

Projekt COST TD1201 „Colour and Space in Cultural Heritage“

(Riešiteľ: M. Hain)

V európskom projekte COST „Colour and Space in Cultural Heritage“ (Farba a priestor v kultúrnom dedičstve) sa riešitelia z ÚM SAV v r. 2016 aktívne zapájali do práce pracovnej skupiny WG2 a riešenia štúdie „Roman silver coins“. Na ÚM SAV boli rozvíjané a aplikované röntgenové mikrotomografické metódy na analýzu, testovanie a dokumentovanie historických artefaktov kultúrneho dedičstva. V projekte je zapojených okrem Ústavu merania aj mnoho významných vedeckých inštitúcií z 27 krajín Európy, pričom vedecký záber pokrýva oblasti multispektrálneho a hyperspektrálneho zobrazovania, rtg počítačovú tomografiu, skenovanie 3D objektov s využitím štruktúrovaného osvetlenia, laserové skenovanie, terahertzové zobrazovanie a ďalšie optické – fyzikálne metódy. Projekt bol ukončený na poslednom zasadnutí riadiaceho výboru v Mainzi, SRN v októbri 2016. Výsledky boli prezentované aj formou posteru na medzinárodnej konferencii Conference on Computer Applications and Quantitative Methods In Archaeology, Siena, Italy.



Multidisciplinary Analysis of Roman Coins

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Project

The project is an exploratory, interdisciplinary study of ancient Roman silver coins. The study involved examination and digitisation of the test coins. A range of non-invasive imaging and analytical techniques to identify and examine the properties and features of the coins, compare and evaluate the methods and multimodal results. This two-year study (2014-2016) was undertaken by a group of scientists, cultural heritage researchers, conservators and museum professionals participating in the European network, Colour and Space in Cultural Heritage, supported by the European Cooperation in Science and Technology between 2013-2016. This trans-domain COST Action (TD1201) is exploring high-resolution optical techniques, defining good practice and open standards for state-of-the-art documentation of material cultural heritage.

Roman Coins Case study

One case study is applying imaging and analytical techniques to digitise coins and evaluate 3D multimodal visualisation. Numismatic collections continue to rely on traditional documentation methods, predominantly black-and-white 2D photography. Such representations are not accurate in terms of dimensional and spectroscopic information.

Two ancient Roman silver denarii were selected as test objects to establish whether the proposed digital recording methods can support professional comparison of features and properties. The coins raise many interesting questions concerning their provenance, authenticity, design, purpose of issue and historic usage. They also pose considerable recording challenges due to their material and surface properties. The coins have been examined by the following techniques:

- Photography and focus stacking (Fig. 1. and 3.)
- Dome photography giving image sets for PTM/RTI visualisation and photometric stereo (Fig. 2 and 6);
- X-ray microtomography for detection of cracks or impurities (Fig. 8.);
- Scanning electron microscopy (SEM) for detailed surface investigation (Figure 8);
- Energy-dispersive X-ray spectroscopy (EDX) for elemental analysis (Fig. 7);
- Micro X-ray fluorescence (XRF) spectrometry mapping;
- Laser and structured light scanning for 3D spatial capture (Figures 5 and 7);
- Photogrammetry with structure-from-motion software
- Hyperspectral imaging for reflectance over wide range of wavelengths.
- Quantitative geometric comparison of 3D surface models (Fig. 9.)

The results will indicate the feasibility of such techniques for museum documentation and as contribution to scientific examination of coins in general. The target beneficiaries are numismatic researchers and scientists, historians, collectors, conservators and educators.

Publications/ Website

The COSCH project website is at: www.cosch.info.
The images and 3D datasets of the Roman Coins project and associated reports will be accessible via: <https://coschromancoins.wordpress.com>.

Results and analysis

Fig. 1. (title image) Obverse and reverse of two silver Roman denarii depicting Diva Faustina. The images were taken by a Nikon D200 camera using a single flash light to the upper left at an elevation of approximately 60°.



Fig. 2. Coin A, obverse (detail). a) RTI capture UCL dome; b) RTI capture Cyl dome; c) RTI capture RBINS Minidome, albedo mode; d) RTI capture RBINS Minidome, ambient mode; e) RTI capture Southampton dome; f) Focus stacked picture.



Fig. 3.: Coin A, focus stacking picture.



Fig. 4. Coin B was scanned without any surface treatment. Colour information mapped from an external camera using add-on software to AICON's scanning software.

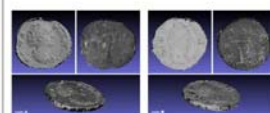


Fig. 5. 3D models of coins A (left; clockwise: obverse, awers and oblique views) and B (right; clockwise: obverse, awers and oblique views) acquired with the NextEngine laser scanner, at Cyl. Rendering in Meshlab.



Fig. 6. Coin A Photometric Stereo from Dome-Photography. Final reconstruction of Faustina A obverse, viewed in CloudCompare.

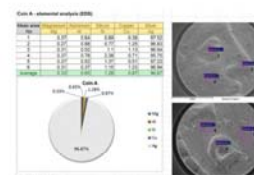


Fig. 7. Results of EDX elemental analysis of the Roman coin A.

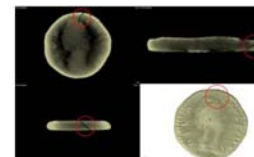


Fig. 8. Crack inside the Roman coin A visualised by microCT method (three perpendicular microCT sections and rendered 3D model)

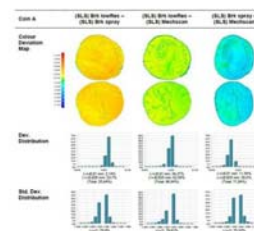


Fig. 9. Results of the deviation between pairwise complete 3D models of coin A: Colour Deviation Map, Deviation Distribution of points and Standard Deviation Distribution of points.



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