

Reconstructing the perishable: perspectives on the study of coffins at the Temple of Amenhotep II in Western Thebes

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Recent research undertaken by the Centro di Egittoologia F. Ballerini, under the direction of A. Sesana, has brought into focus the intensive funerary use and reuse of the area occupied by the Temple of Amenhotep II in Western Thebes. Twenty-four shaft tombs with one or two irregular chambers at the bottom dating to the Third Intermediate-Late Period were discovered. The work conducted by our team also revealed the presence of funerary structures that predate the construction of the Temple, dating from the early Middle Kingdom to the early Eighteenth Dynasty: two corridor tombs and less complex burials in niches, shallow shafts or simple holes. Despite the extensive looting of many of these tombs, we still had, at times, the chance to recover well preserved or undisturbed burials.

The funerary chambers of these tombs were usually cut in the layer of compact sand that in this area underlies the higher levels of conglomerate and tafлах. This geological situation and the proximity of the Valley caused the coffins, along with other perishable materials, to often be badly damaged by humidity and by the actions of white ants. Hence they were often preserved only as brownish or whitish imprints in the sand. However, careful excavation allowed us to sketch their original shape, to hypothesise the presence of one or more containers

and to reconstruct the spatial relationships within the assemblage.

Sometimes, more remained: areas of different coloured powders revealing details of the original decoration, figures and texts, hieroglyphs showing the name or title of the dead person, and, rarely, a quantity of gold leaf or a pair of inlaid eyes. The total disappearance of the organic materials – linen or wood – that once supported plasters and pigments, and the sudden deterioration which these typically suffer once they have been exposed, make the consolidation and preservation of these vanishing traces almost always impossible, given the conservation interventions available on site.

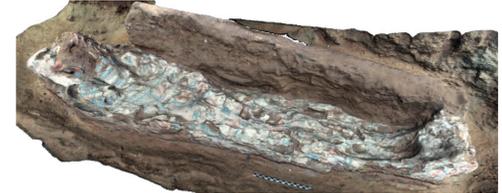
Due to the importance of coffins in establishing the “use-life” of these tombs and in revealing the identity and social status of the dead and taking into account the difficulties of conservation of these items, we devoted particular attention to recording the remains *in-situ*, going beyond the traditional techniques of drawing and photography.

During the excavation we also paid attention to all the aspects connected with the different forms and rates of deterioration of these containers, with the aim of understanding as much as we can about their original appearance.

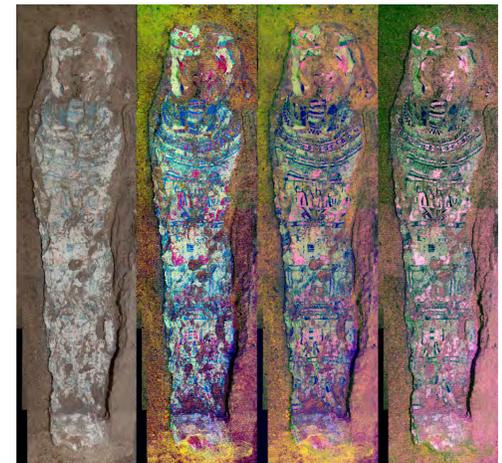
Other examples



Tomb F23. Context predating the construction of the temple, probably Second Intermediate Period-early 18th dynasty. Original photo of the cartonnage (left) and decorrelation stretch in colourspace LDS (right).



Tomb D21, Middle Kingdom -Second Intermediate Period, with a phase of reuse during the Third Intermediate Period. The cartonnage found in chamber E belongs to the 22nd dynasty. Remains of the outer wooden coffin, very deteriorated and with poor traces of the decoration of the face, were also present. 3D model of the cartonnage (top).



Original photo of the cartonnage and decorrelation stretch in colourspace LDS, YBK and YBG (bottom, from left to right).

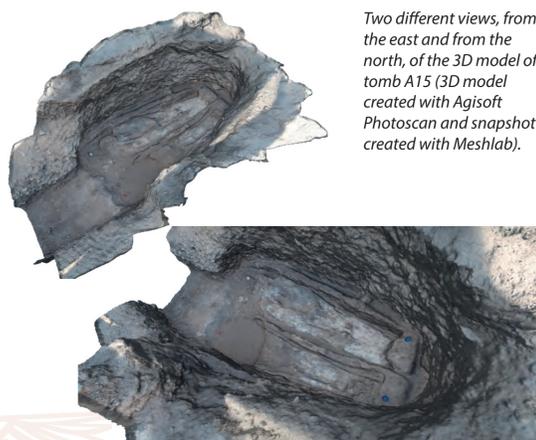
Recording workflow

1. From photorectification to GIS

The recording of coffins, cartonnages and the related human remains (still anatomically connected), as in any other context of archaeological interest, has been undertaken using photorectification and, when necessary, photomosaics. The item is documented with one or more zenithal photographs. The individual images are imported into special software and orthorectified. The image obtained has been georeferenced in the Temple project GIS and vectorised with all details needed for the creation of the final traditional plan already available in digital form. In this phase, one can thus document the shape, the ensemble and the position of coffins in their funerary context and in relation to other funerary equipment. The photomosaics thus allow us to have complete documentation, including photographs, of the excavated area.



Tomb A15. Context predating the construction of the temple, probably Second Intermediate Period-early 18th dynasty. Photorectification of the two coffins and cartonnages (top, left) and of the TT94 (bottom, left). Digital plan of the whole context (right), generated with the GIS software.



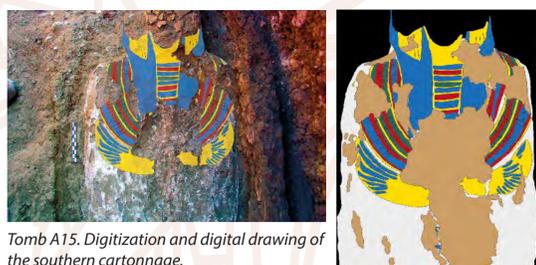
Two different views, from the east and from the north, of the 3D model of tomb A15 (3D model created with Agisoft Photoscan and snapshot created with Meshlab).

2. 3D modeling

From the 17th field season on, we began testing Computer Vision techniques based on “Structure from Motion” – which are tools that generate high resolution three-dimensional models from photogrammetric processing of sets of digital images – in order to create 3D models of the remains of the coffins. In addition to the traditional and digital field documentation, that is a schematic and interpretative drawing, the three-dimensional model can also be used for measuring the volume of the find and recording the state of preservation at the time of discovery. Moreover, in contrast to traditional photographs, a 3D model provides a comprehensive and high-resolution view of the archaeological evidence and can be explored at different levels of detail both during field activities and post-excavation analysis, guiding excavation and conservation strategies.

3. Colour transform

In most of the cases, the remains of coffins or cartonnages found in the area of the Temple of Amenhotep II have very weak traces of colour, almost invisible to the naked eye. To improve the visualization of decoration and painted figures, we started using the software ImageJ, with plug-in DStretch, written by J. Harman. This plug-in, that applies the image enhancement technique called decorrelation stretch, has been specially developed for the study of rock paintings and has been widely used in this field. It is now being exploited for the first time on artefacts in an Egyptological context. The final aim is to be able to gather as much detail as possible about the decoration and all clues that might aid in a reconstruction as close as possible to the original, no longer conserved or visible, item.



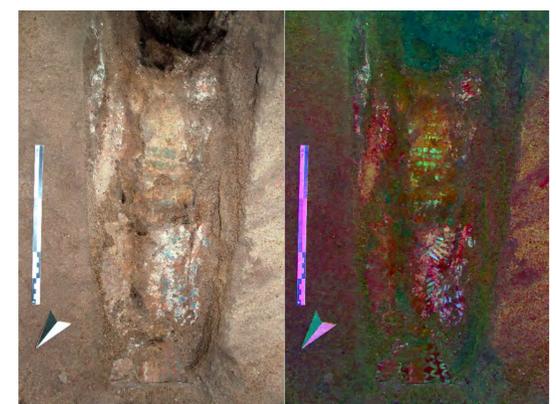
Tomb A15. Digitization and digital drawing of the southern cartonnage.



Tomb A15. Original photo of the southern cartonnage (top, left); decorrelation stretch in colourspace LAB (top, right), LDS (bottom, left) and YBL (bottom, right).

4. Digitization and reconstruction

With DStretch, we create some false colour images, that result from application of both default and modified colourspace. In fact, different colourspace enhance in a more or less marked way the overall look of the picture or a single colour. At the end of all these processes, starting with the superposition of the original photo and the enhanced images in a single image-editing software workspace, we begin drawing visible remains and then reconstructing the possible original decoration of the coffin.



Funerary shaft R11, chamber B. Third Intermediate Period (22nd dynasty), lower portion of cartonnage. Original photo of the cartonnage (left) and decorrelation stretch in colourspace CRGB (right).



Funerary shaft L13, chamber B. Late Period (26th dynasty ?), bottom of kheresu coffin. Original photo of the coffin (left) and decorrelation stretch in colourspace YRD (right).

Future perspectives

In addition to the approaches based on iconography and texts, we are particularly interested in exploring the technological aspects connected with the materials, construction and decoration of the coffins we found. In fact we have observed, along with the traditional wooden coffins and cartonnages, the presence of decorated “mud” coffins and cartonnages, which are also attested in the surrounding area, but with few parallels. Regarding the decoration, once the nature of the surviving pigments, which deteriorate in different ways and at different rates, has been determined, it would be interesting to confirm their presence – and maybe to reconstruct other parts of the decoration – through chemical analysis of their potential traces on the surfaces, even if nothing remained visible to the naked eye or could be identified through the colour transform techniques.

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Acknowledgements

We would like to thank Angelo Sesana, director of the excavations at the Temple of Millions of Years of Amenhotep II (Luxor, West bank) for permission to present this study. We also thank Dr. Craig Alexander for improving the English of this poster and Dr. Christopher Chippindale for introducing us to the use of DStretch.

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