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# Guanine - an unexpected organic pigment identified in the polychrome of the wood sculpture using the method of Raman microspectroscopy

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An investigation of polychrome of the wood sculpture Our Lady of Sorrows (1460-1470, Inv. No. P 6041, lime wood, h. 65 cm) was carried out in the chemical-technological laboratory of the National Gallery in Prague. The sculpture represents a late reminiscence of the work of a significant Prague sculptor, so called Master of the Týn Calvary active between 1420 and 1450 in Prague. His influential style spread out the Central Europe and very soon influenced a number of artists. The sculpture is characterized by simplifying of forms and rural style of carving skills.

Samples of the paint layers were taken and a complete chemical analysis was carried out. The cross-sections were prepared and pigments from the layers of polychrome were identified by using Raman micro-spectroscopy. In the sample (flesh tone) of the neck of Virgin Mary an organic interlayer was found between two pink layers containing common inorganic pigments. The comparison of the Raman spectrum of the organic interlayer with a specialized library resulted guanine ($C_5H_5N_5O$). Raman mapping (laser wavelength 780 nm, laser power 13 mW, exposure time 1 s, number of exposures 60, X step size 2,5 µm, Y step size 3 µm) was applied on the area where guanine was identified to see the position of the guanine layer on the cross-section.

Guanine layer has been never described on a polychrome sculpture yet. In this case guanine layer is probably a secondary historical treatment as the origin and time of this treatment is not clear. The layer is preserved fragmentally under repaint containing usual inorganic pigments (lead white, vermillion, chalk). The sample with guanine layer was taken on a boundary of flesh and silvered coat of the Virgin Mary, so it's possible that guanine was used for retouching the silvering.

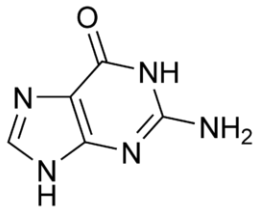


Fig. 1. Guanine

Guanine and little amount of hypoxanthine (3 - 24 %) together form natural pearl essence, the oldest nacreous (pearlescent) pigment. At first this pigment was isolated in the middle of the seventeenth century from fish scales by the French rosary maker François Jacquin. In the eighteenth century pearl essence was applied by coating in fish glue and simulated pearls were produced. Widespread use that occurred in the beginning of the twentieth century led to a development of cheaper synthetic nacreous pigments. At the present day natural pearl essence is used in cosmetics or for coatings [1]. In one case guanine coating was described in the interior of a hope chest from the sixteenth century [2].

Our unique discovery of guanine was enabled by applying the Raman micro-spectroscopy method, an analytical technique of a great use in the conservation science primarily in the field of pigment analysis.

[1] Greenstein, L. M. Nacreous (Pearlescent) Pigments. Pigment Handbook, 1st ed.; Wiley: New York, 1973; Chapter I-H, pp 871–890.

[2] Beltran, V.; Salvadó, N.; Butí, S.; Cingue, G. Micro infrared spectroscopy discrimination capability of compounds in complex matrices of thin layers in real sample coatings from artworks. Microchem. J., **118** (2015) 115–123.