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Standardised Mapping System for the Digital Documentation of Organic Materials on Metal Finds and In-Situ-Blocs

Introduction: Necessity for and development of the standardised mapping system

The corrosive layers on archaeological metal finds often contain remains of organic materials such as textiles, leather, fur, wood and feathers. These substances are usually severely decomposed and difficult to identify. Due, however, to the information they may reveal, they are important primary sources for archaeological research (Figs 1 and 2). Using suitable investigation methods, it is possible to establish manufacturing and processing techniques once used. Based on the sequential arrangement of the layers, it is even possible to reconstruct various details of clothing. Due to the severe fragility of these organic remains and due to the fact that any handling of the objects is a threat to the structural stability, thorough documentation throughout all steps of handling, from excavation to analysis, is of utmost importance. In order to ensure that all information relevant for research is preserved, it is necessary to record the position, orientation and context of each individual find during excavation (*e.g.* colour point marking on the upper side). This has particular significance for subsequent analysis, particularly with regard to grave context. Moreover, it is important that documentation of mineralised structures occurs during all conservation and restoration processes, to ensure continuous data collection of the organic remains. Conservation procedures include the cautious preparation of in-situ blocks, the stabilising of metal objects (*e.g.* desalination, consolidation), investigative conservation (*e.g.* partial exposure of

metal surfaces) and the actual restoration of objects. The data can only be considered in its entirety during the later scientific analysis if the exact organic makeup has been documented within its stratigraphy (Nowak-Böck 2010, 174-180; Nowak-Böck 2013, 131-143).

The necessity of systemising the form and content of the descriptive documentation has been mentioned in various publications (*e.g.* Walton-Eastwood 1983; Mitschke 2001; Gillis and Nosch 2007; Peek 2013a, 183-198; Peek 2013b, 37-44). Such methods are especially significant when dealing with sites rich in finds, when planning projects involving many parties and experts and when relaying scientific results to other disciplines. Loss of information and lacking data quality can be avoided by implementing a consistent approach. Furthermore, labour-intensive data collection alleviates work in the subsequent scientific evaluation and publication of the results.

In order to utilise the above-mentioned benefits also when mapping organic substances within metal finds, a digital mapping system has recently been developed at the Bavarian State Department for the Protection of Historical Monuments and Sites (BLfD) as part of a pilot project on early medieval finds from Unterhaching near Munich (Nowak-Böck *et al.* 2013, 156-185; 258-300). The system is based on the image processing software Adobe Photoshop® Version CS3. Consequently, this “prototype” has been further developed, employed in other projects, and could even be adjusted for a much wider range of applications (see *e.g.* Nowak-Böck *et al.* 2014, 98-110). The goal was to create an easily comprehensible, implementable

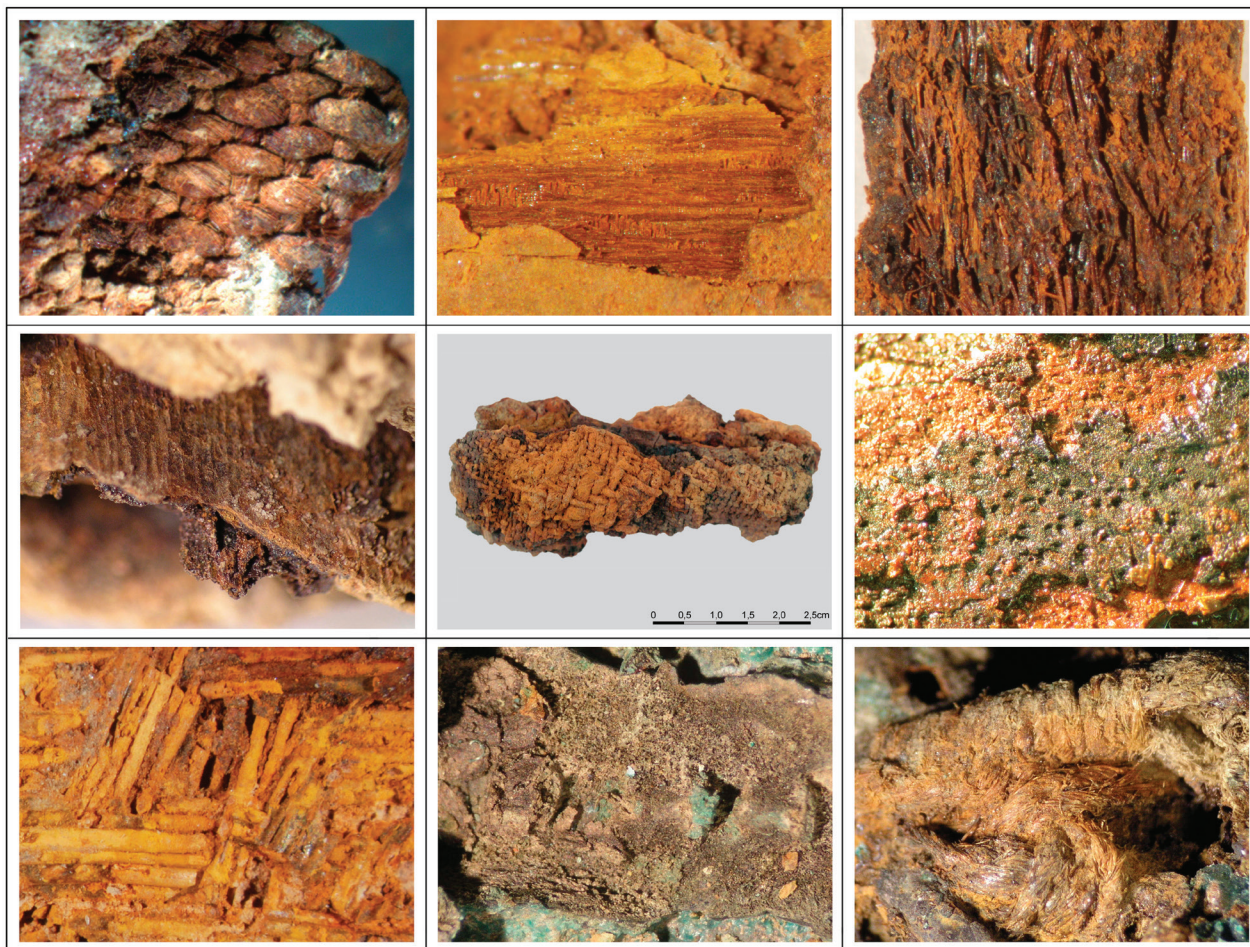


Fig. 1. Different organic materials on metal finds (from left to right): Textile, wood, fur, horn, multilayered textiles, leather, botanical residues, leather and loop (© Helmut Voß, Britt Nowak-Böck, Bavarian State Department for the Protection of Historical Monuments and Sites).



Fig. 2. Dürrlauingen, Lkr. GZ, grave 42: Front and back side of two strap-ends with organic residues (42.5f and 42.5e) (© Helmut Voß, Britt Nowak-Böck, BLfD).



Fig. 3. Example of use: Mapping of all organic remains on the metal finds of grave 42 from Dürrlailingen, Lkr. GZ: Iron buckles (42.3a, 42.5d), fittings (42.2, 42.3b, 42.5g, 42.5h, 42.5i) and strap-ends (42.2, 42.5e, 42.5f) of the belt 42.3 and the sword belt 42.5. Due to the fact that the fibre materials of the textile structures have not yet been analysed, the remains are depicted using the bright “extra” colour red (© Helmut Voß, Britt Nowak-Böck, BLfD).

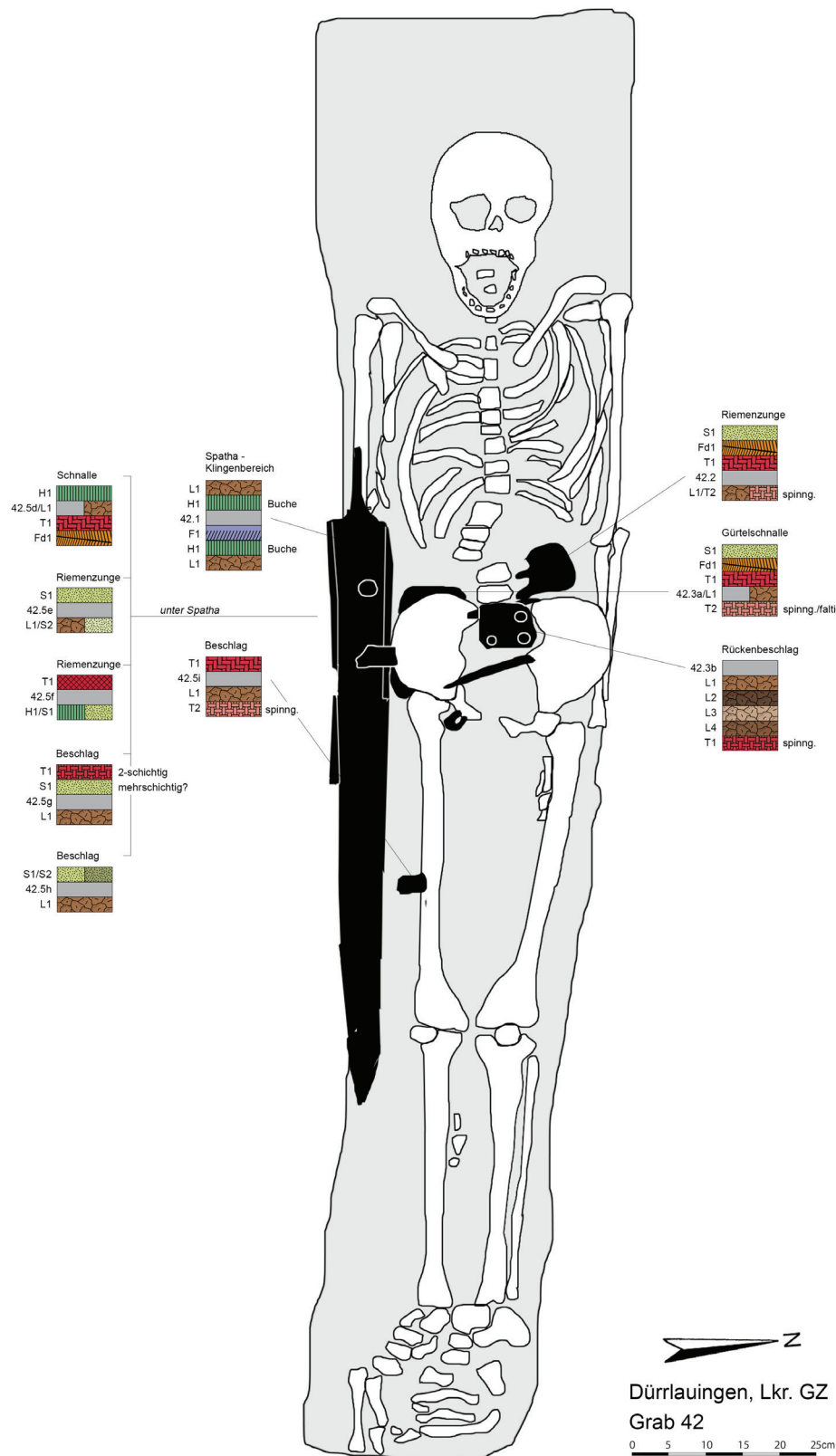


Fig. 4. Situation of grave 42 from Dürrlauingen, Lkr. GZ with all stratigraphic layer bars (for more information on the archaeological context see Neupert 2009). Here is also illustrated the sword (42.1) with the remains of the scabbard made of beech wood, leather and one-sided fur inlay (© Helmut Voß, Britt Nowak-Böck, BLfD).



and uniform mapping system for organic substances applicable to single finds and to in-situ blocks across various time periods. A standardised depiction with predefined colours, pictograms and acronyms enables easier understanding and optical comparison of pieces and complexes. Further reasons for the development were the adaptability of the standardised system to individual cases, and the possibility of recording and making easier amendments to detailed information gained during processing.

The application of the digital mapping system

The system consists of a planar map with a set colour code and a stratigraphic presentation by means of coloured pictograms. Schematically determined acronyms are used to identify the substances that are to be mapped (Figs 3 and 4).

Planar mapping with defined colours

To create a foundation for mapping organic substances, the objects must be depicted from the front and back, and if necessary also from the side. Rectified photos or drawings with clear outlines can be used for this purpose. These must be scaled according to actual size (for small finds usually 1:1). The find is depicted in

grey. Should two or more objects be joined together, these can be illustrated using various shades of grey. All organic residues are shown in their entirety and the different materials are mapped according to a standardised colour code. The most common mineralised structures are distinguished using nine different colours, each with one lighter and one darker shade (opacity is always 100%). The ranging shades of one colour are to show materials layered on top of each other. The colour values are complementary to each other and are within the colour range of Adobe-RGB and CMYK. This is very important for working on a computer screen and also for accurate colour printing. Three “extra” colours can be used for rare materials or for depicting substances that are specifically important to a certain project (e.g. silk, threads or entomological residues).

The course of organic layers around the edge of an object can be depicted in the planar view using predefined arrows. The direction of warp and weft (system 1 and system 2) in textile structures are identified using small crosses (Fig. 5).



Fig. 5. Defined Colour Code: Predefined colours (middle colour range) for various organic materials, each with a darker and a lighter shade (© Helmut Voß, Britt Nowak-Böck, BLfD).





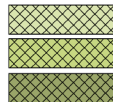


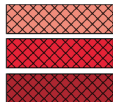
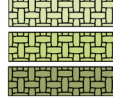
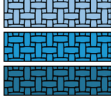
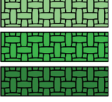
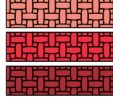
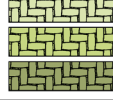





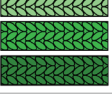
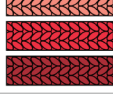
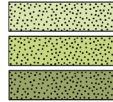
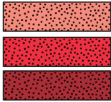
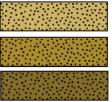
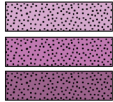
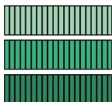
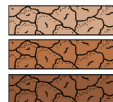
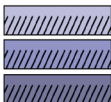
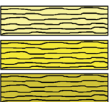








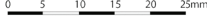

		front side up	front side down	fragment
object/find				
	non-specific material	wool/animal fibre	vegetable fibre	"extra" colour
non-specific textil				
plain weave				
twill weave				
tablet weave				
	non-specific material	"extra" colour	"extra" colour	"extra" colour
substance				
wood	leather	fur	bone	feather
				
	system 1	system 2	arrows	
				
	layer bar	split bar	split bar	
				
	north arrow	scale 25mm	scale 25cm	
				

Fig. 6. Table with symbols and coloured pictograms for stratigraphic depiction (© Helmut Voß, Britt Nowak-Böck, BLfD).



Stratigraphic mapping using colours and pictograms

The layers of organic structures contained on both the front and the back of finds are schematically depicted using layer bars when mapping stratigraphically (for more on micro-stratigraphical analysing method, see Hägg 1989, 431-439; for depictions, see *e.g.* Rast-Eicher 2012, 56-77). For finds containing very complex layering or for large objects (*e.g.* swords), depicting the stratigraphy at several different positions and creating additional detailed drawings and descriptions are recommended. The initial starting point is the find, which is represented by a grey bar. If the orientation of the object upon excavation was recorded, this can be shown using a bold line on the grey stratigraphic bar; this information is very useful for subsequent analysis. The bar for organic residues consists of material colour and pictogram. These are standardised for the following materials: leather, fur, bone/horn/antlers, feathers, wood and non-specific substances. To maintain clarity in planar object mapping, the use of pictograms has to be avoided; these areas are often too small to be able to easily recognise the pictograms. The pictogram for non-specific substances can be combined with different colours. For example one can use the neutral substance-colour (beige) when the substance is unidentified, or a bright “extra” colour (red) if a special or rare material needs to be shown for which a pictogram or colour has not been assigned (*e.g.* botanical residues). By using the substance pictogram and “extra” colours to vary combinations, the system can be adapted to suit individual cases.

Specified textile pictograms exist for the most common weaving techniques (especially those of the Middle Ages) such as plain weave, twill weave and tablet weaving. Again, to ensure clarity we have abstained from extra pictograms for derivations of these weaves (*e.g.* diamond twill). More precise information about the weave technique can be expressed using logical abbreviations noted to the right of the stratigraphic bar (*e.g.* in German: Rips – Rp; Panama – Pm; Köper – K 2/1 bzw. K 2/2 bzw. K 3/1; Spitzgratköper – Sgk; Rautenköper – Rak; “Rippenköper” – Rik; “Rosettenköper” – Rok; Fischgratköper – Fgk; Diamantköper – Dik; “Kreuzköper” – Krk; “Blöckchendamast” – Bld). This form of illustration enables not only a clear overview, but also allows the presentation of textile structures with varying degrees of information. Further characteristic details such as spin-pattern, fine, coarse or multilayered can also be noted next to the pictogram.

An unspecific textile symbol can be used for indeterminate or very rare weave techniques (*e.g.* weft-faced compound twill, patterned weaves or combined bindings) or also for other fabric techniques

such as sprang or netting. This must be assigned with a material colour and identified using an acronym.

If two substances are contained within the same stratigraphic layer (*e.g.* the sheath and handle residues from a knife), these can be depicted using a split bar. Any “non-planar” substances (*e.g.* single yarns or small leather strips) are not depicted in the stratigraphic view, but solely documented in the planar using the correlating acronym (Fig. 6).

Acronyms for identifying organic layers

Every substance must be assigned an acronym to ensure each of the mapped layers can be uniquely identified in documentation, photos or samples. The acronym consists of a letter for the material (*e.g.* T = textile, L = leather, B = bone, W = wood, F = fur, Ft = feather, S = (non-specific) substance) and a sequential number. The acronym is depicted to the left of the corresponding stratigraphic bar.

Field experience and advice to users

The standardised mapping system has already been implemented in various projects, including tertiary education for thesis research in both conservation/restoration and archaeology. The focus was not only on recently excavated and/or restored finds from the early Middle Ages, but also on prehistoric and post-medieval material.

Based on field experience gained so far, the advantages of a standardised system outlined above have been proven. Documentation quality was improved remarkably, as each researcher was forced to consider each object intensively. Although the preparation and creation of the map initially demanded more time and effort, this method led to a more efficient recording process. This effect became even more apparent when several people worked in different locations, at various times. This was the case, for instance, in projects with many phases, involving several restorers with diverse activities (*e.g.* for recording finds, conservation measurements, investigative conservation, restoration and analysis). A homogenous approach is a major advantage to projects like these that deal with large numbers of finds. It ensures the collected data is concise and greatly eases the subsequent compilation and analysis of the documentation. If aspects such as map documentation, the concluding scientific analysis and the publication of all results are considered from the early stages of a project, most steps of the process can be made easier and more efficient. For example, initial object photos should be taken distortion-free (avoiding wide angle), in focus and with a scale positioned at the height of the object. For analogue sketches it is important to ensure a solid line of

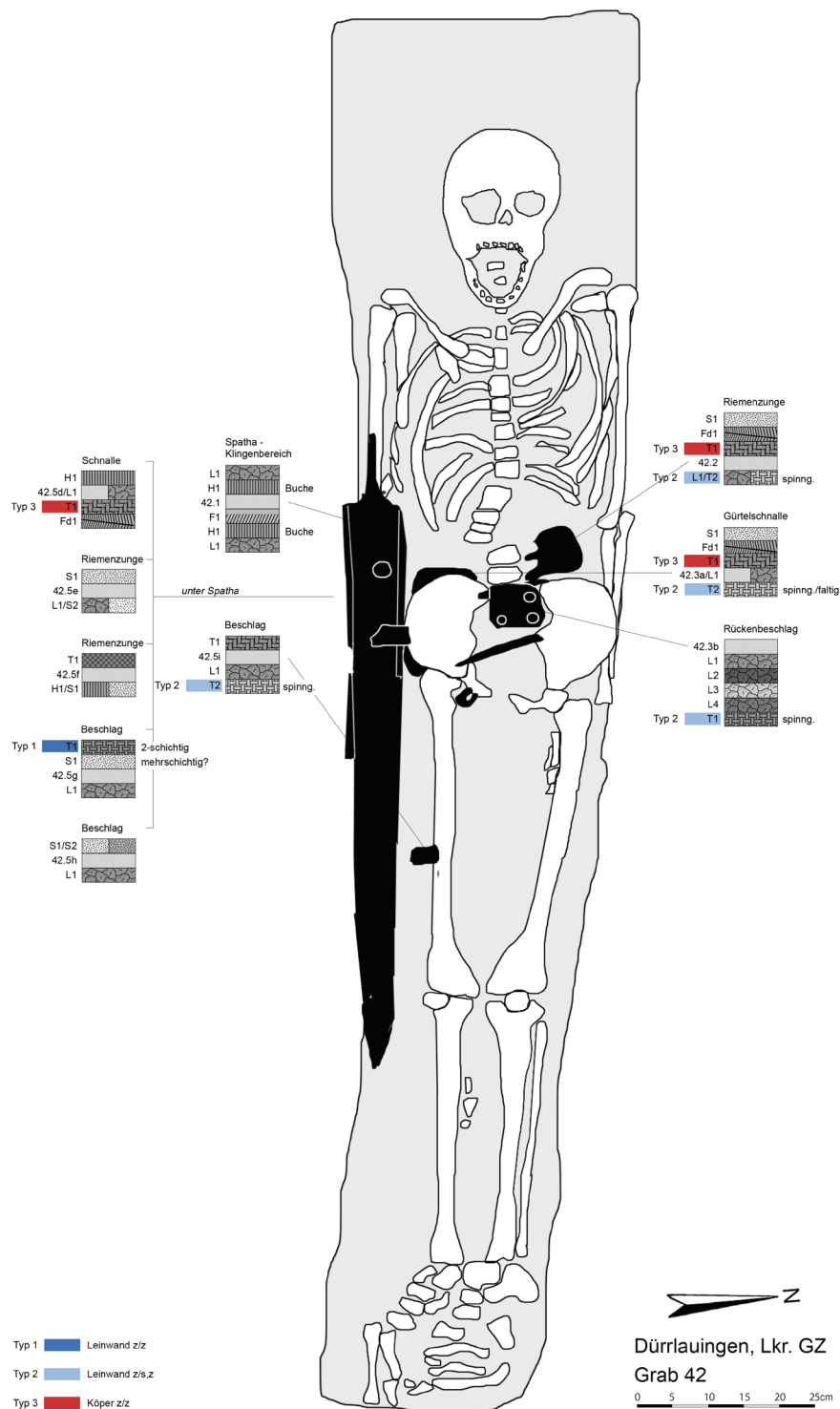


Fig. 7. Interpretation of the textile data and depiction of defined textile types in grave 42 of Dürrlauingen, Lkr. GZ: type 1 (plain weave z/z): located only on the fitting 42.5g, function unclear; type 2 (plain weave z/z,s, spin-patterned): especially preserved on the inner side of the belt (42.3a and 42.3b), maybe residues of a garment worn under the belt (tunic?), type 3 (twill z/z): preservation on the front side of the belt buckle 42.3a (recovered underneath the dead person), the strap-end 42.2 and as well under the sword 43.5d, possibly interpretable as an outer garment worn over the belt or as a relic of the bedding, because documented underneath the body and always in combination with feathers (© Helmut Voß, Britt Nowak-Böck, BLfD).



consistent thickness. These templates can be later used as a map foundation without requiring time-consuming editing. In most cases, digital mapping can replace the need for complex hand sketches. Moreover, the colour and pictogram of a given mapped layer can be added “with one click of the mouse” if new information is gained at a later date during material and textile analysis.

Furthermore, a standardised mapping system for organic materials is a significant aid when communicating and comparing organic finds. Images using colours and symbols allows even readers without expert knowledge to gain a quick understanding of very complex information. In this way, for example, a reader can quickly gain an insight into the distribution of repetitive stratigraphic sequences, the appearance of combined layers or certain substances within a grave. This consequently creates a sound basis for objective discussion of fact-based interpretations (e.g. closely related stratigraphic layers within diverse grave goods or the distribution of defined textile types within a site). In a further step these interpretations can also be shown using the mapping system (Fig. 7). The advantages outlined above have become more apparent the more consistently the system presented has been applied. Necessary project-oriented modifications can be achieved by combining predefined “extra” colours and substance or textile pictograms, so that additions to the system should remain an absolute exception. Detailed “Guidelines for Installation and Implementation of the Mapping System”, including helpful Plug-ins for Adobe Photoshop® and all fundamental settings, predefined colours and pictograms have been compiled to make implementation of this system as simple and consistent as possible. Additional automated actions offer even the inexperienced user practical help for planar and stratigraphic depiction (Fig. 8). All files and further information can be accessed free of charge on the BLfD homepage http://www.blfd.bayern.de/bodendenkmalpflege/restaurierung_archaeologie/index.php (“Kartierungssystem für organische Materialien und Kartierungsvorlagen”) or requested from the authors. An English version of the guidelines is currently being developed.

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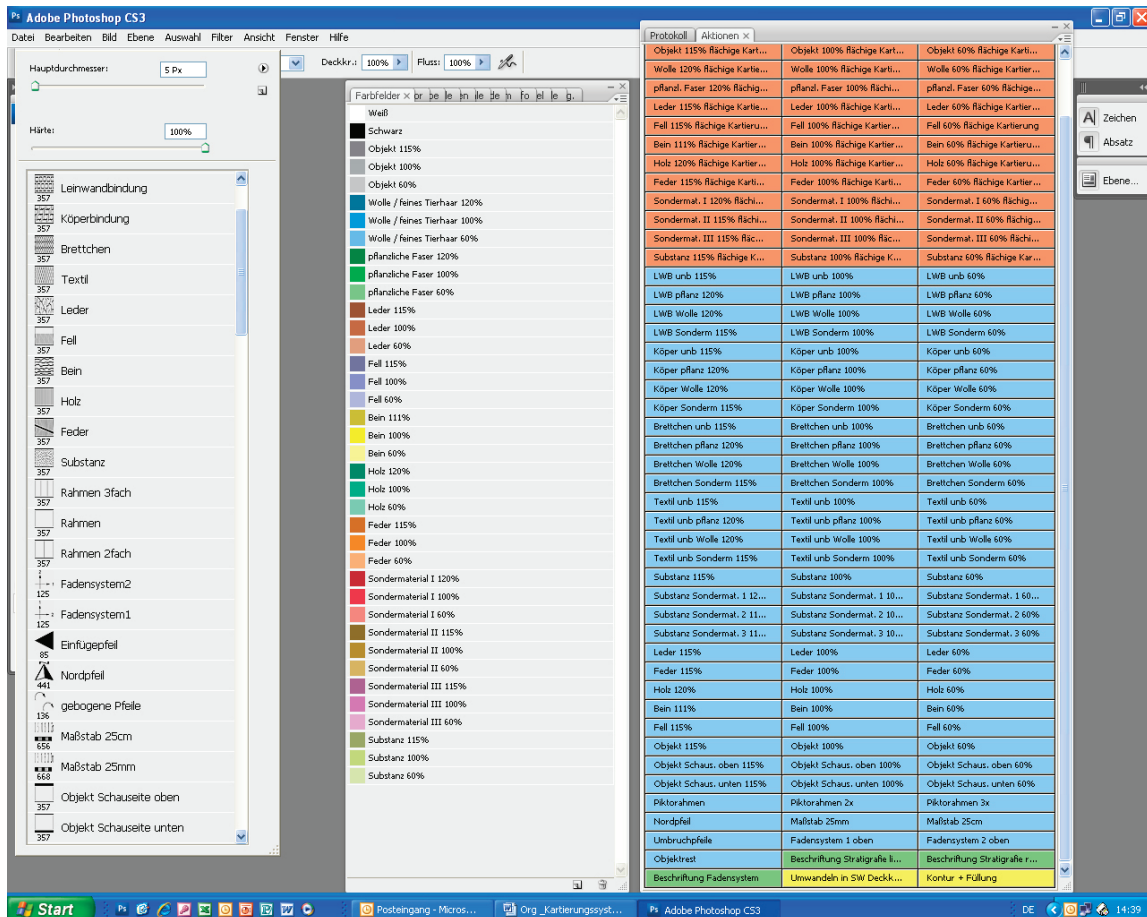


Fig. 8. Adobe Photoshop® CS3 Interface with standardised brushes, colours and automated actions (German version) (© Helmut Voß, Britt Nowak-Böck, BLfD).

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