

PREHISTORIC PAINTINGS IN BRESIL: A STUDY OF RED & BLACK PIGMENTS BY RAMAN MICROSCOPY

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Since Raman Microscopy is so well applicable to the non-destructive physico-chemical determination of geological/biological materials of archaeological interest, a new research project has started to examine parietal decoration in prehistoric caves of the Matto Grosso District in Bresil. Although the final objective is to carry out routine analysis in situ inside the caves using optical fibres and a remote sensor without any microsampling, the project has begun with the laboratory study of sub-millimetre microsamples scraped off parts of the paintings.

Cidade de Pedra
Como
Fazendinha
Ferraz Egreja
Vermelhos
Cipó



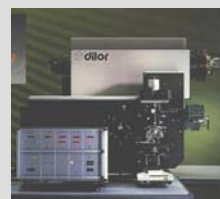
Micro-sampling in Santa-Elina

Program of analysis of the prehistoric pigments of Santa Elina and the sites of the Cidade de Pedra

◆ The first step of this program is a general observation of the various archaeological sites with the aim of visualizing the various parietal representations (thousands in the Serra das Araras) in an archaeological and artistic total unit.

◆ The second step consists in indexing the various tonalities of existing colours: black, white, purple, red, yellow, and different tone of orange etc. and afterward in the analyses in laboratory of the petrologic and mineralogical characteristics of the crystals. Indeed, the size of the crystals and their proportion in the mixture (pigment/support/dyer) can give certain indications on the mode of application and manufacture of the pigments by the Prehistoric man (mixing, drawing using a pencil, "crachis" etc).

◆ The third step consist in the purely physicochemical analysis of these pigments which will be done by Raman Microscopy (totally non-Destructive method), but also, by if it is possible, by other techniques of analyses such as X ray-Diffraction, MEB/EDX, IR or XPS.

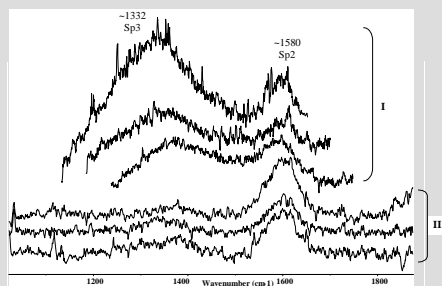


The Raman Microscope Dilor XY is one of the Raman instruments used in this project.

Results

The priorities of the analyses was based on the colour of the samples and was done in the following order of priority: white, black, yellow, purple, oranges and finally reds samples (the red samples having already been studied in 2001 and identified as being mainly composed of hematite Fe_2O_3). Nevertheless, five types of materials were identified and three of them are presented within this poster:

● **Carbon** identified in four samples: Antieira (A3, southern wall, supposed piece of coal & A13, black) and Santa Elina (St5, white & St13, beige, m41). The composition of carbon of the A3 sample makes possible an eventual dating by the technique of the ^{14}C .

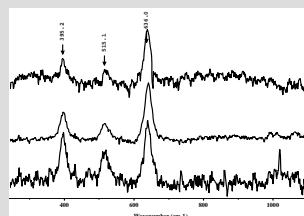


Superposition of the various carbon spectra identified in the Brazilian prehistoric sites. From up to down MBR26, MBR27 (Santa Elina), MBR21, MBR53, MBR51 (Antieira), MBR47 (Santa Elina).



Microphotographies of carbon crystals in St13 Santa Elina-left, St5 Santa Elina-middle and A3 Antieira-right- (x50).

● The second mineral identified is anatase (TiO_2 , polymorph of rutil and brookite). It has been observed in the microsamples of Ferraz Egreja (Fe_2 , orange circles, face N, panel I) and in the white "pencil" from Cipo (N°162). This mineral can have very variable colours from yellow, to orange, black, grey, etc. Anatase has a secondary origin and can be found in the cracks of gneissic or schist rocks in quartzite or limestone. Thus, its presence in the samples of Ferraz Egreja (Fe_2) doesn't indicate clearly its origin (from the wall or from the pigment itself?). However, it is clear that anatase is definitely a constitutive element of the white "pencil" of Cipo, such as the quartz.

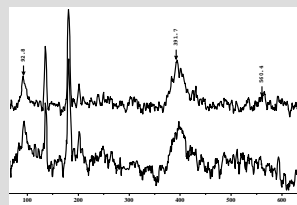


Raman spectra of anatase; from up to bottom MBR60, MBR62 (white "pencil"), MBR63 (Ferraz Egreja-)



Different red motifs of Santa Elina. Their analysis led mainly to a composition of hematite

● The third mineral species observed within this project is **goethite** ($FeOOH$). It has been identified in the samples St10 and probably in St13 from Santa Elina.



Raman spectra of goethite identified at Santa Elina in sample St10 (upper) & St13 (lower) (the very thin bands correspond to the laser parasite).



Two mineralogical species of hematite (left) and goethite (right) very commonly used by Prehistoric man in Cave paintings.

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