A secret of Mayan alchemy: how to turn a colorant into a pigment

SANCHEZ DEL RIO M. [1,2], MARTINETTO P. [3], DOORYHEE E. [3], SUAREZ M. [4], SODO A. [1], REYES-VALERIO C. [5], HARO PONIATOWSKI E. [2], PICQUART M. . [2], LIMA E. [2], REGUERA E. [6]

[1] European Synchrotron Radiation Facility, BP 220, F-38043 Grenoble Cedex, France

[2] Universidad Autónoma Metropolitana Iztapalapa, Mexico 09340 D.F., Mexico

[3] Laboratoire de Cristallographie, CNRS, BP166 F-30842 Grenoble, France

[4] Universidad de Salamanca, Departamento de Geología, E-37008 Salamanca, Spain

[5] Instituto Nacional de Antropología e Historia, Mexico D.F., Mexico

[6] Universidad de La Habana, 10400 La Habana, Cuba

Colorants used in antiquity are organic molecules extracted from plants and animals. They cannot be used in many artworks because they are not very stable over the years. They fad with light, age, pollutants and some of them react with other chemicals (oil, resins, substrates, etc.) of the artwork. Pigments made from minerals are very stable and always preferred for many artistic techniques (mural paint, oil paint, polychromatic pottery, etc.). The Maya have succeeded in “mineralizing” the indigo, the most common blue colorant well known by many ancient civilizations, by embedding it in a very particular clay mineral (palygorskite).

We present a review of recent studies about this pigment, known as Maya blue. We tested the stability of the pigment against acids, and performed synchrotron experiments (XRD, XANES) aiming to determine the structure of the pigment and palygorskite. μ-XRD and μ -XRF investigations performed at ESRF on archaeological mural samples of Maya blue suggest that the Maya also created a green pigment (the “Maya green” of Bonampak) with the same ingredients used in Maya blue. The synchrotron studies are being complemented by other laboratory techniques (FTIR, Raman and NMR) with the aim of understanding how indigo interacts with palygorskite, and why this compound is so stable.