



THE MULTISPECTRAL PORTABLE LIGHT DOME: DOCUMENTING THE EGYPTIAN EXECRATION FIGURINES OF THE ROYAL MUSEUMS OF ART AND HISTORY, BRUSSELS

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The execration figurines of the Royal Museums of Art and History (RMAH, Brussels) were discovered at Saqqara in the 1920s.¹ The collection comprises over a hundred (fragmentary) figurines and three small rectangular coffins, all made of unfired clay and dating to the late Middle Kingdom. The figurines are covered with execration texts: hieratic inscriptions in red or black, listing names of foreign places, rulers and/or individual enemies.² By focusing on the direct neighbors of Egypt—Libya, Nubia and the Levant—as well as on Egyptian enemies, these figurines are often regarded as crucial primary sources for our knowledge of the political geography of the region. Their study is mainly hampered by the poor state of conservation, while a second challenge is the only partial preservation of the ink traces, resulting in a great loss of information.

The figurines were selected as a case study for the Egyptian Execration Statuettes Project of the RMAH. The project is involved in the development of a multispectral, multilight and easily transportable imaging system, the Multispectral Portable Light Dome (MS PLD), in collaboration with the KU Leuven's Digital Lab and ESAT-VISICS.³ The MS PLD offers an approach requiring minimal handling of the object while delivering maximal output for research and conservation purposes. The system, originally developed for the documentation of cuneiform tablets,⁴ has now been adapted to create multispectral 2D+ images of small, decorated (and often fragile) artifacts. The relief and texture/color values are interactive data based on a recording process using infrared, red, green, blue and ultraviolet light spectra computed with photometric stereo algorithms.⁵

Preliminary tests on a selection of figurines with this system delivered very promising results. The readability

of the red inscriptions, representing the vast majority of the texts, was significantly improved, enabling the decipherment of parts of an inscription previously considered to be lost for good.⁶ The geometrical characteristics of the figurines can be interactively visualized by the viewer system of the PLD, enabling the study of the manufacturing process and other technical art studies (Fig. 1).⁷

While the main goal of the project is to develop new MS imaging techniques, it also includes a comprehensive analysis of the state of preservation of the objects, essential for the development of these techniques. Furthermore, the chemical composition of the clay and the pigments was determined by handheld X-ray fluorescence, confirming the presence of red ochre pigments and carbon black.⁸

It is generally stated in studies on the multispectral imaging of parchment, papyri and ostraca that black (carbon) inks tend to give the best results in the infrared spectrum, whereas visualizing red ochre inks is often problematic.⁹ The MS PLD tests on the clay figurines, however, indicate the contrary. The black ink inscriptions gave very poor responses in the infrared spectrum, thus confirming the new insights that carbon black pigments and clay have nearly the same reflectance response in both visible and infrared spectral bands. Therefore, the contrast between the pigments and the clay is not sufficient to distinguish zones with pigment from those without.¹⁰

Reaching its final stage of development, the entire collection of the Brussels execration figurines will be documented and the PLD tested on a wider range of materials. Further non-destructive analyses on the materials are also considered. The MS PLD project thus enables a renewed and in-depth study of this valuable collection by Egyptologists, archaeologists and curators.

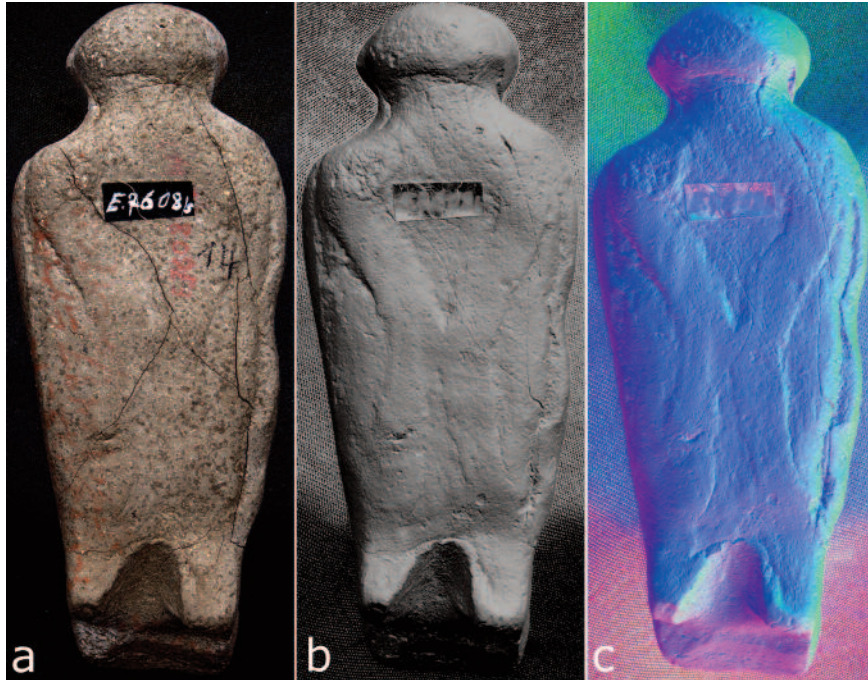


FIGURE 1: Verso of figurine E.7608. Interactive images produced by the PLD system reveal different aspects of the surface and topography/relief: a) color-sharpen filter, b) shaded filter, c) normal filter (© RMAH; PLD).

- ¹ For a detailed description of the origin and acquisition, see Georges Posener, *Princes et pays d'Asie et de Nubie. Textes hiératiques sur des figurines d'envoûtement du Moyen Empire* (Brussels: Fondation Égyptologique Reine Élizabeth, 1940) and Athena Van der Perre, Dennis Braekmans, Vanessa Boschloos, France Ossieur, Hendrik Hameeuw, and Luc Delvaux, "The Egyptian Excretion Figurines of the Royal Museums of Art and History, Brussels: Conservation, Pigments and Digitisation," *Bulletin des Musées royaux d'Art et d'Histoire, Bruxelles* 85 (2014) (in press).
- ² Partially published in Posener 1940.
- ³ Coordinated by Luc Delvaux (RMAH) and financed by the Belgian Science Policy Office (Belspo): BRAIN.be (BR/121/PI/EES) and IAP VII/14: Greater Mesopotamia.
- ⁴ Hendrik Hameeuw and Geert Willems, "New Visualization Techniques for Cuneiform Texts and Sealings," *Akkadica* 132/2 (2011): 163–178.
- ⁵ Athena Van der Perre, Hendrik Hameeuw, Vanessa Boschloos, Luc Delvaux, Marc Proesmans, Bruno Vandermeulen, Luc Van Gool and Lieve Watteeuw, "Towards a Combined Use of IR, UV and 3D-Imaging for the Study of Small Inscribed and Illuminated Artefacts, in *Proceedings Lights On... Cultural Heritage and Museums! Porto 2015* (forthcoming).
- ⁶ Van der Perre et al. 2015 (forthcoming).
- ⁷ Tests were undertaken on several objects of the Egyptian collection, e.g., a Fayum portrait (Athena Van der Perre and Hendrik Hameeuw, "La creation

- d'images multi-spectrales: les portraits romains du Fayoum," in Luc Delvaux and Isabelle Therasse (eds.) *Sarcophages. Sous les étoiles de Nout* [Brussels: Racine, 2015], 164–165), a Ramesside decorated vase (Lieve Watteeuw, Hendrik Hameeuw, Bruno Vandermeulen, Athena Van der Perre, Vanessa Boschloos, Luc Delvaux, Marc Proesmans, Marina Van Bos and Luc Van Gool, "Light, Shadows and Surface Characteristics: The Multispectral Portable Light Dome," *Applied Physics A* 122 (2016): 976. doi:10.1007/s00339-016-0499-4). The preliminary results provided information on underdrawings, previous restorations and the general state of conservation.
- ⁸ For a detailed report on the examination of the pigments, see Van der Perre et al. 2014. The clay analysis will be published in Dennis Braekmans, Vanessa Boschloos, Hendrik Hameeuw and Athena Van der Perre, "Chemical Characterisation of Ancient Egyptian Excretion Figurines through Non-Destructive X-Ray Spectrometry Analysis," (forthcoming).
- ⁹ E.g., Roger Macfarlane, Thomas Wayment, Stephen Bay and Gregory Bearman, "Exploring the Limitations and Advantages of Multi-Spectral Imaging in Papyrology: darkened, carbonized, and palimpsest papyri," in Vessa Vahtikari, Mika Hakkarainen and Antti Nurminen (eds.), *Eikonopoiia: Digital Imaging of Ancient Textual Heritage*, (Helsinki: Societas scientiarum Fennica, 2011), 95.
- ¹⁰ Van der Perre et al. 2014.