Advancing the Technical Study of Color in Archaeological Collections: White Paper

NEH Award Number: PR-276751-21
Principal Investigators: Caroline Roberts and Suzanne Davis, Kelsey Museum of Archaeology, University of Michigan

Contents
Summary ..................................................................................................................................... 2
Origins and Goals ........................................................................................................................ 2
Activities, Team, Participants, & Challenges ........................................................................... 5
Outcomes and Audiences ......................................................................................................... 10
Evaluation and Impact ............................................................................................................... 13
Continuation and Long-Term Impact ........................................................................................ 15

Project investigator Caroline Roberts examines painted funerary stela with a digital microscope.
Summary

This project focused on exploring color and its use in the ancient world. This exciting and attractive research area is of interest to a wide range of people, from scholars in both the humanities and sciences, to students and members of the general public. Scientific study of ancient colorants has been limited, however, because it is expensive to conduct and requires specialized equipment and expertise. For this reason, it tends to focus on small studies of single objects—often lacking provenience—from only a few time periods and cultures. Our project’s purpose was to change this; our main goal was to expand color research by developing simple, affordable, nondestructive research methods that could be used by researchers with minimal scientific knowledge and small budgets. We especially hoped to facilitate color research at academic museums like ours, the Kelsey Museum of Archaeology at the University of Michigan (U-M). Academic museums like the Kelsey often have scientifically excavated archaeological collections, but lack the resources to conduct technical research. As a secondary yet important goal, we also wanted to contribute data about color use in Roman Egypt, an understudied time period and one in which our museum’s collection is especially rich.

Major outcomes from the project include workflows for the use of multispectral imaging (MSI), X-ray fluorescence spectroscopy (XRF), and digital microscopy to investigate ancient pigments and dyes, as well as a website that shares these tools alongside information about the techniques, case studies, and bibliographies (see https://sites.lsa.umich.edu/color-roman-egypt/). As part of the project, we also gathered pigment and dye data from 190 Roman Egyptian objects in the Kelsey Museum’s collection, including painted limestone funerary stelae, fragments of wall paintings, stone sculpture, wooden panel paintings and toys, painted terracotta figurines, woven wool textiles, and plaited palm basketry.

The primary participants were the project’s principal investigators Caroline Roberts and Suzanne Davis, both archaeological conservators at the Kelsey; a graduate student, Laurel Fricker, from U-M’s Interdepartmental Program in Mediterranean Art and Archaeology; an undergraduate student, Harrison Biggs, majoring in materials science engineering and minoring in museum studies; and a group of advisors that included curators, faculty instructors and researchers, librarians, and conservation scientists.

Origins and Goals

We sought funding to explore, expand, and contribute to research on ancient colorants for multiple reasons. First, the scientific study of ancient color is a broadly appealing scholarly research area; it engages the interest of archaeologists, art historians, chemists, conservators,
cultural heritage scientists, historians, and teachers and students of the ancient world. The study of color on ancient objects can contribute to understanding ancient artists’ materials and practices; economies and trade; architecture, fashion, and design; funerary practices; and race, class, gender, and representation in the ancient world. Yet despite the huge potential and excitement surrounding this field, it has remained out of reach for many collecting institutions—including ours. We wanted to explore practical, affordable research tools and create easy-to-follow workflows that would enable small academic museums like ours to pursue this exciting research area.

Second, we were highly motivated to create resources that would facilitate pigment and dye research in other academic museums because the ancient objects in academic collections often come from known archaeological sites. They often have well-recorded contextual information and may have precisely located find spots. This is rarely the case for objects in the collections of the large, well-resourced museums that have, typically, been the only institutions with the financial resources and scientific expertise to conduct ancient color research. Although in-depth studies of unprovenanced materials from these collections can be fascinating,¹ their ability to produce new knowledge is limited. Until provenienced material can be studied at larger scales, it will be difficult to draw meaningful conclusions about what, where, how, and why colorants were used in the ancient world.

Third, we wanted to study the Kelsey Museum’s collection of Roman Egyptian artifacts because of their potential to reveal how ordinary people used and experienced color in antiquity. The objects we studied were scientifically excavated, and they come from the everyday lives of non-elite people who lived and died roughly two thousand years ago in two small cities in Egypt’s Fayoum and Delta regions.

Fourth and finally, we wanted to contribute data on pigment and dye use in Roman Egypt, a time period and region that has remained relatively under-studied in cultural heritage science. The Kelsey Museum is uniquely well-suited to contribute to such a study; it has one of the largest and best documented collections of Roman Egyptian objects in the world (fig 1). The Kelsey’s objects come from a series of carefully recorded, U-M led archaeological excavations in the 1920s and 30s, and the museum retains extensive archives related to the archaeological sites and the objects’ find spots.

The primary intended users and audiences for our project are humanities researchers including university faculty and students, as well as curators, conservators, and collections managers at small and mid-size museums. We are especially interested in supporting researchers working in or with under-resourced collecting institutions. We also hope that our suggested research tools and workflows will enable more researchers to conduct color studies in archaeological field settings.

Our project engaged multiple fields of study including archaeology, technical art history, the history of ancient materials and technology, conservation, cultural heritage science, and materials science and engineering. Notably, although our object-based research focused on artifacts from the ancient Roman world, we collaborated with faculty and students studying other cultures and time periods.

In planning, developing, testing, and evaluating our project’s outcomes, including the scientific data we collected, we built on previous work at our own institution and on work by multiple external institutions and scholars, including:

- International Roundtable on Polychromy; this series of conferences, with resulting publications, has been ongoing for nearly 15 years and is organized by an international group of scholars interested in color in the ancient Roman world. See, e.g.:
- Studies by technical art historians like Mark Abbe and conservation scientists such as Joanne Dyer. See, e.g.:
Activities, Team, Participants, & Challenges

The core of this project focused on developing transferable protocols for color research, including workflows for MSI, XRF, and microscopy. At the very start of the grant period, therefore, we focused on improving our capacity to conduct this type of research. Funds from the grant enabled the acquisition of a Bruker Tracer 5g handheld XRF instrument calibrated for pigment analysis. The grant also supported expansion of our MSI capabilities through the purchase of additional filters and related supplies like magnetic filter holders. Later in the grant period, we also acquired an additional handheld digital microscope that enabled a higher depth of field; this improved our ability to capture photomicrographs of rough surfaces, such as woven textiles and molded terracotta figurines (see fig. 2).
Our next activity was to review existing literature on color research and develop draft workflows. These were then tested and refined over the course of a large-scale study of objects from two Roman Egyptian sites: Karanis and Terenouthis. Karanis was an agricultural city located in Egypt’s Fayoum oasis and occupied from the 4th-c BCE to the 7th-c CE; most of the Karanis artifacts in our study date to the 1st to 5th centuries CE. Terenouthis was a Roman Egyptian town in Egypt’s Delta region, and it included a cemetery with tombs dating to the late 3rd and early 4th centuries CE. U-M excavated Karanis and Terenouthis in the 1920s and 30s; today, thousands of colorful daily life artifacts from Karanis are housed in the Kelsey Museum, as are roughly 200 painted limestone funerary stelae from Terenouthis.

Roughly two and half years were required for testing the workflows through the study of Karanis and Terenouthis objects. We examined and gathered data from painted sculpture, dyed textiles and basketry, painted wooden toys and terracotta figurines, fragments of painted panels and wall decoration, and painted limestone funerary stela. In addition to objects from Karanis and Terenouthis, we also examined a few objects that the museum had acquired through purchase or donation. In total, 190 artifacts were investigated.

The project was carried out by two full-time staff members (the project’s PIs) who conducted the study alongside their daily duties, and it was assisted by a graduate student studying ancient mediterranean archaeology and an undergraduate student majoring in engineering. The students helped to develop and refine the workflows, which were also tested and evaluated by U-M faculty, librarians, and collections managers in a half-day workshop.
As the study was ongoing, we created a publicly-available website to share resources developed during the project (see: https://sites.lsa.umich.edu/color-roman-egypt/, fig. 3). These resources include our finalized workflows (available for PDF download), information about the techniques we used, flow charts for identifying pigments and dyes, bibliographies related to color research, case studies from the project, and links to useful external resources. Website creation and editing was supported by the Kelsey Museum’s graphic designer and its editor.

**Multispectral/Multiband Imaging (MSI)**

A photographic technique in which the painted surface of an artifact is illuminated with ultraviolet, visible, and infrared light sources. Pigments absorb, reflect, and emit light in characteristic ways that can be captured in an image, so we use this technique to learn what pigments or dyes might be present in a painted area on an object or in a dyed textile.

We commonly use the following types of MSI:
- Visible light (VIS)
- Ultraviolet-induced luminescence (UVL)
- Visible-induced luminescence (VIL)
- Infrared reflected false color (IRRFC)
- Multiband reflectance or Indigo Subtraction (MBR Indigo) to reveal indigo.

**X-Ray Fluorescence Spectroscopy (XRF)**

An elemental (or chemical) analysis technique in which the painted surface of the artifact is hit with an X-ray beam. The beam causes electronic transitions within the atoms of the sample, a phenomenon that can be measured and recorded as a spectrum. The spectrum is used to determine which elements are present in the paint surface, which can help us identify an unknown pigment.

Fig. 3. Screen shot from the project’s website, *Investigating Color in Roman Egypt*, showing the “Introduction to the Techniques” landing page.
Our project was originally planned to be two years in duration. In year one, we planned to focus on conducting the study referenced above; a large-scale scientific investigation of the collection, with the goal of studying 200 objects. Year two was planned to focus on developing the investigation’s research workflows into a set of transferable tools or protocols that would be shared online.

Although work on the project progressed steadily, COVID-related disruptions impacted our ability to consistently work on-site. Our original project end date was February 2023, but delays and disruptions led us to request a no-cost project extension of six months. We also found that it was necessary, due to COVID, to conduct the planned activities simultaneously, versus in the phased order we had originally planned. This allowed us to continue working off-site on days when we could not access the museum’s collection, or when family care or school closures disrupted onsite work. Happily, this turned out to be very beneficial. Our workflows were written and refined as the study progressed, not afterwards, which allowed us to fully test each iteration. Similarly, the simultaneous development of the website helped us think about what resources would be needed and how we could make them easy to use. We had originally planned that the community feedback and dissemination components of the project would begin in the fall of 2022, and these were delayed until winter/spring 2023, but this did not disrupt our planned launch of the project’s website in late spring 2023.

We created the project team and identified stakeholders in several ways. Initially, we approached individuals with whom we already had relationships; the Kelsey’s curator of Roman Egypt, a research scientist from the Detroit Institute of Arts, and a conservator who works with U-M’s papyrus collection. These individuals agreed to work with us as advisors, and we asked them to identify areas of the collection and color-related questions that would be of interest to their own research. They also agreed to assist with the interpretation of pigment and dye analytical data when needed and to identify potential workshop participants. We were also fortunate that two students, both previously mentioned, approached us with interest in working on the project. The graduate student researcher was interested in working with the Kelsey’s collections and in learning more about ancient polychromy, while the undergraduate student was completing a minor in museum studies and seeking a hands-on internship in a conservation laboratory.

Overall, the following personnel were closely involved in the project:

- Project co-PIs Caroline Roberts and Suzanne Davis, both conservators at the Kelsey Museum
• Project advisors: Terry Wilfong, Curator of Graeco-Roman Egypt at the Kelsey; Christina Bisulca, Conservation Scientist at the Detroit Institute of Arts; and Marieka Kaye, Director of Preservation Services at the U-M Library

• Student research assistants: Laurel Fricker, PhD candidate in the Interdepartmental Program in Mediterranean Art and Archaeology; and Harrison Biggs, undergraduate student majoring in materials science engineering and minoring in museum studies

• Kelsey Museum Graphic Designer Eric Campbell and Editor Emily Allison-Siep

These individuals represented the following types of expertise:

• Materials science of cultural heritage
• Photographic documentation of artifacts
• Multispectral imaging, including capture, processing, and data interpretation
• X-ray fluorescence spectroscopy, including instrument use, safety, and data interpretation
• Knowledge of the art, history, and archaeology of Roman Egypt, specifically Karanis and Terenouthis
• Data analytics

We recruited additional stakeholders to help evaluate the project by circulating a questionnaire to researchers affiliated with the Kelsey Museum and with the Anthropology and History of Art departments on U-M campus. We also recruited participants through professional collections care networks on campus. These individuals participated in a hands-on workshop and provided critical feedback on the research protocols, workflows, and website.

Although our project progressed well, we did encounter challenges along the way. These ranged from mundane information technology difficulties to project management hurdles. For example, as a small museum within a very large university, our initial instrument setup was challenging, as the campus Wi-Fi network perceived the Wi-Fi-controlled XRF unit as a security threat. Thankfully, a few weeks of troubleshooting provided by the dedicated IT department within our parent college was eventually able to solve the problem. Our biggest challenges, apart from COVID-related disruptions, were associated with project and data management. With multiple researchers gathering data, we had to find shared systems for integrating and tracking the results. Clearly articulating and communicating a data management plan from the outset was key in helping us find and troubleshoot areas of difficulty. Training students was also time consuming at first, but part of the project focused on developing detailed workflows and, as they began to regularly practice with and edit the protocols, the students began to train themselves to do increasingly advanced work. Soon they were contributing at a very high level.
Finally, being able to make sense of and draw meaningful conclusions from what could, at times, feel like a flood of data was challenging. Here again, having a well-organized data-management plan helped us stay afloat; we interpreted data and tracked pigment and dye identifications in shared spreadsheets as well as in our collections database as we worked. This ensured we never had a backlog of unexamined data and also meant our results were being recorded in real time in at least one place (the museum’s collections database) that is immediately available to the wider Kelsey Museum community. We also benefited from working with people who have diverse backgrounds and research interests, as they each brought unique skills and expertise to tracking, interpreting, and presenting the data. For example, Laurel, the PhD candidate in archaeology, applied her subject area knowledge to producing color reconstructions, while Harrison, the engineering major, delighted in helping with data analytics.

Outcomes and Audiences

There were two primary and expected outcomes from this project, along with a third bonus outcome which was unexpected. The first primary outcome(s) were the research workflows and protocols for color research; these were developed as planned and are shared on a dedicated website that was developed as part of the grant project. The website also presents bibliographies, extra information about the research tools, and case studies of objects and textiles we investigated.

The pigment and dye data gathered over the course of the project were our second major outcome. We investigated more than 175 objects and textiles from Karanis and Terenouthis and, while our results correspond closely with previous research, there are notable differences as well as new discoveries. To provide a few examples, we found optical blue (a mixture of white and black pigment that produces a blue shade) on two wall painting fragments from Karanis. Optical blue has not yet been reported in the scientific literature for Roman Egyptian pigments. We also discovered an unusual trace element, chromium, in green earths on objects from Karanis, which could point to local sourcing of that pigment. Another pigment, lead white, may be traceable to a specific source in the Roman empire based on its isotopic signature. Egyptian blue, meanwhile, was seen on 26 of the Terenouthis stelae, but only four objects from Karanis, which may tell us something about its availability in the Delta versus Fayoum regions. We also investigated dyes on 65 textiles and baskets from Karanis, finding only plant based-dyes. Indigo was the most frequently observed dye; it was used to produce dark blue and we also observed it being combined in two different ways to create green and lighter purple colors. For green, wool yarns were doubled dyed with indigo and a yellow colorant, while purples and pinks were created by combing and/or spinning together fibers dyed red with madder and blue.
with indigo. By combining these fibers in different proportions, ancient textile workers produced yarns in varying shades of pink and purple. These are a few examples of our findings, which we have begun to share with the scholarly community in conference presentations. We are also planning one or more scholarly articles to share pigment and dye findings from the funerary stelae, terracotta figurines, and textiles. To reach general audiences, we have also authored Kelsey Museum newsletter articles and blog posts about the project.

The project also resulted in unexpected lessons about teaching, including the value of project-based learning and written protocols that allow students to acquire and practice scientific techniques on their own. The workflows and protocols we were developing were actively tested and refined by the two students who worked on the project. While we expected this to help us evaluate the clarity and utility of the written documentation, we did not predict how beneficial the documentation would be for the students. Having written protocols allowed them to learn and progress quickly, so that they were soon exploring and answering their own research questions. This benefited the project but also the students; they were engaged and excited by the project in part because their work could be self-directed. They were able to “go deep” into questions that interested them, while also knowing they were contributing in a meaningful way to the project’s overall success. Their involvement in the project, and our experience working with them, was so positive that we have presented this unexpected bonus outcome at a conference session on pedagogy in museums, at the 2023 annual meeting of the American Society for Overseas Research.

Our actual audiences have aligned with our expectations, and we have been pleased to receive a lot of interest from archaeologists and archaeology students. We have found that graduate students are especially interested in learning the techniques and applying them to their own research.

We made several decisions early on about how our project’s resources and collected data would be stored and reported. MSI imaging and XRF spectra are saved in our department’s shared cloud storage. Provided by our parent college of Literature, Science and the Arts, this storage space receives automatic backups every few minutes. We used a shared spreadsheet, also in our shared cloud storage space, to record our research findings for the purposes of data analytics. Our research findings for each object were also recorded in our museum’s collections database (Collective Access is the platform), and relevant MSI images were uploaded to the database as well. Our public-facing website, meanwhile, uses WordPress. We used a standard design template available for no cost through our parent college, but the look and feel did receive some improvements from the Kelsey’s graphic designer. An advantage of using a user-friendly platform like WordPress is that we can update the website and add content at any time, without the help of specialized IT or web design staff.
Although copyright and privacy were not concerns for our project, we encountered a few challenges relating to documentation, accessibility, and language use. First, although we had a good data management plan at the outset, the number of images generated from MSI was overwhelming in the beginning. Before long, however, we had developed processing and archiving workflows that moved the images quickly from pre-processing to long-term storage. We also discovered that it was best to capture and process images in small batches of five to ten objects, which kept us from creating processing and archiving backlogs. We also, somewhat surprisingly, discovered an accessibility challenge with our website; writing alt-text for an MSI image is very different from writing alt-text for a normal photograph. After some iteration, we realized that our MSI images functioned more like charts or tables than photographs, and we adjusted our alt-text to reflect the information each image conveyed, versus a description of the image itself. Last but not least, now that the website is complete, we have realized we would like to create an Arabic language version; all of the case studies featured on the website come from Egypt, all our data come from Egyptian objects, and the low-cost, portable techniques and workflows we have tested and feature would potentially be very useful to archaeologists and conservators supporting Egyptian collections and excavations in Egypt. This will be a project for the future, but we wish we had built it into our original project and application.

On a more personal note, we also received important professional benefits from the project. NEH awards are somewhat rare on our campus, and the grant award raised our profile within both our home academic department, the Kelsey Museum, and in our college. We each received a personal note of congratulations from the college dean, and the award was featured in various campus news outlets. This brought important attention to our research and practice, which is often characterized as “behind the scenes” and not lauded or recognized as much (or at all) in comparison to the research work of our tenure-line faculty colleagues. In the past year, we also both received promotions. Although we cannot draw a direct, causative line between the project and these happy events, we believe the project influenced them for the better. This is significant because career advancement is often overlooked for conservators, both at museums and in academia.

Readers interested in learning more about our project can visit the project website: https://sites.lsa.umich.edu/color-roman-egypt/. We are currently evaluating publication venues and strategies for the project and its findings. We are considering an overall project publication in the open access journal PLOS One, and/or collection-specific reports of the project’s research findings in an archaeology journal such as the Journal of the American Research Center in Egypt or the Journal of Near Eastern Studies. Future publications will be listed and linked in the publications tab of the website.
Evaluation and Impact

We evaluated the impact of the project’s contributions in several ways. Our primary outcomes were the research workflows, protocols, and tools we developed. These were first tested and developed iteratively by us and our student researchers, who worked extensively with the workflows and protocols during the data gathering phase of the project. Based on their experiences, the workflows were edited and adjusted until the students could follow them to acquire data easily, quickly, and consistently. Once this was the case, a wider group of students, faculty, librarians, and collections managers were invited to participate in a workshop to learn about the techniques, after which they were invited to experiment with the techniques, follow the protocols, and provide critical feedback (fig. 4). This helped us see where problems remained. For example, we found that participants had a hard time with image processing, and we made a number of adjustments based on their recommendations: we added sample images and showed how they should look before and after processing, clarified and expanded instructions in areas that were confusing, and removed information specific to our archiving and data management procedures, since this was not useful for researchers working in other settings. The same group was later invited to provide feedback on the website, critically evaluating our resources’ discoverability, comprehensiveness, and readability.

Fig. 4. Images from the color investigation workshop. Left: Carrie Roberts gives a presentation on multispectral imaging techniques. Right: workshop participants process images in Photoshop.

The wider group was compensated only with a nice lunch during the workshop, and we had concerns that people might not be willing to devote much time to their evaluations. To our surprise, the participants all expressed how nice it was to be able to attend a workshop and learn a new research technique for free, how much they enjoyed being invited to experiment
with something new and think about how to apply it to their own work, and how much they appreciated the opportunity to meet people with similar interests.

The pigment and dye data gathered over the course of the project were our second major outcome. We are just beginning to evaluate the impact of this outcome, primarily through presenting the results at professional conferences, including the annual meetings of the American Society of Overseas Research and the American Institute for Conservation. We have not yet submitted our results for publication in a peer-reviewed journal, but conference audiences have been highly engaged and we have received invitations to speak and conduct additional research in other collections and venues. Our pursuit of the project has also coincided with a new and growing interest in Roman Egyptian history and material culture, and this makes our results especially interesting to other scholars.

Each time we present the project, we post a QR code to the website and, to understand the wider impact and reception of the project, we are working on gathering statistics from our project website. We have already received feedback from colleagues at other university museums that the imaging workflows, which are available for viewing and download from the website, have been particularly useful for their own work.

Beginning evaluation and iteration early in the project ultimately made our final products easier to use and, we hope, easier for others to replicate or adapt to their own institutions. We are particularly grateful for the input of the students who worked with us and for critical feedback from researchers outside the heritage science profession (e.g. art history faculty members and librarians).

We learned, or reconfirmed, a few key things that other project directors may wish to note. First, working with students is good! Engaging students in our project had huge benefits for us, for them, and for the overall project. Second, we were able to achieve meaningful results with non-invasive techniques that are also user-friendly. In conservation science, there is a tenet that non-invasive analysis should be coupled with destructive analysis for the results to be reliable. Many studies that take this approach are looking at only one object, or just a few objects. Our project used multiple non-invasive methods to examine a large sample size and also compared those results to the findings of other researchers. In this way, we were able to validate many of our observations without the need to sample the objects in our collection. And, although we investigated only a small percentage of the Karanis and Terenouthis collections (one to twenty percent depending on the collection and type of object), we were able to see clear and interesting differences in pigment use at the two sites. Finally, it benefited our project to collaborate with people outside archaeology and conservation. Sharing and evaluating our research processes with the help of individuals outside our own profession gave
us new ideas, helped us develop a shared language, and greatly improved the project’s final products.

**Continuation and Long-Term Impact**

Although the grant-funded phase of our project has concluded, we will continue the research. We plan to investigate more textiles from Karanis (we have examined almost three percent of the collection now!) and to expand the pigment research to objects from the site of Seleucia, a Hellenistic and Parthian site occupied from 323 BCE to roughly 200 CE. Located in modern day Iraq, Seleucia was excavated in the 1920s and 30s by a U-M led team. From a research perspective, we are interested to see how pigments on Seleucia material compare to those on Karanis and Terenouthis objects.

There are also a few questions that our current research tools are not capable of answering. For example, we cannot investigate binding media or trace elements, and pigment mixtures are difficult to fully identify. Yellow dyes are similarly challenging to identify due to complexities in their chemistry and structure. To answer these questions, we would like to acquire instrumentation to do limited invasive analysis; tools—ideally portable and relatively inexpensive tools—like benchtop Fourier Transform Infrared Spectroscopy (FTIR) and/or Fiber Optic Reflectance Spectroscopy. We also hope to interest a chemist or conservation scientist in analyzing the yellow dyes, which will require a liquid chromatography technique to study further. Finally, we are curious to see if isotopic analysis of the lead white pigments will allow us to trace them to a particular geographic location within the Roman empire; previous studies of lead-based pigments on artifacts have been able to reveal source information.

We also plan to do more field testing of the workflows; we have conducted limited testing on archaeological field sites, using only a few of the imaging techniques, but we would like to evaluate our workflows further with objects at Abydos, Egypt, and on wall paintings at the site of Jebel Barkal in Sudan, if geopolitical conditions permit.

To fund continuing work, we are considering both internal and external grants, including NEH funding opportunities, as well as sponsorship from individuals and family foundations.

We also hope to see researchers using and adapting our workflows to explore new questions and to study collections from other cultures and time periods. We especially hope to see the products from this project forming the foundation for new investigations in academic museums and at field sites.
We will continue to post about our work, to adjust and expand our workflows as technology changes, and to share our publications and research findings on the project’s website. We are also considering ways to stay in contact with our project’s participants; early ideas include a research group on campus, with regular meetups; an annual research report; and organizing meetings or sessions at mutually agreed conferences.

While we do have outstanding research questions, new areas we would like to explore, and relationships we hope to maintain, it is also true that we will continue the project because color-focused research is enjoyable and satisfying. It connects us to the objects, materials, and practices of artisans from other places and times, it advances our understanding of the ancient world, and it is an attractive entry point for students of the ancient world as well as non-specialist audiences. We are grateful to NEH for supporting this work.