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Zoology

Removal of ferric sediments from the museum alcoholic reptile specimens using Chelaton 3

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Abstract. A method is described to restore the museum reptile alcoholic specimens covered by corrosion crusts that accumulated as a result of inappropriate preparation.

■ **Restoration, reptiles, alcoholic museum specimens, corrosion crusts, Chelaton 3**

INTRODUCTION

Checking specimens from the Department of Zoology of the National Museum in Prague, it was found that some of the alcoholic reptile specimens are covered by quite massive surface incrustation of iron oxides. This damage was apparently caused by inappropriate material (iron wire) used for fixation of a label with the evidence number. As a result of the wire corrosion the alcohol solution had brown colour and continuous layer of corrosion products covered the stored museum specimen. The corrosion layer was so thick that the original colour of the reptile scales was completely hidden. In some cases, the corrosion layer penetrated through the scales and raised them up. The corrosion of the iron wire was probably caused by the water contained in the solution for preparation (30 %) and in the body of the animal specimens. Solution of Chelaton 3 (3 %) had been proposed for purification of organic materials from corrosion products in archaeological practice (Farke 1997).

Chelaton 3 agents are substances commonly used in analytical chemistry. They contain groups that react with cations to soluble complexes. Most complexons are polyfunctional α-amino-acids with at least two carboxyl groups, such as derivatives of aminoacetic acid, NH_2CH_2COOH. Currently the most common complexion is Chelaton 3, in particular a duodenum salt of ethylenediaminetetraacetic acid:

$$\begin{matrix} NaOOC\text{-}H_2C & & & & CH_2\text{-}COOH \\ & \diagdown & & \diagup & \\ & & N\text{-}CH_2\text{-}CH_2\text{-}N & & \\ & \diagup & & \diagdown & \\ HOOC\text{-}H_2C & & & & CH_2\text{-}COONa \end{matrix}$$

Its abbreviation is Na_2H_2Y, which in aqueous solution dissociates according to the equation:

$$Na_2H_2Y = 2Na^+ + H_2Y^{2-}$$

The anion H_2Y^{2-} produces stable complexes with divalent, trivalent and tetravalent metal cations. For our point the equation of divalent cation is important:

$$M^{2+} + H_2Y^{2-} = MY^{2-} + 2H^+$$

Complex of Fe^{2+} has logarithm of the stability constant log $K_k = 14.33$, consequently somewhere in the middle of the series.

$$(K_k = \frac{[MY^{2-}]}{[M^{2+}] \cdot [H_2Y^{2-}]})$$

Chelaton 3 $(NaOCH_2C)_2NH(CH_2COOH)_2$ is used in cases where there is a need to remove a metal layer on organic materials surface under mild conditions and for purifying organic material from the corrosion sediments and crust on archaeological metals. The effect of Chelaton 3 was also examined in laboratory conditions for cleaning heavy metals, which were deposited in the tissues of the living organisms (Nerudová et al. 1991).

In the archaeological investigation Chelaton 3 was used for gentle cleaning of flax fibre and ox hide to permit their further identification (Farke 1997).

MATERIALS AND METHODS

The specimens of the Ocellated skink *Chalcides ocellatus* (Forsskål, 1775) were chosen as an experimental object.

The samples of skin with corrosion crust and the sample of corroded fixative wire were examined by optical light microscope Olympus BX 40 with digital camera Olympus DP-12. A part of the metal wire was ground and subjected to powder X-ray diffractometry , using diffractometer Siemens D-5005 under following conditions: Cu K(radiation, 20 range 2–80° with step 0.02° /10s. Diffractograms were then processed using ZDS –System for Windows™ software (ZDS software for X-ray powder diffraction analysis. ZDS Systems Inc.) using powder diffraction file database PDFII (JCPDS 2002) for identification of crystalline phases (for the final diffractogram of the used wire see Fig. 1).

The incrustation was removed by two methods:

(1) A mechanical way. Due to fragility of biological material the incrustation was gently mechanically removed by brush-pencil and cotton clout. The first step was stripping corrosion crust by the capillary brush-pencil under running water. The residuals of the corrosion products were removed from the body of sepses by a cotton clout in the direction of their flakes.

(2) A chemical way. Three groups of specimens were processed: (i) In the first group, Chelaton 3 was applied in the concentration of 1–1.5 % for five days. This procedure was not found sufficiently efficient because of the long time necessary for the treatment and incomplete removal of iron oxides. (ii) The concentration of 3 % was applied for 2–3 days in the second group. The specimens were continuously inspected during this time. In addition the residues of corrosion products were periodically cleaned with a help of brush-pencil. After that time the specimens were taken out of the Chelaton 3 bath, washed with running water and put back into the 70 % alcohol solution. (iii) The concentration of 5 % was used only for surface cleaning by a brush-pencil.

RESULTS

The results of the mechanical cleaning procedure were not very satisfactory. The thickest crusts in the eye pits and in the body wrinkles were not removed completely. The chem-

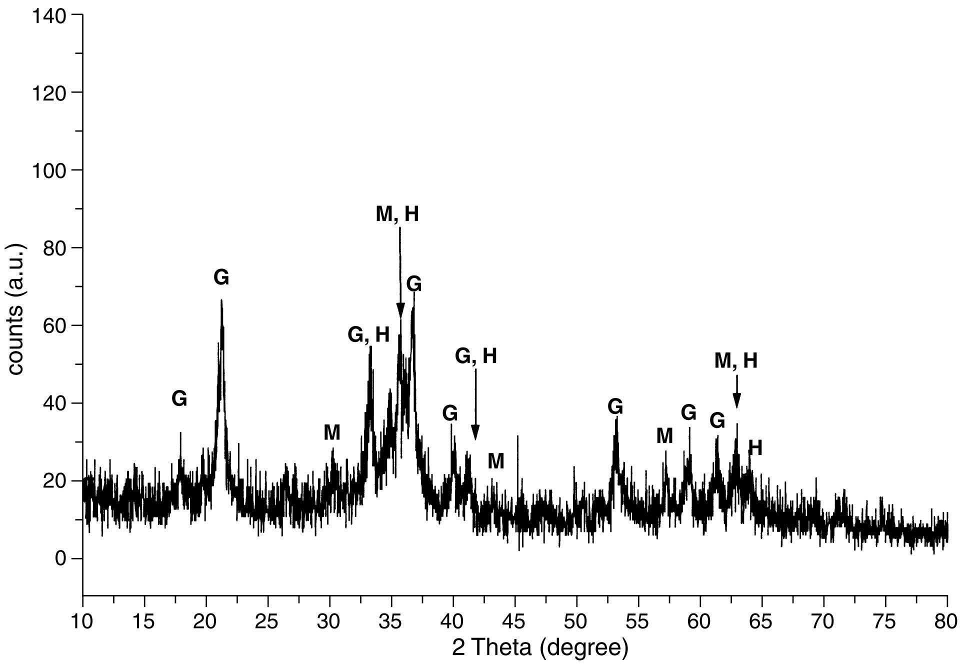

Fig. 1. Fig. 1. Diffractogram of the metal wire. G = goethite α-FeO(OH); M = magnetite Fe_3O_4; H = hematite α-Fe_2O_3.

ical way brought better results. The application of Chelaton 3 in concentration of 3 % was the most successful. The iron sediments remained only in the most affected places, but these residues were only visible by microscope. The skin of the skinks resumed its original colour, and the corrosion crusts were removed (Figs 2–5).

DISCUSSION

The presented results show that Chelaton 3 can be successfully used for removing corrosion crusts. Chelaton 3 does not damage organic material according to Farke (1997), Nerudová et al. (1991), Volka et al. (1995) and Vykouková (2002). These facts are also in agreement with our results. No visible changes were found on the preparations two years after their chemical and mechanical cleaning.

The successful application of Chelaton 3 seems to depend on the quality of conservation and the age of the herpetological material. Beside the above experiments, we performed another experiment with different reptile species (juvenile undetermined agamids). These voucher specimens were relatively old (collected in 1953) and insufficiently fixed. Their soft skin on the ventral side was very deeply penetrated by the corrosion products. After the removing from the 3 % solution, some specimens partly collapsed. It indicates that special attention must be paid to the effect of Chelaton 3 during the process of ferric sediments removement. Chelaton 3 is also used in histology as e medium for bone decalcification (Maat at al. 2001).

Therefore, using Chelaton 3 in conservation practice, we recommend first of all to eval-

Fig. 2. Voucher specimen of *Chalcides ocellatus* (NMP6V 83332/2) covered by ferric sediments.

Fig. 3. The same specimen (NMP6V 83332/2) after the process of cleaning by Chelaton 3.

Fig. 4. Detail view of the scales of *Chalcides ocellatus* before the process of cleaning.

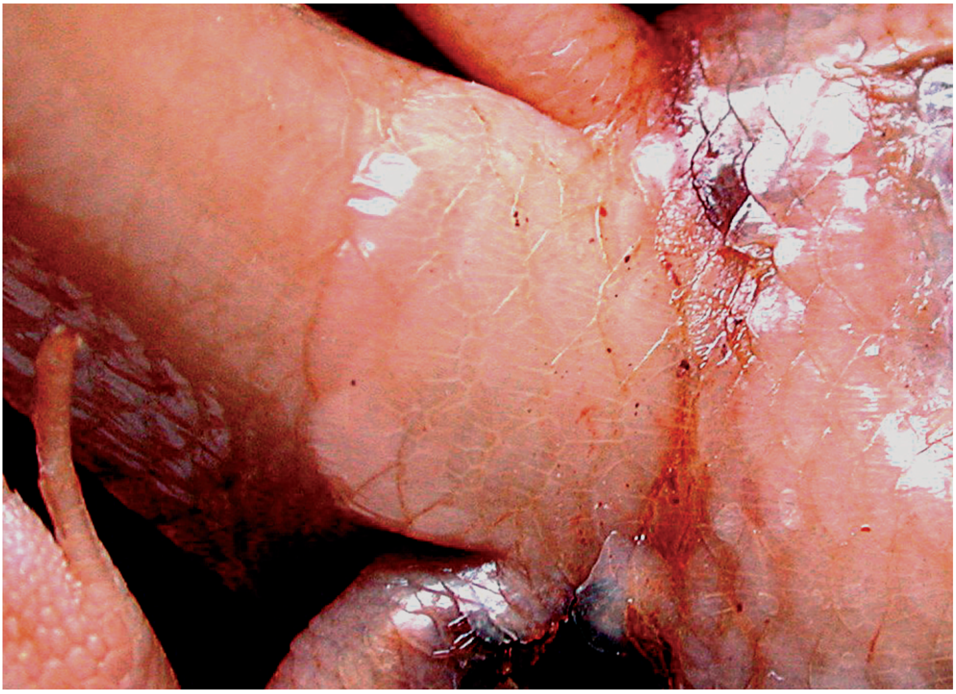

Fig. 5. Detail view of the scales of *Chalcides ocellatus* after the process of cleaning.

uate the level of material damage. The next step is the mechanical cleaning of the material under running water and then its immersion in the 3 % Chelaton 3 solution. After removing the residues of the corrosion products, the material should be removed from the solution, carefully washed, and stored in 70 % alcohol.

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REFERENCES

Farke, H. (1997): Příspěvek ke stanovení organických zbytků na půdních nálezech. – Metodický list, Zajímavosti a novinky z konzervátorské, restaurátorské a preparátorské praxe. 1: 98. Brno.

Maat, G. J. R., Van den Bos, R. P. M., Aarents M. J. (2001): Modification of Frost's "Rapid Manual Method". – Int. J. Osteoarchaeol., 11: 366–374.

Nerudová, J., Bláha, K., Sokal, A., Jehličková, H., Cikrt, M. (1991): Mobilization of Aged Cadmium from Isolated Rat Hepatocytes by Sulfhydril Chelators. – Polish J. Occup. Med. Environ. Health, 4: 349–358.

Volka, K. (1995): Analytická chemie I, II. – VŠCHT, Praha.

Vykouková, J. (2002): Organické zbytky na archeologickém předmětu. – Sborník z restaurátorského a konzervátorského semináře. – Technické muzeum v Brně, Brno.