

## THE ART OF MAKING IN ANTIQUITY stoneworking in the roman world

This essay and the others published on this website are intended to be read alongside and to complement the collection of images on the Art of Making in Antiquity website. References are made to images on the Art of Making in Antiquity website throughout.

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# Making the Art of Making in Antiquity

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*The Art of Making in Antiquity: Stoneworking in the Roman World* is a research-led academic project to create a web resource which appeals to a diverse audience and enables them to research, explore and learn about the tools, materials and processes used in the production of stone monuments.<sup>1</sup> At its core is the photographic archive of Peter Rockwell, a small part of which –around 2,000 slides– has been digitised. These record the activities of stoneworkers under the Roman empire and are one part of a slide collection assembled over a lifetime of study, undertaken alongside his main profession as an active stone carver in Rome and his involvement with the heritage community. The archive, as published online, goes beyond the Roman world by including various documentary and comparative materials which offer up a broader context for the core dataset. These images, essays and videos that bring to life the physical process of making, challenge both traditional approaches to the subject and our perceptions of the ancient artist-craftsperson.<sup>2</sup>

The systematic publication of a photographic collection makes this an archival project and, as such, the slides have been documented according to accepted standards.<sup>3</sup> Yet our approach is unconventional because we are working with the compiler, the person who best understands its nature and intended purpose. The output, therefore, is a close collaboration between Peter Rockwell and the project team. The information pertaining to each slide was recorded during interviews which also produced less traditional metadata, all of which form the digital catalogue. The database itself was modelled around the process of carving, in all its aspects, which we were concerned with capturing and interpreting. A fundamental component of our approach to understanding the evidence for working practices was to analyse the primary evidence through the lens of practical craft experience. Peter Rockwell's expertise has been crucial and we have supplemented his knowledge by working with sculptors in the UK, trained in a different tradition, with whom we have made short videos and put on practical carving days as part of our public events in London.<sup>4</sup> These have engaged a wide interest group and created an appropriate context for the hands-on discussion of issues related to production.

Alongside these archival aspects run innovative research and the aim to create a website that encourages new studies of making. The essays engage with tools and processes as well as the relationship between object and maker. They are based largely on the materials published online, essentially our catalogue, and combine different perspectives from practice-based experience and academic research. Such an approach can be subject to numerous interpretative pitfalls. In particular, when assessing evidence from the Classical world, we have tried to remain conscious of historic changes in artistic practice and their effect on modern approaches to the carving of stone.<sup>5</sup> For example the invention of the

<sup>&</sup>lt;sup>1</sup> For a recent description of the project see Wootton and Russell forthcoming.

<sup>&</sup>lt;sup>2</sup> For a recent project, funded by the AHRC, on stone which presents different views on stone, see <u>http://www.stoneproject.org</u> (accessed on 07.06.2013).

<sup>&</sup>lt;sup>3</sup> Following metadata standards such as Dublin Core at <u>http://dublincore.org</u> or the Getty Vocabularies at <u>http://www.getty.edu/research/tools/vocabularies/</u> (accessed on 07.06.2013).

<sup>&</sup>lt;sup>4</sup> For more information about our events see our 'News' page at <u>http://www.artofmaking.ac.uk/content/news/</u>; we worked with Andy Tanser <u>http://www.andrewtanser.com</u> and Paul Jakeman <u>http://www.pauljakeman.com</u> (accessed on 07.06.2013).

<sup>&</sup>lt;sup>5</sup> Rockwell 1993a: 122; Palagia 2003; Claridge forthcoming.

pointing machine in the 18<sup>th</sup> century has led many scholars to misinterpret the function of measuring knobs on ancient statuary and apply anachronistic methods to ancient makers.<sup>6</sup>

As well as examining the historic use of tools, the project has been concerned with enhancing our understanding of the physical sculptural process in the Roman world and, in so doing, investigating the relationship between monuments and their makers. The intention has been to understand how and why particular tools were used and in what order, as well as how tool use changed according to material, location and period. The digital aspects of this project not only make such research possible but also facilitate the demonstration of these relationships. In particular the digitised slides have been annotated to make the link explicit between the image and the evidence; between a mark on the stone and the type of tool which made it, for example, and the way in which it was being used. Furthermore these pieces of evidence are ordered to clarify, where possible, the sequence in which they were made. This approach has great didactic potential and also unlocks a whole series of new research capabilities by enabling complex queries via our 'Advanced search'.<sup>7</sup>

The underlying structure which describes the process of creation had to be fixed in a formal manner but the digital environment into which this data is placed allows extraordinary flexibility to investigate and visualise the relationships between the various elements. The final website, therefore, offers a very different experience from consulting a paper publication about stoneworking, although if that is what you are looking for then these essays should fulfil that desire. We have not been constrained by the numbers of pictures we can publish and nor do the images become subservient to the text. The images can also be directly linked to our interpretations of them or to explanatory pages giving further information, either visual or textual, on the tools, processes, materials or places. Short videos provide a different form of contextualisation, whether interviews on particular subjects or demonstrations of carving in action.

The digital aspect of this project has required the careful definition of our terminology so as to ensure a standardised vocabulary of making which will allow navigation through all these different materials. In so doing the website provides the first systematic description of stone- working tools and proposes this nomenclature in a number of different languages. All together we hope that this resource will help people to engage with the subject of making, in this case the working of stone, in a way that encourages learning and new research pathways.<sup>8</sup> Its creation has been a collaborative effort between the project team, who are based in the Department of Classics and the Department of Digital Humanities at King's College London, and Peter Rockwell in Rome. It is the result of two years of work generously funded by a Research Project Grant from the Leverhulme Trust.

#### Project aims, approach and context

*The Art of Making in Antiquity: Stoneworking in the Roman World* considers objects as the documents of their own manufacture.<sup>9</sup> Inscribed on their surface or contained within them is a set of data enabling the reconstruction of the making process. Each action is treated as meaningful, forming a sequence which reflects decisions made by the craftsmen, and is related to their technical and artistic knowledge as well as their competence, training and materials. This complex interaction is legible through close observation of the surviving marks on the objects. The website is concerned with displaying and interpreting these individual pieces of evidence in their sequence as part of an extended carving process or project.

Crucial to our success is the identification of the evidence and accurate interpretation. For this we depend upon wideranging experience of contemporary techniques in combination with an understanding of their changes over time and their appropriate application to the ancient material record. This has given us multiple viewpoints from which to assess the archaeological record and avoid over-reliance on a single person's craft experience and a reductionist approach which might limit the range of tools or approaches available to the ancient craftsmen. This is intended to meet a historic problem that academic enquiry into artistic production has been largely undertaken by people with little or no practical experience of making.

<sup>8</sup> For a similar digital projects interested in craft, see the Leverhulme-funded Tracing Networks at <u>www.tracingnetworks.ac.uk/</u> (accessed on 07.06.2013); images of tool marks have also been published on Flickr, for example by the Institut français du Proche-Orient at www.flickr.com/photos/ifpo/sets/72157620663952811/ (accessed on 07.06.2013).

<sup>&</sup>lt;sup>6</sup> Ancient measuring knobs: PR210\_01\_14, PR246\_01\_04, PR301\_01\_08, PR307\_02\_21, PR312\_03\_19. Modern pointing machine: PR918\_01\_09, PR918\_01\_10, PR918\_01\_13. There is a short film available on our 'Essays & Videos' page at http://www.artofmaking.ac.uk/essays-videos/ (accessed on 07.06.2013).

<sup>&</sup>lt;sup>7</sup> Available at https://www.artofmaking.ac.uk/advanced-search/ (accessed on 07.06.2013).

<sup>&</sup>lt;sup>9</sup> Rockwell 1993a: 1–7.

For the most part artist-craftsmen did not record their thoughts on carving in written form, instead passing on their knowledge via the apprenticeship system. For this reason our close collaboration with Peter Rockwell, an expert stone carver who understands the various sculptural traditions, has been a fundamental part of the project.<sup>10</sup> Other artists have also been involved such as Andy Tanser and Paul Jakeman. With them we have been able to differentiate between marks made by different tools and also to understand that the same tool can be used in multiple ways to achieve different results and, in so doing, leave contrasting marks on the stone {Fig. 1}. Although the basic set of tools used by stone carvers has changed little since antiquity, there have been some subtle alterations and additions associated with particular historical moments. Carving is a complex process and its history can be misleading.

Peter Rockwell has been one of the leaders in the field publishing numerous articles and a book on stoneworking.<sup>11</sup> His work forms an important strand in the scholarship of academic texts written by practitioners, which this project builds upon. The publications of Bessac and Pfanner also rely on personal and practical experience.<sup>12</sup> Bessac, for example, offers extensive discussion of tools in their regional context, although not always associated with their respective marks. His earlier publications focused on northern Europe while more recently he has published extensively on material from Jordan and Syria.<sup>13</sup> Rockwell, Bessac and Pfanner provide new perspectives on stone monuments that complement and extend the existing literature, predominately written by art historians. They also demonstrate that practitioners are the best guides for identifying the toolmarks visible on ancient carvings and interpreting what these reveal about how they were made. This is because they are used to working in a wide variety of stones and are aware of the ranges of tools in existence.

By his own admission,<sup>14</sup> Peter Rockwell's work has been influenced by one of his American teacher's adherence to direct carving and also his reading of the English edition of Blümel's *Greek sculptors at work*.<sup>15</sup> Both of these were antithetical to some of the other training he had received in the United States in the indirect production of sculpture via models and the pointing machine. As Claridge points out, the English version of Blümel's book is a summary of the original German publication, *Griechische Bildhauerarbeit*,<sup>16</sup> in which the author also shows how greatly he was affected by the division between direct and indirect carving, the former very much a reaction to the latter and practiced by famous carvers such as Brancusi, Epstein, Gaudier-Brezska, and Gill amongst others. In his analysis of ancient carving, Blümel draws direct parallel with the state of sculpture in the twentieth-century, distinguishing between Greek work done directly and Roman sculpture indirectly, involving a reliance on the copying of models. Although these categories were very much the result of his own historical context and do not hold true, Blümel's influence looms large on the development of the subject, and rightly so.

Blümel was one of the first scholars to highlight the value of unfinished stone objects, recognising that finishing sculpture involved the erasure of the evidence for production. On these pieces he interpreted the surviving marks, connecting them to tools used and the sculptor's methods. Less convincing to us, however, are the links made between these observations on technique and changes in style, an approach associated with the desire to periodise art. Casson and later Adams also concerned themselves with Greek carving, with the Roman material remaining largely neglected.<sup>17</sup> Adams' work continued to test assumptions about tool use, in particular whether tools and techniques remained the same over time. Her book takes care to describe the nature and function of tools before looking at a series of case studies. Although fundamental to the subject as we now know it, these steps were largely incremental and represent the occasional interests of art historian-archaeologists. Sculpture, in particular, remained the domain of the academic with art historians mostly concerned with the work of 'great' artists, and a desire to attribute surviving statuary to sculptors named in the ancient literary sources, with the focus placed squarely on 'the Greek' and 'the Classical'. Roman sculpture continued to be perceived in terms of the 'copy' and, hence, of less interest.

In the 1960s and 1970s new interests and approaches were developed which saw the publication of pioneering academic studies. Burford's work on Greek and Roman craftsmen examined who these people were, what their role in society was and their relationship to the patron.<sup>18</sup> Her sources were largely literary but a significant amount of epigraphic and archaeological material was included. At the same time there was real progress in our understanding of

<sup>&</sup>lt;sup>10</sup> For a recent collaboration between academic and artist, see Palagia 2006: xv.

<sup>&</sup>lt;sup>11</sup> Rockwell 1981–3; 1989; 1990; 1991; 1993a; 1993b.

<sup>&</sup>lt;sup>12</sup> Bessac 1986; 1988; 1993. Pfanner 1989.

<sup>&</sup>lt;sup>13</sup> Bessac 1997; 2008.

<sup>&</sup>lt;sup>14</sup> See the interview "Peter Rockwell and the analysis of stone carving" on our 'Essays & Videos' page at <u>http://www.artofmaking.ac.uk/essays-videos/</u> (accessed on 07.06.2013).

<sup>&</sup>lt;sup>15</sup> For a brief history of direct carving in the first half of the 20<sup>th</sup> century see Zilczer 1981. Blümel 1955; Claridge forthcoming.

<sup>&</sup>lt;sup>16</sup> Blümel 1927.

<sup>&</sup>lt;sup>17</sup> Casson 1933; Adams 1966.

<sup>&</sup>lt;sup>18</sup> Burford 1972.

materiality and production, some of which was connected to the emerging disciplines of ethnoarchaeology and experimental archaeology.<sup>19</sup> A key publication was Strong and Brown's edited volume, *Roman crafts*, which included chapters on various arts-crafts such as metalworking, ceramics, glass, mosaic, textiles, wood/leather-work and painting.<sup>20</sup> This not only focused attention on the Roman world but also, importantly for our project, included a section on the perception of the makers of marble sculpture -either as craftsmen or artists- and focused on their craft, the materials and their methods.<sup>21</sup> At the same time important new studies were published on stone carving techniques in provincial contexts.<sup>22</sup>

Other important studies on materials developed at this time. These were primarily concerned with the identification of the material, in particular the provenance, and their historic trade as part of the ancient economy.<sup>23</sup> The rapid increase in our knowledge of stone via archaeometric analysis has offered a broader understanding of how materials were acquired for making projects and also the types of materials, and their properties, that were selected for particular jobs. Scholarly interest in materiality has often gone beyond simple identification showing a strong connection with ideas of production.<sup>24</sup> All together, we would argue, these advances have led to the current academic environment where the social and economic aspects of art production are mainstream subjects central to publications such as those of Ling and Stewart.<sup>25</sup>

This is the context into which *The Art of Making in Antiquity* fits and it is this scholarship, to which we are indebted, that has opened up the subject to different audiences via their interrogation of new research areas with innovative scholarly approaches. Our project continues to build on this work by offering another way of presenting stoneworking and our own contributions to understanding the subject matter. In particular we intend to highlight the importance of the carver by assessing as precisely as possible their methods and motivations. This helps to understand the interrelationship between the historical moment, the knowledge of the individual, the material being carved and the desired end result.

We have also been concerned with giving greater resolution to the dynamics of making, especially the subtly and complexity of approaches to stone employed by individuals and/or groups of workers. The variety of different solutions to the carving of stone has become apparent; even in the same place and at the same time carvers adapted their skills dependent on their own preferences and the project in question. Therefore the identification of particular traditions on the one hand and clear chronological changes in technique on the other is very difficult, making dating on technical grounds alone exceedingly unreliable. As such we have tried to assess each individual case on its own merits with careful analysis on micro and macro levels, bringing together an understanding of the technical steps using particular tools within the production of a particular monument or object. Rockwell emphasised the notion of "the project", based on his own experiences of producing sculptural decoration to commission. The website reflects this interest and draws attention to carving within its broader context by including evidence such as quarry sites, thereby highlighting actions from material acquisition to the completed object. In addition, while the bulk of primary data relates directly to toolmarks, other evidence for working practices has also been documented where relevant. This includes guidelines or other measuring systems, clamp or dowel holes, traces of painting or plastering, and details which reveal how the work was organized and when it was completed.

Although the digital catalogue reflects the interests and work of Peter Rockwell, our stated aim remains to consider this material as part of a larger comparative analysis of carving techniques as they appear at different times across the Roman world. Therefore the research questions can be defined as follows:

- To assess the nature and value of evidence for stoneworking practices,
- To 'read' the tool marks surviving on stone monuments and associate them with the tools that made them and the techniques used,
- To identify the sequence in which these marks were made and, in so doing, investigate the processes involved in carving,
- To explore tool use as a chronological and regional phenomenon related to carving traditions, the availability of materials and the desired end results,

<sup>&</sup>lt;sup>19</sup> For example Hodges 1965.

<sup>&</sup>lt;sup>20</sup> Strong and Brown 1976.

<sup>&</sup>lt;sup>21</sup> Strong and Claridge 1976.

<sup>&</sup>lt;sup>22</sup> Blagg 1976; Colledge 1976.

<sup>&</sup>lt;sup>23</sup> For example Ward-Perkins 1971; 1980; Dodge and Ward-Perkins 1992.

<sup>&</sup>lt;sup>24</sup> Walker (1990), for example, combines analysis of materials and techniques, including images of toolmarks (figs. 15-17), in her catalogue of the sarcophagi in the British Museum.

 $<sup>^{25}</sup>$  Ling 2000; Stewart 2008.

• To examine the broader organisation of the work, whether the carving of a free-standing sculpture or of part of a large-scale monument.

Going beyond the Roman world, as Peter Rockwell's own photographic collection and interests do, we have been keen to explore and present comparative material in order to understand how stoneworking as a craft varied over space and time. As such we have also been interested in whether stoneworking was a highly conservative craft, as so many have asserted, or if it did change over time, adapting to meet new situations. We have engaged with material from beyond the Roman world to look for any signs of tools and techniques being transmitted between regions and see whether it is possible to trace patterns of influence over time. Material from Peter's archive provides a broad comparative backdrop and his material has been supplemented during our conferences –the papers of which are due to be published on our website– and also by the development of new research by the project team which can be found in the essays on carving traditions and carvers, and in our work, currently in progress, on materials from other provincial contexts such as Britain, Libya and Palmyra.

#### Data collection and analysis

Creating a large online resource to store, manage and present all of this complicated data while at the same time keeping it useable and of interest to a broad audience was not an easy task. From the start a working methodology had to be created for the collection and entry of the data which would facilitate the completion of the project within the short time period of two years. Data collection took place in Rome and was a highly practical and formalised process so that the information was captured in an appropriate form and could be easily found and referred to once the interviews were completed.

The first stage of this data collection process consisted of a full review of Peter Rockwell's slides.<sup>26</sup> The archive had its own system of numbering and was organised by geographic location and monument. In addition to this were Peter's own collections of images, for example for teaching, which were grouped slightly differently. As an archival project we kept this information, thereby retaining the archive's sequence and reflecting its development. The Roman material was selected along with comparative material deemed useful for providing context. In order to analyse this large dataset, the slides were then grouped together, usually by monument, and projected on to the wall of Peter's studio so that each could be discussed in turn. The audio of these interviews was recorded and a video was also made of the projected slides. A laser pointer was used to indicate precisely which details were important. This was crucial later when making the link between image and evidence.<sup>27</sup> During this activity the following categories were documented in a digital spread sheet: slide name, monument name, date of interview, audio and video filenames, timings, and notes recording the main points of the discussion.

The interviews focused on identifying the evidence for working practices visible in each image, in particular toolmarks, but there were no limits to the topics covered: materials and materiality, the identification of the tools used and their application by the craftsman, the process and progression of tools and associated actions, and the organization of work were all discussed where relevant, as were themes relating to the artist-craftsmen, such as evidence for specialization, training, their background and number, and their relationships with the clients or patrons who commissioned the work. This produced a large amount of information about the making history of an object or monument which was documented and recorded alongside the conventional data usually associated with an archival project, whether relating to the slide (film type, date and location) or the subject of the photograph (name, date, location and material). These interviews rightly gave Peter Rockwell the role of primary interpreter of his images but there was much dialogue during this process and new insights into the material also emerged. The spread sheets, supported by the audio and video files, ensured the proper documentation of these meetings. Immediately following the interviews the slides were sent for scanning in Rome and then the process of entering the data into the project database was begun.<sup>28</sup>

<sup>&</sup>lt;sup>26</sup> The catalogue of Peter Rockwell's slide collection is available in the appendix.

<sup>&</sup>lt;sup>27</sup> For the audio a Roland R05 Handheld WAVE MP3 Digital Recorder was used and the video was recorded with the built-in camera on a laptop.

<sup>&</sup>lt;sup>28</sup> The slides were carefully cleaned using a brush made of white goat's hair and then scanned by Laura Primangeli of LC Service. This was done at a resolution of 4000 dpi, creating one Master Image File from each item in 24 bit RGB colour and Adobe 1998 colour profile. Each Master Image File was an uncompressed TIFF at Version 4.2 or above and had a .tif file extension. They were named according to Peter Rockwell's conventions, the filenames beginning with "PR" followed by the archive number separated by underscores, e.g. PR202 03 03.tif and so on.

#### Database: design and implementation

A relational database sits behind the *Art of Making in Antiquity* web application and holds much of the data that drives it. The conceptual schema for this database needs to match the intellectual interests of the project. Thus it was developed in close collaboration between the project team in the Department of Classics and the Department of Digital Humanities (DDH), and reflects the primary entities such as images, materials, artworks, projects, tools, evidence, processes etc. and the relationships between them that were the primary materials for the *Art of Making in Antiquity*. After an initial tentative design was created during the first months of the project, the structure was subsequently adjusted a few times to conform to the actual information that emerged through the interviews. In the end, the database structure allowed us to clearly formulate significant aspects of the nature of the stone carving activity and what specifically we wanted to record about it, and allowed the project team crucially to record information in such a way as to maintain a close link between information about an interesting phenomenon (recorded in the data) and the respective image sources that provided the evidence for it.

From a digital humanities perspective, the project's approach moves beyond conventional archiving by using data capture and representation methodologies that are not found in the standard metadata for describing images or cultural heritage objects, such as the Dublin Core or Getty vocabularies. In fact, though these well-known schemes can provide a quick solution to the problem of classifying the subject and features of an object (in order to support better searches online), they tend to offer an overly simplified –i.e. 'flat'– characterization of the object identity. They are, therefore, less well-suited to representing the historical dimensions of a cultural heritage object, that is the network of decisions and contextual circumstances, that determined its creation. It is precisely this rich historical dimension that the project aims to make explicit. To achieve this a more elaborate and detailed computational model of the sculpture domain was needed which would allow users to explore a range of questions concerning the materials and processes employed, specific tools and how they were used and recognizable traditions emerging from such practices.

The resulting relational database allows a wide range of metadata to be added for each image (or 'source'). It has also enabled us to think about what that information should be and how it should be expressed. An interesting example is the identification of materials, where the methods used and the certainty of their identity has changed over the years. To reflect this we have made clear the basis for the interpretation, for example whether visual or scientific analysis. This is an important clarification, especially for white marbles where differentiation between different types can be difficult and sometimes misleading. This addition makes clear the method and its reliability. The system also allows for a spread of unconventional metadata to be included as 'evidence for working processes', broken down into the type of evidence (i.e. 'toolmarks'), the process that it relates to (i.e. 'roughing-out'), the tool employed, where known (i.e. 'point chisel'), the method employed (i.e. 'held close to the vertical'), and the order that it comes in the broader sequence of observable work. Each of these pieces of evidence is then linked to a particular part of the image in question via an annotation tool.

During data entry we were able to supplement the information from the interviews in a number of different ways. Firstly, the high-resolution digital images enabled new observations to be made from the photographs, especially the recognition of other tools marks or evidence. We also made sure that our terminology was carefully defined and consistent throughout. In the process a terminological database was created for materials, processes and tools which includes terms across different languages (French, Italian, German and English, with UK and US variants), thereby offering a multilingual concordance and standards for the description of these elements. This has all been supplemented by up-to-date bibliographic materials.

#### Developing the web application

As well as working closely with Wootton and Russell in the design and implementation of the database, DDH created the software framework that allowed the project to (i) upload the images, convert them to the JPEG-2000 format, and deliver them as an integrated part of the *Art of Making in Antiquity* web application (ii) provide a data entry framework for the broad range of image metadata and (iii) create a web application publishing framework that allows the user to access the images and data in a sophisticated manner. JPEG 2000 –an image compression standard developed by the Joint Photographic Experts Group– was chosen as the format for storing the images because it allowed DDH to create an series of software components for the *Art of Making in Antiquity* that supported the dynamic zooming of the images, and supported their annotation. To this end, software was developed by DDH that engaged with the Kakadu JPEG-2000 software library (http://www.kakadusoftware.com) so that zooming and annotation of parts of the images could be carried out on demand and then integrated with the web application.

DDH developed the software for the *Art of Making in Antiquity* in the Django framework (https://www.djangoproject.com/). Django provides an excellent environment in which to build the database data entry mechanisms that were used by the project team. In addition, however, Django also supported DDH in its creation of the code for the public web application that provides the dynamic and fluid user experience that you see in the *Art of Making in Antiquity* web application. To design this interface we drew on DDH staff's broad range of experience with user interface design and with the JavaScript technology that allows for rich level of user interaction with a modern web browser. Some of the most sophisticated work in this area appears in the working of the project's Advanced Search, and in the provision of the Collections service that allows users to assemble and share their own collections of materials on the website.

In the end, we believe that the public web application combines standard library code with complex bespoke code developed by DDH in such a way to allow the database and web application in front of it to present the unique perspective on stone carving and the evidence for the making of it that this project represents.

#### Web resource

This research project was aimed at a wide audience, hence good visual and functional design was vital if we were to deliver a website that could appeal to academics, by facilitating research and teaching, at one end of the scale and an interested general public at the other. The key user bases that have been identified are academics, students, teachers, museum professionals, artists and anyone interested in stone objects or making more generally. Keeping these groups in mind helped when considering how to enable visitors to the site with broad interests to explore, finding material of interest serendipitously, while also catering to individuals with specific questions by helping them to locate quickly what they were looking for.

The nature of the entities within the database provided a structure for the presentation of the data. Through the 'Explore' page on the website the user has the opportunity to explore the data through six main categories: Monuments, Tools, Processes, Materials, Places and Collections. The first five of these are generated by the data entered for each source image, so that the Monuments page, for example, shows all those monuments for which we have sources images, the Tools page all those tools the marks of which are visible in these same images. Collections, on the other hand, contains curated sets of images, arranged by different criteria depending on who assembled them or the themes they illustrate. Many of the images in Peter Rockwell's archive showing carvers at work or monuments from periods other than the Roman one, for instance, are accessible through the Collections category. Within each of these six main categories the various entries are provided with a descriptive text which acts as an introduction to the source images relating to them. On the Column of Trajan page, therefore, accessible through the Monument category, the visitor can read about the history of the monument before browsing through or querying the source images depicting it. In addition they include a comprehensive bibliography. These pages are intended to help guide the user through the dataset to the source images that interest them. It is the source images that form the core of the database. These are displayed on pages that function something like a catalogue, giving you the image itself with the traditional metadata as well as annotations linking the image itself, to discussion of the evidence for working practices on it and their interpretation. These source images pages, however, are not an endpoint as the user can explore the metadata by clicking on the hyperlinks or, at the bottom of the page, look at related sources by place or monument, for example.

Via the source image page it is also possible to download the images and to save them to an individual's 'Workspace'. This area allows visitors to create collections as they explore the site and subsequently to share them. One possible application would be for teaching, where a collection could be assembled and then shared with the intention of looking at a particular monument's production or at aspects of working practice through tools, processes or materials. Collections can also be made directly from the 'Advanced Search' facility, accessible from all pages via the link in the top right corner of the website. This area of the site is intended for specialist users who wish to interrogate the data in a more precise fashion. Searches can be constructed across the main entities within the database and, importantly, the 'Advanced Search' includes the ability to construct queries across multiple categories, defining relationships between them. So, for example, one can design a search for "Source images from Italy *but not* Rome which show use of Point Chisel *and* Flat Chisel *but not* Tooth Chisel." Each of these elements are selected from dropdown menus but the overall query is translated into plain text automatically so that the user knows exactly what they are searching for. This function also helps others who may not be so familiar with the material or subject area.

Supplementing the core data are videos providing visual and audio contextualization in the form of interviews with Peter Rockwell and carving demonstrations with Andy Tanser. To go with these are the essays on a series of different subject areas to provide the core academic content reflecting on aspects of stoneworking in the Roman world. These

can be downloaded or read online. On each page there is the opportunity to engage with social media and also to copy a citation that can be quickly pasted into any piece of academic work.

The design was not done in isolation but incorporated one set of formal user testing. For this we identified the website's potential visitors and recruited individuals from each of our representative user bases. In particular we were interested in identifying their interests, methods of engagement with the subject and contexts of working. This gave us useful qualitative information which has greatly enhanced the impact of the resource and avoided having to make changes towards the end of the project.

#### **Future applications**

The website is built upon open source software and has tried to make as much of its data available to anyone who wishes to use or engage with it. The methodology is reusable and constitutes an important output as it provides a set of standards for describing craft issues and a modeling paradigm transferable across humanities subjects. We hope that our approach to visualizing the making process and modeling personal interpretation will help others interested in artistic production or archival activities. Moreover we intended the resource to be able to function didactically, enabling visitors to learn about artistic practice and challenge their notions of the artist-craftsmen. We intend, in due course, to supplement the images with other datasets relating to carving so that we extend the chronological and geographic spread as well as the collection types to incorporate those from museums or excavations, for example. We also would very much like to explore how our approach might be applied to different art forms in order to describe and compare artistic practice more broadly.

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### Figures



Figure 1a-d: PR915\_01\_01, PR915\_01\_05, PR915\_01\_03, PR915\_01\_04: Different types of marks made by the point chisel on white marble