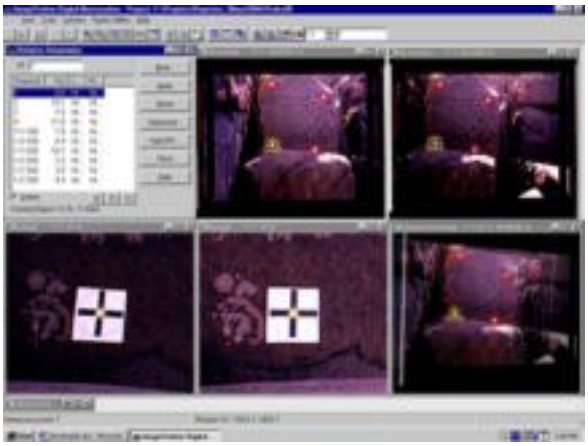

Figure 6 - – Relative Orientation

among the control points, necessary for I calculate him/it of the coordinates.

4.3 Restitution with ImageStation

The first stage for the images processing in the software SSK of Z/I Imaging is ImageStation Photogrametric Management - ISPM that is constituted of a photogrammetric manager projects, making possible data entrance to obtain the photogrammetric models, as matching of the metric photographic camera, the fidutial marks, the coordinates of the control points. Next stage is Imagestation Digital Photogrametric Mensuration
- ISDM the one where the measurement of the necessary points is accomplished for the orientation of the stereoscopic pair.
After ISFC the last stage is Imagestation Stereo Display is the graphic environment walks if it accomplishes the restitution work through a group of tools for the definition, threedimensional digitizing and edition of the graphic features. The work of three-dimensional restitution should be made with the aid of the visualization glasses 3D CrystallEyes ® Stereo Kit.
The following stage and Imagestation Feature Collection - ISFC is a series of tools of administration of the graphic features, in which is made up graphic attributes and alpha numeric attributes. For these attributes definition it is used the command Feature Table, that understands all the graphic definitions.
The obtained restitutions are edited in the auxiliary program

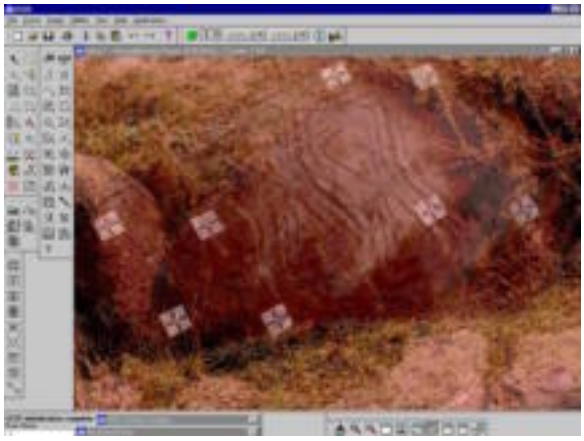

Figure 8 – The actual rock art

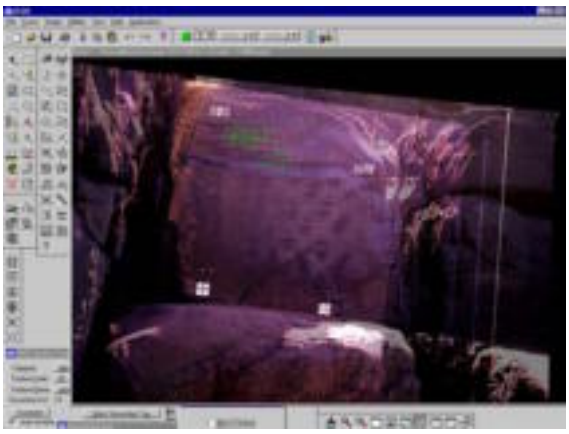

Figure 9 – 3D Model of rock art

MicroStation. MicroStation works in an integrated way with Imagestation Stereo Display - ISSD, that is, the measure that the image is restored in ISSD a same image it is generated in MicroStation.

5 - FINAL COMMENTS

The work shows the importance of the application of the close range photogrammetry in the documentation of the rock art. Mainly for being a documentation tool that doesn't need direct contact with the analyzed object which preserves its integrity. The generation of a 3D model in digital medium, accomplished through the measurements photogrammetric, allows us a three-dimensional documentation, besides a series of studies and simulations, such as: analyze its erosive progression, metric relationship of the lines and ways that it composes the petroglifo and metric comparisons with other petroglifos of the same or of other archaeological site. The software ImageStation SSK reached the degree of desired detail, milimetric level, in the documentation of the rock art.

REFERENCES

AGUIAR, Rodrigo Luiz Simas de. **Manual de arqueologia rupestre: Uma introdução ao estudo da arte rupestre na ilha de Santa Catarina e ilhas adjacentes.** Florianópolis: Ioesc, 2002. 88p.

XIXth International Symposium, 30 September – 04 October, 2003, Antalya, Turkey.

ALTROCK, Priscila von. **Aplicações da fotogrametria arquitetural digital na documentação de edificações históricas – Estudo das obras do brigadeiro Joseph da Silva Paes, séc. XVIII.** Florianópolis, 2004. 180p. Tese (Doutorado em engenharia de produção e sistema) – Curso de Pós-Graduação em Engenharia de Produção, Universidade federal de Santa Catarina.

DALLAS, R. W. A. **Architectural and archaeological photogrammetry.** IN: K. B. Atkinson (Edit). Close Range Photogrammetry and Machine Vision. Scotland: Whittles Publishing. pg 283 - 302. 1996.

DOWMAN, I. J. **Fundamentals of digital photogrammetry.** IN: K. B. Atkinson (Edit). Close Range Photogrammetry and Machine Vision. Scotland: Whittles Publishing. pg 52-77. 1996.

FRYER, J. G. **Introduction.** IN: K. B. Atkinson (Edit). Close Range Photogrammetry and Machine Vision. Scotland: Whittles Publishing. pg 1-7. 1996.

HANKE K. **The Photogrammetric Contribuition to Archeological Documentation of Prehistory.** ISPRS - International Archives of Photogrammetry and Remote Sensing Vol. XXXIII, Part B5. Amsterdam 2000. pg 403.

KERN, Arno Alvarez. **A carta internacional da arqueologia e os critérios básicos para a intervenção em sítios arqueológicos.** Coleção Arqueologia. Porto Alegre, EDIPUCRS, nº 1, v.1, p.17-35, 1995-96.

MAVROMATI, D. et all. **Experiences in photogrammetric archaeological recording**. Commission V, WG 5. CIPA 2003 XIXth International Symposium, 30 September – 04 October, 2003, Antalya, Turkey.

VÖGTLE T. et all. **Photogrammetric Recording and Evaluation of the Market Gate of Miletus for Architectural Heritage Conservation**. Commission V, WG 5. CIPA 2003